Bus Punctuality Statistics GB: 2007

Department for Transport

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Cardiff Buses
First Glasgow
First York
Lothian Buses
Oxford Bus Company
Reading Buses
Wilts and Dorset Buses

Symbols and conventions

The following symbols have been used throughout:

.. = not available
- = negligible (less than half a unit)
. = not applicable
0 = nil

Rounding of figures:

In tables where figures have been rounded to the nearest final digit, there may be a slight discrepancy between the sum of the constituent items and the total shown.

Acronyms:

VOSA	Vehicle and Operator Services Agency
BCO	Bus Compliance Officer
TC	Traffic Commissioner
TfL	Transport for London
GPS	Geographical Positioning System
EWT	Excess Waiting Time

Other terminology:

Northern/Midland Regions include the following Government Office Regions. North-East, North-West, Yorkshire and the Humber, West Midlands and East Midlands. Southern Regions include the following Government Office Regions: East of England, South-East and South-West.

Overall punctuality is measured by weighting the observations at bus stops as follows: 30% Start Timing Points, 40% Intermediate Timing Points and 30% Other Bus Stops.

Key Points

- Punctuality levels in England in 2007 were estimated to have improved since the last national survey was carried out in 2005. 75 per cent of buses on non-frequent routes were found to be on-time in 2007, compared to only 72 per cent in 2005. Also, the excess waiting time experienced by passengers on frequent routes improved from about 1.5 minutes to 1.3 minutes.
- Buses in the South of England were the most punctual. 77 per cent of non-frequent buses in the South West, South East and East of England regions were on time in 2007. The equivalent percentage for Scotland was 73 per cent.
- Punctuality falls along the course of a bus route. 84 per cent of the buses observed at the start of their route were on time, but for those at stops more than one hour from the start of the route, only 62 per cent of buses were on time.
- Bus punctuality was better in London. Using TfL definitions to enable comparability, it is estimated that 74 per cent of buses in England outside London were on time, compared to 78 per cent for London buses.
- GPS and other electronic devices on buses were found to be generally accurate in measuring the punctuality of buses. It is estimated that 90% of such devices gave a reading within one minute or so of the actual departure times from stops. This suggests that the electronic data currently available provides a good guide to overall punctuality, as assessed by the 1 minute early to 5 minutes late measure.

Bus Punctuality Statistics GB: 2007

Introduction

1. This report covers the second national bus punctuality survey, which was conducted in May/June 2007. A first survey was carried out in March/April 2005 and the results were published in a report which is available from the DfT website.

2. As in 2005, the survey was conducted in all areas of Great Britain outside London. Care was taken to avoid making observations during the summer half-term holiday period with its atypical traffic conditions. The work was carried out by Bus Compliance Officers (BCOs) who work for the Vehicle and Operator Standards Agency (VOSA). They needed no briefing as to how to record the times of bus departures as their normal work consists of checking bus punctuality of failing bus services, as directed by the Traffic Commissioners (TCs). Full details of the methodology and other relevant material are provided in Annex 1 at the end of the report.

3. Data were also collected from bus operators with working Geographical Positioning System (GPS) and other electronic means of recording punctuality data. A comparison of these electronic timings with those observed by the BCOs in 2007 is included in the second part of the report.

4. Detailed analysis of the 2007 survey, and subsequently 2005, data showed some of the estimates for Scotland in both years were affected by miscodings. As a result, the 2005 data have been reworked and revised. Comparisons in this report are with the revised 2005 figures and a full explanation is provided in Annex 3.

Results

5. Punctuality is judged by the actual times that buses set off from bus stops. For non-frequent services (i.e. those services with 5 buses or less per hour), these departure times are compared with scheduled departure times. If a bus departs up to 1 minute early to 5 minutes late (more precisely, 60 seconds early to 5 minutes 59 seconds late), then it is deemed to be "on time". It is the percentage of scheduled buses that are "on time" that is of key importance. The TC standard is that 95% of buses starting a route should depart "on time" and that the proportion of those departing intermediate Timing Points[1] should be at least 70%, ideally 90%. There is no standard for other bus stops, which are not normally monitored. However, up to 50 per cent of passengers board at such stops and estimated times of departure for these stops is normally available online, so they were included in the survey.

6. For frequent services (6 or more buses per hour) punctuality is measured by reference to the Excess Waiting Time (EWT) measure. This is a calculation of the extra waiting time borne by passengers over and above the waiting time that might be expected if all the buses on the route ran on time. Details of how EWT was calculated are provided in Annex 2.

7. The findings for frequent services are based on 8,138 observations. This is rather less than the 16,973 observations for non-frequent services. Further, the number of such routes (460) was very much less than for non-frequent services (3,897), as obviously there are more buses per route for such services. As a result of this, the results for frequent service buses are less reliable than those for non-frequent ones.

<u>Non-frequent services</u>

8. For Great Britain excluding London as a whole in 2007, 75% of buses overall were found to depart on time. This was 3 percentage points higher than the average found in 2005.

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[1] Timing Points include the start point and other important stops along a bus route for which the operator must provide scheduled departure times when registering a bus route.

9. Punctuality for non-frequent services varied considerably between the three types of bus stop: the Start Timing Points (often at bus stations), Intermediate Timing Points and Other Bus Stops or Non-Timing Points.

Table 1: Percentage of non-frequent buses on time by type of stop and region/country: 2007

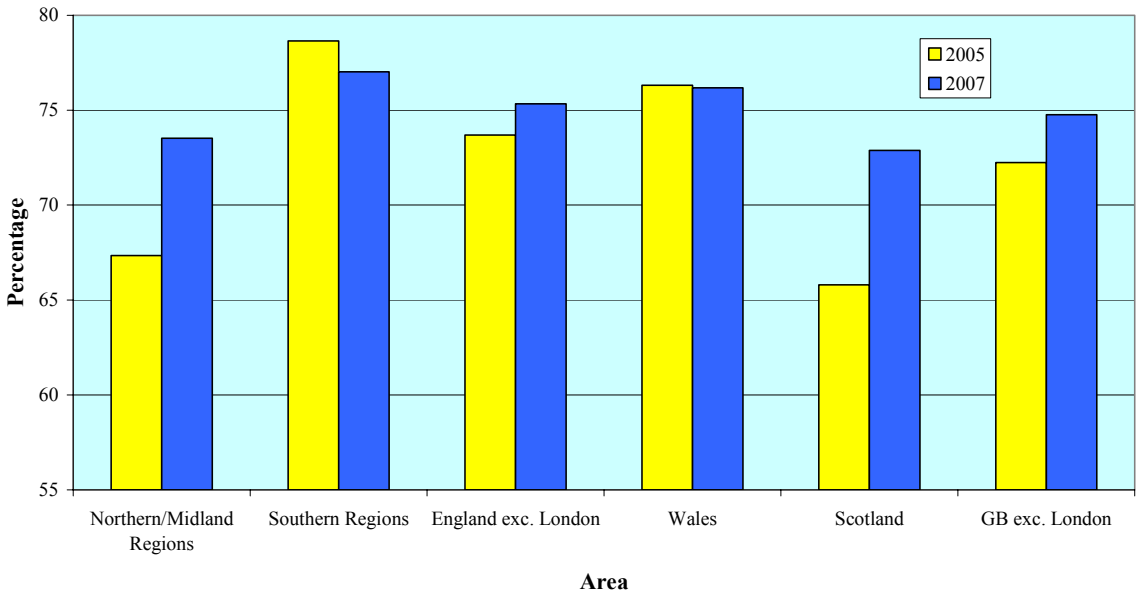
Percentage

	Start Timing Points	Intermediate Timing Points	Other Bus Stops	All Bus Stops	All Bus Stops (2005)
Northern/Midland Regions	*82*	*71*	*69*	*74*	*67*
Southern Regions	*87*	*76*	*69*	*77*	*79*
England exc. London	*84*	*74*	*69*	*75*	*74*
Wales	*85*	*75*	*69*	*76*	*76*
Scotland	*82*	*71*	*66*	*73*	*66*
GB exc. London	*84*	*73*	*68*	*75*	*72*

10. Table 1 shows that, for GB excluding London, 84% of buses were on time at the start of routes. This percentage fell to 73% for Intermediate Timing Points and 68% for Other Bus Stops. The levels of punctuality were lower than those deemed acceptable by the Traffic Commissioners. The levels are, though, consistent with results of the previous national bus punctuality survey and with bus punctuality estimates produced by local authorities.

11. The proportions of observations at each type of stop varied from area to area. Therefore, as for the 2005 survey, all analyses in the report are standardised with weightings of 30%, 40% and 30% for the three types of bus stop to give the "all bus stops" figures. These percentages partly reflect the likely number of passengers boarding at each type of stop and partly the importance of each stop in the measurement of bus punctuality. Clearly, it is very important that buses start their route on time, even though this is just one stop and the bus may not be very full at this point in the journey.

Chart 1: Overall Percentages of Non-Frequent Buses Departing on Time: 2005 and 2007



12. The table and Chart 1 suggest that the highest levels of punctuality were to be found in the English Southern Regions, though there appears to have been a narrowing of the difference between the Northern and Southern regions of England since 2005. Table 1 also shows that Scotland had the poorest level of bus punctuality with only 73% of buses estimated as being on time, though this was better than the 66 per cent recorded for 2005.

Table 2: Percentage of non-frequent buses on time by type of area: 2007

Percentage

	Start Timing Points	Intermediate Timing Points	Other Bus Stops	All Bus Stops	All Bus Stops (2005)
Large conurbations	*83*	*68*	*66*	*72*	*66*
Mixed area authorities	*85*	*77*	*71*	*78*	*79*
Rural authorities	*84*	*76*	*69*	*76*	*73*
GB exc. London	*84*	*73*	*68*	*75*	*72*

13. Table 2 shows that punctuality was worst in the large conurbations, particularly at intermediate timing points. There could be a number of reasons for this, such as more traffic congestion and the fact that PTEs have only partial control over the roads in the Metropolitan Boroughs.

Chart 2: Percentage of Non-Frequent Buses that were On Time by Time since Start of Route: 2007

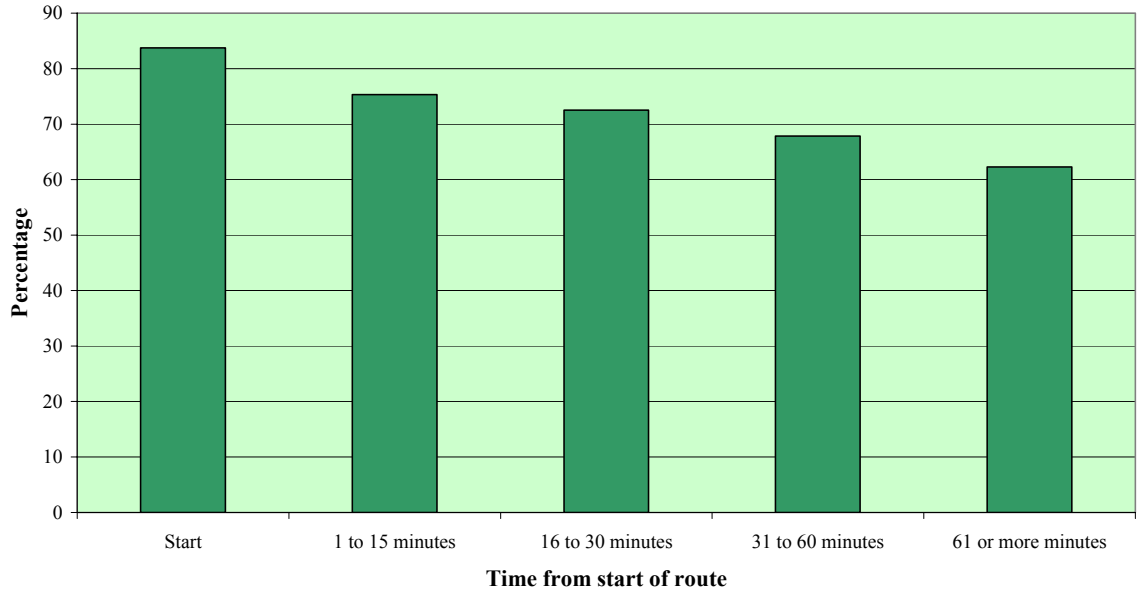


Table 3: Percentage of non-frequent buses on time by time from start of route: 2007

Percentage

	Start Timing Points	Intermediate Timing Points	Other Bus Stops	All Bus Stops	All Bus Stops (2005)
Start	*84*	*na*	*na*	*84*	*85*
1 to 15 minutes	*na*	*77*	*73*	*75*	*70*
16 to 30 minutes	*na*	*74*	*70*	*72*	*67*
31 to 60 minutes	*na*	*70*	*66*	*68*	*64*
61 or more minutes	*na*	*66*	*57*	*62*	*61*
All departures	*84*	*73*	*68*	*75*	*72*

14. Chart 2 and Table 3 show that punctuality falls off along the route. Passengers waiting for buses towards the end of routes can expect quite different levels of timeliness. Results from the survey suggest that only 62 per cent of buses were on time if the bus had been travelling along its route for more than one hour.

Table 4: Percentage of non-frequent buses on time by time of day: 2007

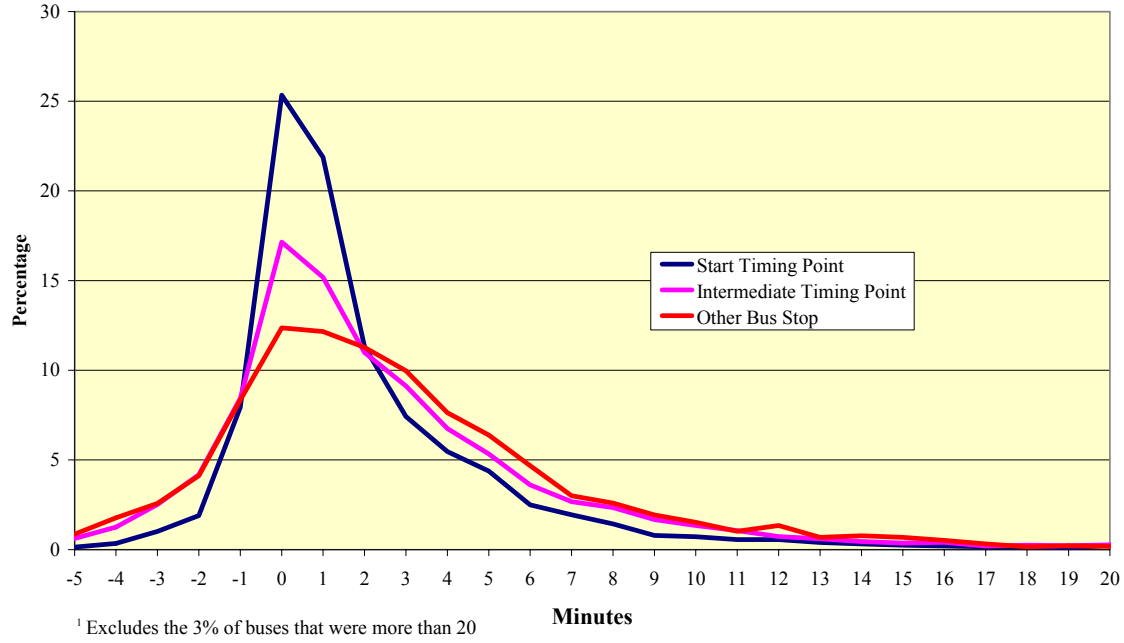
Percentage

	Start Timing Points	Intermediate Timing Points	Other Bus Stops	All Bus Stops	All Bus Stops (2005)
0800 to 0930	*83*	*71*	*67*	*74*	*71*
0931 to 1529	*85*	*78*	*71*	*78*	*74*
1530 to 1730	*83*	*69*	*66*	*73*	*70*
All times - 0800 to 1730	*84*	*73*	*68*	*75*	*72*

15. Table 4 shows how punctuality varied by time of day. As might be expected, punctuality, particularly at intermediate bus stops, was best in the interpeak hours when traffic levels are normally lower.

16. Chart 3 below shows how the distribution of lateness and how this varies by type of bus stop. In particular, it shows that over a quarter of buses started their journeys exactly on time, but for non-timing points stops, the proportion was about 12%.

Chart 3: Lateness of Non-Frequent Buses by Type of Bus Stop[1]: 2007



[1] Excludes the 3% of buses that were more than 20

Frequent Services

17. As described in paragraph 6, the punctuality of frequent services is measured by the Excess Waiting Time (EWT) borne by passengers. As for non-frequent services, overall punctuality was assessed by assuming proportions of 30%, 40% and 30% for the three types of bus stop.

18. It should be noted that whilst an EWT of, say, 2 minutes may seem acceptable, this is in addition to the average waiting time. For an “every ten minute” service it represents a 40% increase in waiting time over the average scheduled waiting time of 5 minutes. Over half of the passengers would therefore have to expect to wait at least 7 minutes for their bus, some much longer.

Table 5: Excess Waiting Time for frequent buses by region/country: 2007

Minutes

	Start Timing Points	Intermediate Timing Points	Other Bus Stops	All Bus Stops	All Bus Stops (2005)
Northern/Midland Regions	1.19	1.36	1.43	1.33	1.70
Southern Regions	0.43	1.23	1.74	1.14	1.56
England exc. London	1.10	1.32	1.58	1.33	1.63
Wales	0.44	0.67	1.39	0.82	0.66
Scotland	1.27	1.45	1.21	1.33	1.73
GB exc. London	1.08	1.35	1.40	1.29	1.53

19. Like non-frequent services, punctuality varies by type of bus stop. Buses observed at the start of their routes had an average EWT of only 1.08 minutes, whilst those at other stops were less punctual: an average of 1.35 minutes at Intermediate Timing Points and 1.40 minutes at Other Bus Stops.

20. Table 5 also shows how EWT varied by area. The values suggest that bus punctuality was best in Wales. Elsewhere there was little difference between the different areas. Table 5 shows that in all areas, EWT was lowest at the Start Timing Points, as one would expect. This was particularly true for the Southern Regions and for Wales, with increasing EWT along routes perhaps reflecting difficulties with traffic congestion on some routes in these areas.

Table 6: Excess Waiting Time for frequent buses by type of area: 2007

Minutes

	Start Timing Points	Intermediate Timing Points	Other Bus Stops	All Bus Stops	All Bus Stops (2005)
Large conurbations	1.10	1.42	1.53	1.35	1.74
Mixed area authorities	1.20	1.34	1.03	1.20	1.13
Rural authorities	0.64	1.19	1.37	1.08	1.56
GB exc. London	1.08	1.35	1.40	1.29	1.53

21. Punctuality of frequent bus services was found to be best in rural authorities and worst in the large conurbations (see Table 6). It is notable that the EWT in large conurbations were reasonably good at the start of routes, but traffic congestion and other factors resulted in poorer standards along the route.

Table 7: Excess Waiting Time for frequent buses by time from start of route: 2007

Minutes

	Start Timing Points	Intermediate Timing Points	Other Bus Stops	All Bus Stops	All Bus Stops (2005)
Start	1.08	na	na	1.08	1.38
1 to 15 minutes	na	1.29	1.07	1.20	1.23
16 to 30 minutes	na	1.18	1.50	1.32	1.77
31 to 60 minutes	na	1.40	1.73	1.54	1.59
61 or more minutes	na	1.94	1.36	1.69	2.25
All departures	1.08	1.35	1.40	1.29	1.53

22. Table 7 shows that punctuality was best at or near the start of the route. The average EWT was 1.69 minutes for those waiting at a stop more than one hour from the start of the route.

Table 8: Excess Waiting Time for frequent buses by time of day: 2007

Minutes

	Start Timing Points	Intermediate Timing Points	Other Bus Stops	All Bus Stops	All Bus Stops (2005)
0800 to 0930	0.92	1.12	1.52	1.18	1.80
0931 to 1529	0.77	1.46	1.28	1.20	1.32
1530 to 1730	1.35	1.44	1.42	1.41	1.44
All times - 0800 to 1730	1.08	1.35	1.40	1.29	1.53

23. Average EWT varied by time of day. It was highest during the evening peak. By this time, the knock-on effects from earlier delayed services meant that punctuality at start timing points was particularly poor. Perhaps surprisingly, the best punctuality was recorded during the morning peak.

Percentage of Buses that Failed to Run

Table 9: Percentage of no-show buses: 2007

Percentage

	Start Timing Points	Intermediate Timing Points	Other Bus Stops	All Bus Stops	All Bus Stops (2005)
0800 to 0930	*2.8*	*2.0*	*2.8*	*2.4*	*1.7*
0931 to 1529	*2.7*	*1.5*	*1.8*	*1.9*	*1.5*
1530 to 1730	*3.4*	*2.5*	*2.3*	*2.8*	*2.2*
All times - 0800 to 1730	*3.0*	*2.0*	*2.3*	*2.4*	*1.8*

24. Because of staffing difficulties, extreme traffic congestion, mechanical problems and other such problems, there are occasions when buses fail to operate part or all of their route. If a scheduled bus was not observed by a BCO during the observation period, it was recorded as a "no-show". The overall percentage of "no-shows" in the survey was found to be 2.4%, rather higher than the percentage recorded in 2005 (1.8%). This was also higher than the level of lost mileage reported by operators in the DfT quarterly bus reliability survey – (1.2%) for the April to June quarter of 2007. In a survey of this size, with many observations recorded at busy stops, it is inevitable that a handful of buses will not have been recorded. It is also likely that lost mileage is more prevalent during peak hour traffic, when most of the survey took place, than at other times, such as in the evenings and at weekends.

Comparisons with London

25. There are comprehensive statistics on bus punctuality in London. However, Transport for London (TfL) is responsible for monitoring bus standards in London, not the Traffic Commissioners, and slightly different conventions are used by them to assess timeliness. Adjustments have had to be made to the National Survey results in order to compare figures between the two areas. In particular, frequent services in London are defined as those running every 12 minutes, not every ten minutes as is the case outside London. Further, non-frequent buses in London are regarded as being on time if they are within the window of 2 minutes and 30 seconds early to 4 minutes 59 seconds late.

26. As for the 2005 survey, the raw data from the 2007 survey were adjusted to fit in with these conventions, assuming that half of those buses running between 2 to 3 minutes early were "on time". The London figures included data for weekdays in May of 2007. Only data for timing points were available and these did not distinguish between Start Timing Points and Intermediate Timing Points. For comparison purposes, it was assumed that 20% of the London observations were made at the start of routes. Data for Scotland and Wales were excluded from the comparison.

Table 10: Weekday Punctuality May 2007 (London conventions)

Measure	London	Rest of England	London (2005)	Rest of England (2005)
Excess Waiting Time (minutes)	1.1	1.3	1.0	1.7
Buses departing on time (%)	*78*	*74*	*79*	*74*

N.B. Data for London based on data for selected hours on weekdays in May. Data are not representative of all buses in 2005 and 2007.

27. Table 10 shows that punctuality for buses was again higher overall for London than for the rest of England. However, the gap in performance identified in 2005 has narrowed, particularly in respect of frequent services. (It should be noted that the drop in punctuality for London buses seen in Table 10 is not matched by the full dataset for London buses and may just reflect the limited sample size of the data used to compile the estimates.)

Comparisons with data from operator GPS and other electronic devices for measuring punctuality

28. An increasing number of bus operators and local authorities are relying on electronic data to judge bus punctuality. GPS systems can provide real-time operational benefits as bus operators can track the progress of each bus, as well as providing useful management information. In principle these systems should provide data that are cheaper to obtain that from roadside observations and be free of human error. However, it is known that such devices can fail to work on occasions and it was decided to compare the results from the two sources to check on these differences.

29. Eight operators provided bus departure times recorded by their GPS and other electronic devices aboard their buses. Two operators were only able to provide data for one route and so were excluded from the analyses below. Also excluded were those services of the remaining six operators, where it was not possible to match more than 50% of the observations from the two sources. It was assumed that for these services, not all buses were fitted and that it was therefore inappropriate to use the sparse data available for these routes.

30. Where there was sufficient data, it was possible to match around 1400 scheduled departures with information from roadside observations by BCOs. From the GPS data available, it is calculated that on about 7 occasions there was no match because the bus failed to run. Apart from some missing observations in Scotland, there appear to have been only 3 occasions when a bus was not correctly recorded by the BCO.

31. As the number of observations for matching is relatively small, and only comparable for six operators, the comparisons below should be regarded purely as indicative. The analyses below do not provide robust national estimates on punctuality from GPS systems.

32. None of the six operators had data for all the BCO observations. The proportion where a value was “missing” varied from 7 to 29 per cent. These missing values could be because:

- The bus was not fitted with a device;
- The device was switched off or not working for some reason or;
- The BCO had recorded a bus, which had, in fact, not run at all.

33. These gaps in the data means that it is probably not yet possible to use the electronic devices to measure the excess waiting time on frequent services where it is essential to record every departure.

Table 11: Punctuality of buses by whether recorded by electronic device or not: 2007

Percentage

Lateness (minutes)	Recorded by GPS and BCO	Recorded solely by BCO
-3 or less	*6*	*6*
-2	*5*	*4*
-1	*11*	*12*
0	*15*	*15*
1	*12*	*13*
2	*11*	*15*
3	*11*	*4*
4	*8*	*8*
5	*5*	*5*
6	*4*	*6*
7	*3*	*4*
8	*2*	*1*
9	*2*	*1*
10	*1*	*2*
11 or more	*5*	*4*
All	*100*	*100*
Percentage on time (1 minute early to 5 minutes late)	*73*	*72*

34. Table 11 shows that the punctuality of buses with a working GPS device was only slightly better than those where it was not possible to obtain a recording: 73 per cent compared to 72 per cent. This suggests that, in aggregate, there is currently no bias in relying on data from roadside observations or from buses with working GPS devices to measure overall punctuality using the 1 minute early to 5 minutes late measure.

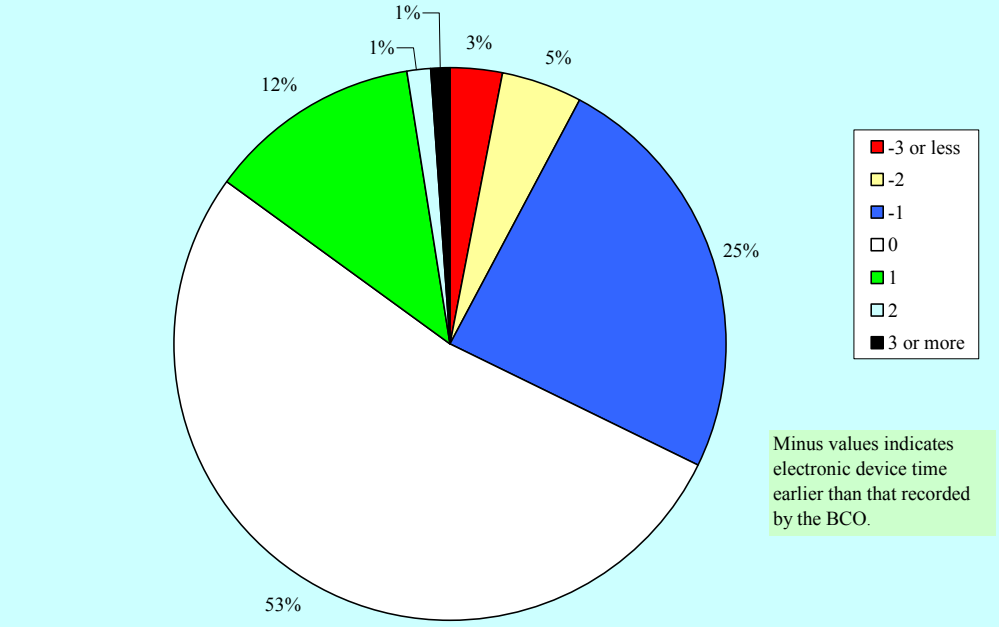
Table 12: Differences between BCO and electronic records of departures by operator (minutes): 2007

Percentage

Operator	-3 or less	-2	-1	0	1	2	3 or more	All	% +/- 1 minute
A	*18*	*18*	*26*	*19*	*11*	*2*	*5*	*100*	*56*
B	*0*	*0*	*7*	*71*	*19*	*2*	-	*100*	*97*
C	-	*7*	*44*	*44*	*4*	-	-	*100*	*93*
D	*2*	*6*	*18*	*60*	*12*	*1*	*1*	*100*	*89*
E	*1*	-	*22*	*51*	*24*	*3*	-	*100*	*97*
F	-	-	*54*	*46*	-	-	-	*100*	*100*
Weighted Average	*3*	*5*	*25*	*53*	*12*	*1*	*1*	*100*	*90*

35. Although the overall proportions of punctual buses recorded via GPS or by roadside observation do not appear to be biased Table 12 shows how the times recorded by the electronic devices differed from those recorded by the BCOs. Perhaps surprisingly, there was only a 53 per exact matching between the visual and electronic estimates of times of departure. Whilst the BCOs use radio-controlled watches to determine departure times, it is possible that, on occasions, they may not have been able to spot the exact time of departure for a bus, e.g. at a busy bus station with many stands. On the other hand, the recording of a departure time for an electronic system may be based on a variety of triggers: the issuing of a last ticket, the closing of the bus door, the passing of a certain point just beyond the bus stop, etc.. If some allowance is made for minor timing differences, the match is very good. About 90% of buses had a match within one minute around the BCO time of departure.

Chart 4: Difference in minutes between roadside and electronic observations: 2007



36. If it is assumed that the BCO recordings are generally unbiassed, there appears to have been a tendency for GPS systems to record departures prematurely.

37. Since a bus is considered on time if it departs one minute early up to 5 minutes late, this tendency to record departures ahead of time may result in buses being erroneously categorised as departing too early, thereby lowering the overall percentage being recorded as “on time”. In addition, actual departure times are related to scheduled departure times for individual buses. This can further depress the observed timeliness of the service. (Consider the example of a service running every ten minutes with one bus ten minutes behind schedule and the bus following it failing to run. To the passenger, this would be regarded as one bus which failed to run followed by one bus that was exactly on time. However, to the operator it would appear as one bus that was ten minutes late and one that failed to run). The survey results in the main body of the report assign bus departures to the most appropriate bus schedule times rather than the declared running order of each bus. This means that the levels of punctuality suggested in this report may be higher than that reported by a purely electronic system of recording punctuality.

Annex 1

1. This annex provides details of the methodology, sample sizes and other technical details including a short description of how EWT is calculated.

Sampling method

2. Bus Compliance Officers (BCOs) in the eight Traffic Areas outside London were asked to carry out observations of buses at selected locations throughout Great Britain outside London. These sites were originally chosen from a list of sites used by DfT to monitor traffic levels in the National Traffic Survey. These original sites were those with an expected number of at least 200 buses and coaches per day on urban A-roads and minor roads. Sites were then eliminated if they were suspected of containing mainly coach traffic, e.g. around airports. The sites were then examined using a Geographical Information System (GIS) to ensure that a good distribution of sites in urban areas. Final modifications were made by the BCOs themselves, who considered the sites carefully and adjusted a large proportion of them to the nearest bus stops designated as Timing Points. In particular, they were instructed to ensure that all bus stations were suitably covered in each area. Whilst some sites were observed in both 2005 and 2007, a number of other sites were switched so as to have a better balance of the different types of stop in each area.

3. BCOs recorded the route numbers, direction and times of departure for all buses passing the site on weekdays in the designated 4 weeks of May 2007 and a few days in June, mainly for 2.5 hours, either from 8am to 10:30am or from 3pm to 5:30pm. The recorded times were then matched with data from bus timetables available from the internet (www.traveline.org.uk) or other sources before being returned to DfT. The data provided to DfT included both the scheduled times at the bus stop observed as well as the scheduled time at the start of the route for each service.

4. Over 25,000 observations were recorded at 229 sites. The median number of observations per shift was 87, though there was one site where 418 buses were recorded in the two and a half hour period. Table A shows the geographical distribution of these sites and observations.

Table A: Observations by Area: 2007

	Sites	Observations	Of which:		Sites	Observations
			Frequent	Non-Frequent	(2005)	(2005)
Northern/Midland Regions	83	9,181	3,733	5,448	98	6,935
Southern Regions	74	7,536	1,484	6,052	97	7,581
England exc. London	157	16,717	5,217	11,500	195	14,516
Wales	21	1,749	375	1,374	18	1,397
Scotland	51	6,645	2,546	4,099	51	5,576
GB exc. London	229	25,111	8,138	16,973	264	21,489

5. The analyses were carried out making the following assumptions/adjustments:

- "No shows", where identified, were treated as if the bus had arrived and departed at the same time as the next bus observed. This reflected the wait time for those left standing at the stop by "no shows".
- Buses observed to be more than 5 minutes early were assumed to similar to "no shows" and were also assumed to be as late as the next bus.
- For some early and "no show buses", no next bus was observable. In these cases, it was assumed that the next bus departed on time at the first scheduled time of departure after the end of the observation period. However, see bullet point below about ignoring missing bus departures towards the end of the departure period
- The maximum lateness for a bus was set at 60 minutes.

- Buses observed or due to depart within the first or last ten minutes of the observations period were generally ignored, unless they were clearly “on time” or if they had a frequency of 2 or less per hour and were definitely too early or too late.
- If a route was found to have many “no-shows” or found to be badly unpunctual in one direction, it was assumed that the service had been diverted or subject to some special factor. Results for the service were then omitted from any further analyses.
- Bus routes were deemed frequent if buses on the route were scheduled to run 6 times or more per hour for the whole period of observation, even if the scheduled times of departure were not evenly spaced over the course of this period.

6. Tables below provide further details of the buses observed during the exercise and comparisons with the characteristics of the 2005 Survey. It is noticeable that there was a better balance of type of stop in the 2007 survey, but a slight deterioration in the balance of observations in the morning and evening peaks – particularly in the Northern/Midlands Area.

Table B: Service Frequency by Area: 2007

Service Frequency (per hour)	Northern/ Midland Regions	Southern Regions	England exc. London	Wales	Scotland	GB exc. London	GB exc. London (2005)
1	*11*	*18*	*14*	*24*	*11*	*14*	*12*
2	*18*	*19*	*19*	*26*	*15*	*18*	*23*
3 to 5	*30*	*43*	*36*	*28*	*35*	*35*	*38*
6 to 9	*30*	*20*	*25*	*21*	*32*	*27*	*25*
10+	*11*	*-*	*6*	*-*	*6*	*6*	*3*
All Frequencies	*100*	*100*	*100*	*100*	*100*	*100*	*100*

Table C: Type of Bus Stop by Area: 2007

Service Frequency (per hour)	Northern/ Midland Regions	Southern Regions	England exc. London	Wales	Scotland	GB exc. London	GB exc. London (2005)
Start Timing Points	*45*	*25*	*36*	*26*	*10*	*28*	*18*
Intermediate Timing Points	*37*	*47*	*41*	*34*	*55*	*45*	*42*
Other Bus Stops	*19*	*27*	*23*	*40*	*35*	*27*	*40*
All Stops	*100*	*100*	*100*	*100*	*100*	*100*	*100*

Table D: Scheduled Departure Time of Day by Area: 2007

Service Frequency (per hour)	Northern/ Midland Regions	Southern Regions	England exc. London	Wales	Scotland	GB exc. London	GB exc. London (2005)
0800 to 0930	*21*	*34*	*27*	*42*	*36*	*30*	*34*
0931 to 1529	*31*	*37*	*33*	*38*	*31*	*33*	*38*
1530 to 1730	*49*	*30*	*40*	*20*	*34*	*37*	*27*
All times - 0800 to 1730	*100*	*100*	*100*	*100*	*100*	*100*	*100*

Annex 2

How Excess Waiting Time (EWT) is calculated

1. Services which are registered as frequent (i.e. with at least 6 buses per hour) were assessed by a measure (used in London) called Excess Waiting Time. This is the difference between the average waiting time actually experienced by passengers and the waiting time one would expect from the schedule. If buses on a route are expected to run every ten minutes, then statistically the average waiting time is half this gap or headway, i.e. 5 minutes. If the buses run exactly to schedule then the average waiting time experienced by passengers will be 5 minutes and there will be no excess waiting time. If buses do not run at even 10 minute intervals, there will be excess waiting time. The new Traffic Commissioner standard is for a maximum of one-and-a-quarter minutes of Excess Waiting Time per route. This means that, for a service registered as every 10 minutes the average wait experienced by passengers should be no longer than 6.25 minutes. For a service registered as every 8 minutes, the average wait should not exceed 5.25 minutes.

How is bus operator performance calculated?

2. It is necessary to make a sufficient number of observations and then calculate a **weighted average,** so as to penalise longer headways.

Why use a weighted average?

3. If, say, the middle one of three buses is 5 minute late on a route with a scheduled 6 buses per hour, there will be a headway of 15 minutes between the first and second buses, but one of only 5 minutes between the second and third buses. The average headway is therefore still ten minutes, i.e. (15+5) divided by 2. However, on the assumption that passengers arrive randomly at the stop, three times as many passengers will be affected by the long headway than the short headway and this has to be reflected in the calculations. For instance, if passengers were arriving at the rate of one per minute, then there would be 15 passengers affected by the long wait and only 5 passengers benefiting from the short wait.

How do I calculate the weighted average?

4. This is best illustrated by means of an example, such as the one shown below with a ten-minute interval between buses. First, the departure times, and thus the headways between buses over a period of time, are recorded. If two buses arrive at the same time then the headway for one of them will be 0 minutes. The information then needs to be entered into a spreadsheet to calculate the average waiting time (see below). Once this has been calculated, the result needs to be compared to the scheduled waiting time in order to estimate the excess waiting time.

Bus departures (a)	Headway (minutes) (b)	Average wait time for each bus (c)	Weighted average wait time ((b)*(c)) (d)
0800			
0811	11	5.5	60.5
0819	8	4	32.0
0830	11	5.5	60.5
0850	20	10	200.0
0900	10	5	50.0
0913	13	6.5	84.5
0918	5	2.5	12.5
0930	12	6	72.0
0941	11	5.5	60.5
0950	9	4.5	40.5
1000	10	5	50.0
1020	20	10	200.0
1020	0	0	0.0
1030	10	5	50.0
1038	8	4	32.0
1050	12	6	72.0
1100	10	5	50.0
		Total	1,127
		Total Time (minutes)	180
		Average Wait	6.26

5. The total waiting time during the period monitored, i.e. the total of column (d), is 1,127 minutes. This was for a period of 3 hours or 180 minutes. Thus the average waiting time for the period is 6.26 minutes (1,127 divided by 180). The scheduled waiting time was 5 minutes and so the excess waiting time is 1.26 minutes (6.26 minus 5). Note that the timekeeping of the bus route was generally excellent for this period, apart from a "no-show" at 0840 and the fact that two buses arrived at the same time of 1020. These two lapses were sufficient for the overall performance to be below the standard during this time.

Annex 3

Revised tables for the 2005 Bus Punctuality Survey

1. For the 2007 survey, the BCOs were required to provide the scheduled departure time for each bus at the start of its route, as well as at the stop under observation (In the 2005, survey they were only required to give an average time from the start of the route for each service in each direction). A Quality Assurance study of the data provided in 2007 by the Scottish BCOs revealed that over 5 per cent of the timetable data provided were duplicates. It appeared that these had been included to match the number of observed buses on particular routes, where the number of observations exceeded the number timetabled for the period under observation. The electronic data from Scottish operators confirmed that there had been some misreporting by the Scottish BCOs. It was decided to exclude all identified excess sightings of buses from the analyses and assume that the passengers only boarded the bus observed to be close to the scheduled departure time.

2. The 2005 survey was then reviewed and similar duplications were identified. It was decided to apply the same approach to these data. This was important as it helped to explain why the level of bus punctuality in Scotland was found to be so low in the 2005 survey. The tables below reflect the revised values for 2005.

3. As a result of the revisions, the estimate of the overall percentage of on-time, non-frequent buses in the 2005 survey in Scotland was raised from 61 per cent to 66 per cent. The estimated EWT for frequent buses was reduced from 2.03 minutes to 1.73 minutes.

Table 1: Percentage of non-frequent buses on time by type of stop and country: 2005

Percentage

	Start Timing Points	Intermediate Timing Points	Other Bus Stops	All bus stops
Northern/Midland Regions	*83*	*62*	*60*	*67*
Southern Regions	*86*	*78*	*71*	*79*
England exc. London	*85*	*71*	*66*	*74*
Wales	*91*	*69*	*71*	*76*
Scotland	*77*	*65*	*56*	*66*
GB exc. London	*85*	*70*	*63*	*72*
Sample	3,018	6,638	6,012	15,668

Table 2: Percentage of non-frequent buses on time by type of area: 2005

Percentage

	Start Timing Points	Intermediate Timing Points	Other Bus Stops	All bus stops
Large conurbations	*78*	*64*	*58*	*66*
Mixed area authorities	*89*	*77*	*71*	*79*
Rural authorities	*83*	*73*	*65*	*73*
GB exc. London	*85*	*70*	*63*	*72*

Table 3: Percentage of non-frequent buses on time by time from start of route: 2005

Percentage

	Start Timing Points	Intermediate Timing Points	Other Bus Stops	All bus stops
Start	*85*	*na*	*na*	*85*
1 to 15 minutes	*na*	*70*	*70*	*70*
16 to 30 minutes	*na*	*69*	*64*	*67*
31 to 60 minutes	*na*	*70*	*57*	*64*
61 or more minutes	*na*	*68*	*52*	*61*
All departures	*85*	*70*	*63*	*72*

Table 4: Percentage of non-frequent buses on time by time of day: 2005

Percentage

	Start Timing Points	Intermediate Timing Points	Other Bus Stops	All bus stops
0800 to 0930	*85*	*69*	*60*	*71*
0931 to 1529	*86*	*71*	*67*	*74*
1530 to 1730	*82*	*67*	*63*	*70*
All times - 0800 to 1730	*85*	*70*	*63*	*72*

Table 5: Excess Waiting Time for frequent buses by area: 2005

Minutes

	Start Timing Points	Intermediate Timing Points	Other Bus Stops	All bus stops
Northern/Midland Regions	1.17	1.71	2.21	1.70
Southern Regions	1.75	1.35	1.66	1.56
England exc. London	1.38	1.56	1.96	1.63
Wales	0.12	0.85	0.93	0.66
Scotland	2.27	1.78	1.15	1.73
GB exc. London	1.38	1.62	1.56	1.53

Table 6: Excess Waiting Time for frequent buses by type of area: 2005

Minutes

	Start Timing Points	Intermediate Timing Points	Other Bus Stops	All bus stops
Large conurbations	1.81	1.82	1.54	1.74
Mixed area authorities	0.96	1.21	1.19	1.13
Rural authorities	1.44	1.17	2.19	1.56
GB exc. London	1.38	1.62	1.56	1.53

Table 7: Excess Waiting Time for frequent buses by time from start of route: 2005

Minutes

	Start Timing Points	Intermediate Timing Points	Other Bus Stops	All bus stops
Start	1.38	na	na	1.38
1 to 15 minutes	na	1.28	1.17	1.23
16 to 30 minutes	na	1.76	1.78	1.77
31 to 60 minutes	na	1.49	1.73	1.59
61 or more minutes	na	2.62	1.76	2.25
All departures	1.38	1.62	1.56	1.53

Table 8: Excess Waiting Time for frequent buses by time of day: 2005

Minutes

	Start Timing Points	Intermediate Timing Points	Other Bus Stops	All bus stops
0800 to 0930	1.48	2.04	1.81	1.80
0931 to 1529	1.25	1.31	1.38	1.32
1530 to 1730	1.39	1.47	1.46	1.44
All times - 0800 to 1730	1.38	1.62	1.56	1.53

Table 9: Proportion of no-show buses

Percentage

	Start Timing Points	Intermediate Timing Points	Other Bus Stops	All bus stops
0800 to 0930	*1.0*	*1.3*	*2.5*	*1.7*
0931 to 1529	*0.9*	*1.8*	*1.6*	*1.5*
1530 to 1730	*1.7*	*1.8*	*2.8*	*2.2*
All times - 0800 to 1730	*1.2*	*1.6*	*2.3*	*1.8*