Bus Accidents, Bus Deregulation and London

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Summary

Local bus services were deregulated in October 1986 in all of Britain except London. Government policy is to extend deregulation to London. This paper analyses statistics on bus accidents from the national road accident database from 1981 to 1991 to compare results for London and the rest of Great Britain and to consider whether deregulation has affected safety. The conclusions depend on the assumption that accident recording practice was not itself affected by deregulation.

Bus accident rates are higher in London than on built-up roads elsewhere, partly apparently because of road traffic conditions in London and partly because open-platform buses have higher accident rates involving occupants (including boarding and alighting accidents) than buses with doors.

The main safety effects of deregulation operate through its effects on bus activity, though there is also some evidence that the rate per bus-kilometer of accidents involving other road users fell slightly. This may be due in part to the trend towards smaller buses associated with deregulation. Deregulation has led to a fall in bus patronage and, thus, to a fall in occupant casualties and to a rise in bus-kilometers and, thus, to a rise in casualties among other road users in accidents involving buses. The number of fatal and serious casualties among other road users involved in bus accidents is larger than the number among bus occupants, so deregulation in London could lead on balance to a small rise in fatalities involving buses. On the other hand, the number of slight casualties among other road users involved in bus accidents is smaller than the number among bus occupants, so deregulation in London could lead to a fall in the number of slight casualties involving buses.

Despite fears that changes in the management of bus operations or financial pressures might lead to increased accident rates following deregulation, the findings do not support such fears.

1. Introduction

Local bus services were deregulated in Britain in all areas except London in October 1986. Government policy is to extend deregulation to London. There were no formal changes in the general bus safety requirements at deregulation, but there were fears that changes in the management of bus operations or financial pressures might lead to increased accidents. Previous studies of British bus deregulation and safety (Astrop et al, 1991) and of deregulation and safety in other modes and countries (Moses and Savage, 1989) have found little evidence to support such concerns, but safety remains an important and live issue.

Data from the British national database of road accidents reported to the police was analyzed to:

(1) place accidents involving buses in the context of road accidents generally;

(2) compare bus accidents in London with bus accidents on built-up roads elsewhere in GB;

(3) explore whether deregulation outside London appears to have affected bus accidents; and

(4) consider what might be the effect on bus accidents of bus deregulation in London.

The paper continues as follows. Section 2 discusses the accident data, exposure data, and related topics. Section 3 briefly reviews the trends and levels of road accidents and casualties generally in Britain. Sections 4, 5, 6, and 7 respectively discuss topics (1) to (4) above. Section 8 presents conclusions. Tables demonstrating findings are presented within the text; in addition, three reference tables containing the data used are presented in an appendix.

2. Data

Road Accidents and casualties

This study is based on the national database of road accidents reported to the police and held by the Department of Transport, using data for the eleven years 1981 to 1991 inclusive. The database distinguishes accidents by (among other things) type of vehicle(s) involved, type of road, and severity of casualties. One category of vehicle is "buses and coaches", which includes all vehicles with bus-type or coach- type bodies, whether or not they are licensed as passenger- carrying vehicles and whether or not they are operating local bus services. Throughout this paper, we use the word "bus" to refer to any vehicle with a bus-type or coach-type body. To distinguish most effectively the environment of local bus services, this study is confined to accidents on built-up roads only, that is those roads with a speed limit of 40 miles per hour or less. The association between local bus services and buses or coaches on built-up roads is not perfect. We discuss it later in this section.

The detailed accident and casualty data used are in Appendix Tables A2 and A3. These data are assembled largely from special tabulations from the database produced on request by the Department of Transport and cover aspects of accidents to buses, accidents on built-up roads, and accidents in London. These were combined with published data from Road Accidents Great Britain (DOT, annual), which gives a good, consistent selection of more general results from the database.

Accident reporting

All accidents involving a vehicle on the public highway and causing personal injury are potentially reportable to the police and thus included in the database. However, the legal reporting requirements are narrower (James, 1991), and not all accidents for which there is a legal reporting requirement are in fact reported. Therefore, there is known to be under-reporting of potentially reportable accidents, which varies with the type and severity of the accident. James (1991) has estimated that there is no under-reporting of fatal casualties, but 24 percent of potentially reportable serious casualties and 38 percent of slight casualties are not reported. Under-reporting is particularly prevalent for single-vehicle accidents and for two-wheel-vehicle accidents.

There is likely to be relatively less under-reporting of injuries involving buses than private vehicles, because buses are usually operated by bodies with a corporate system for accident reporting. Comparisons between buses and other vehicles of non-fatal and/or one-vehicle-only accident rates are, therefore, likely to overstate the relative propensity of buses to accidents.

During 1984, the Metropolitan Police (covering London) improved their procedures for allocating the level of severity of injuries in road accidents and at the same time improved the recording of fatalities (London Research Centre, 1993). Therefore, severity-classified data for London before 1985 are not directly comparable with data for 1985 and after, nor with data from the rest of Great Britain. There is an apparent large jump upwards in the number of fatal and serious casualties in London in 1985 (clearly visible in Table A2), but this is largely spurious. Analysis of severity-classified data spanning this period must allow for this.

Allsop and Robertson (1994, forthcoming) have identified another reporting change in London in January 1982 and a possible further one in March 1987. The reasons are less clear, and their affects appear to be less important for this paper, so we have made no further adjustments for these. Therefore, with the exception for London above, we have taken the data at face value. However, it must be noted that unrecorded changes in reporting practices could have occurred outside London at the time of deregulation, in which case the conclusions of the paper might be affected.

Exposure and activity data

There is a dearth of reliable data on exposure to road accidents. The obvious general measure of exposure is the level of traffic, measured in vehicle-kilometers. British traffic estimates are limited and were revised substantially in the late 1980s. Some data for earlier years have been re-estimated and re-published, but detailed data published before the late 1980s are now of little value. The weakness is in the estimates for traffic on minor roads; this is serious because minor roads account for about 50 percent of traffic in built-up areas. There are no officially-published series for traffic on built-up roads by vehicle type, but estimates are used implicitly to calculate accident rates in *Road Accidents Great Britain*, and we have used these together with the published traffic data (DOT, 1991 and 1992a) to derive series for buses, cars, and all motor traffic. These are shown for reference in Appendix Table A1. The traffic estimates are useful for identifying large differences in accident rates, but we must be cautious where conclusions depend on small differences in time series. There are no traffic estimates for London apart from traffic on major roads.

Data related to local bus services are more complete and accurate than traffic data. There are series in *Bus and Coach Statistics* (DOT, 1992b) for passenger-journeys and vehicle-kilometers for London and the rest of Great Britain separately. In addition, the *London Transport Annual Report* (LT, annual) has a series showing LT bus vehicle-kilometers operated by "crewed" buses, that is with a conductor as well as a driver. Crew-operated buses are mostly open-platform types, so this series allows an approximate subdivision of London bus-kilometers between doored and open-platform buses. All these series are given in Appendix Table A1.

For much of this study, we have assumed that results for buses on built-up roads are results for local bus services. As mentioned above, the identity is clearly not perfect: other buses also use built-up roads, including long-distance, private-hire, tourist, and empty buses; and local bus services sometimes use non-built-up roads, though probably not much, even in non-metropolitan areas, since their function is to serve settlements. There are two items of data supporting a reasonably close identification of the two definitions. First, the average number of local bus-kilometers per year from Bus and Coach Statistics is 93 percent of the estimated bus traffic on built-up roads. Secondly, Astrop et al's (1991) detailed study of bus accidents in two metropolitan areas found that 95 percent of bus accidents in the West Midlands and 96 percent in Strathclyde involved buses on local services.

Non-highway bus accidents

Accidents involving buses off the public highway in bus stations and garages are not included in road accident statistics but are reportable to the Health and Safety Executive (HSE) as industrial accidents. Again, there is under-reporting of non-fatal injuries, but the reporting of fatalities is believed to be fairly complete. The HSE provided brief anonymous verbal accounts of fatal accidents in relevant categories over various periods so that those involving buses could be identified. In the four financial years ending in March 1992 there were 12 bus fatalities in bus stations and bus parks in the whole of Great Britain; this figure is 1.5 percent of the 825 on-the-road bus fatalities in a similar period. There were 5 bus fatalities in garages in the six years to March 1992, which is 0.4 percent of the 1,251 on-the-road fatalities in a similar period. These results suggest that it is indeed correct to focus on road accidents when considering bus safety.

3. Road Accidents and Casualties in General

Table 1 summarizes general road accident and casualty data. It shows that there were 249,000 reported personal injury accidents per year on all roads (including non-built-up) in Great Britain in 1981-1991, causing 324,000 injuries per year of which 5,300 per year were fatal and 68,000 per year were serious. The proportions occurring on built-up roads were: 76 percent of accidents; 73 percent of slight injuries; 65 percent of serious injuries; and 50 percent of fatalities. Among the accidents on built-up roads, 5.9 percent involved buses.

The total annual number of road accidents and the total number of casualties in GB were almost steady throughout the decade. However, the number of fatalities fell at an estimated average rate of 1.8 percent per year, and the number of fatal and serious injuries declined at 3.4 percent per year.

The trends for accidents and casualties on built-up roads were somewhat more favorable than those on all roads. The trends on built-up roads in Greater London, and on built-up roads involving buses, were broadly similar to the general trends on built-up roads, though with some variations.

4. Bus Accidents and Casualties on Built-up Roads in Great Britain

Buses have a different pattern of accidents and casualties on built-up roads from cars. The results discussed in this section are broadly similar to those found by Rogers et al (1988) for the period 1975-1985 and by Colski (1991) for 1990.

One-vehicle-only accidents

Table 2 shows accident rates for buses and cars on built-up roads in Great Britain. Buses have about 26 times as many reported one-vehicle-only accidents per vehicle-kilometer on built-up roads as cars. One-vehicle-only (OVO) accidents are defined here to be those involving one vehicle and its occupants but no pedestrians or other vehicles. By definition, all casualties in OVO accidents are occupants of the vehicle concerned. The OVO category includes accidents where vehicles run off the road and hit roadside objects; for buses, it also includes injuries to people boarding and alighting and injuries to people within the bus where no other road user is involved. The last two groups have no parallel for other vehicles, and that is a major reason the OVO accident rate for buses is higher than that for cars. It is likely also that reported figures overstate the difference between buses and cars, because the reporting of non-fatal OVO injuries is probably more complete for buses than for cars.

Accidents involving buses and other road users

Table 2 shows that buses also have many more accidents per vehicle-kilometer on built-up roads involving other road users than cars. For all such accidents, the rate for buses is 70 percent higher than that for cars. Figure 1 plots the data points over time (the fitted lines may be ignored for the moment), and shows that the difference is persistent. For one-vehicle/pedestrian accidents, the bus rate is 120 percent higher than

Table 1

General Road Accident and Casualty Data: 1981-1991				
	Injuries Accidents	Casualties		
		Killed	Killed & Seriously Injured	All Severities
Average recorded number per year				
All Great Britain	248,624	5,336	73,010	323,526
On Built-up roads:				
All Great Britain	188,018	2,654	46,373	229,142
Greater London	**	446	8,291	50,138
All involving buses	11,109	147	1,903	13,727
Number on built-up roads as a percent of those on built-up roads in Great Britain:				
Greater London	**	16.8%	17.9%	21.9%
Involving buses	5.9%	5.6%	4.1%	6.0%
Estimated average change per year				
All Great Britain	-0.1%	-1.8%	-3.4%	+0.1%
On built-up roads:				
All Great Britain	-0.5%	-2.8%*	-4.5%*	-0.4%
Greater London	**	-3.5%*	-1.8%*	-1.4%
Involving Buses	-1.1%	-3.0%*	-3.3%*	-0.8%
*Trend adjusted to allow for the effect of the non-standard classification of accident severity in London 1981-1984.				

the car rate; for two-vehicle accidents, the bus rate is 70 percent higher. The high accident involvement rate for buses reflects the nature of bus operation: buses are required to stop and start more frequently than other vehicles, and they are used on roads with many pedestrians and other vehicles.

Severity patterns

Table 3 compares the severity patterns of casualties in accidents involving buses with those of all road accidents. About six percent of fatal and serious casualties in all road accidents on built-up roads are fatal, but the proportion is only two percent for bus occupants. On the other hand, the proportion is 11 percent for other road users involved in bus accidents. Fatal and serious casualties as a proportion of all casualties are similarly lower than average for bus occupants and higher than average for non-occupants involved in bus accidents. The conclusion is that on average bus occupant casualties are less serious than all road casualties, but non-occupant casualties in accidents involving buses are more serious. These results are not surprising, because the heavy mass of buses leads them to decelerate more slowly in collisions with lighter vehicles, but it makes them more of a threat to non-occupants. These effects of vehicle mass are well-established (see, for example, Evans, pp64-77).

Table 2

Estimated Road Accidents per Vehicle-Kilometer: Great Britain: Built-up Roads: Average 1981-1991			
	Number of accidents per billion veh-km		Number for buses ÷ number for cars
	Cars	Buses	
One-vehicle-only accidents	0.078	2.058	26.4
One-vehicle plus pedestrian(s)	0.319	0.706	2.21
Two-vehicles	0.962	1.641	1.71
Three or more vehicles	0.265	0.283	1.07
All except one-vehicle-only	1.546	2.630	1.70
All accidents	1.624	4.688	2.89

Table 3

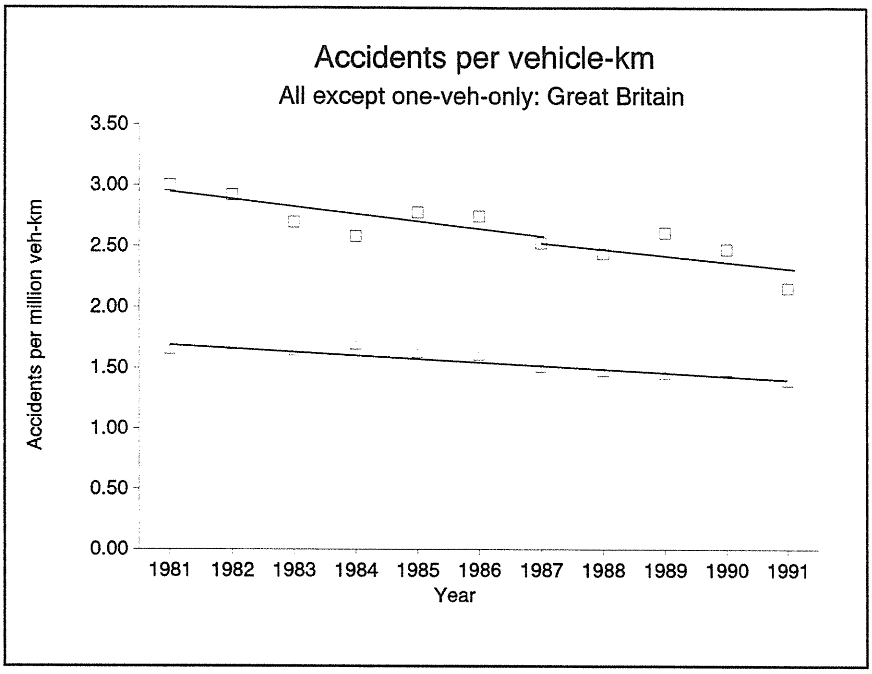
Road Casualty Severity Ratios: Built-up Roads: Average 1985-91*							
	Occupants of Buses				Others in accidents involving buses	All accidents involving buses	All in road accidents
	Bus-only accidents			All Occupants			
	Board/Alight	Other	All				
Killed as percent of killed and seriously injured							
London	2.13	2.24	2.18	1.90	8.16	4.62	4.71
ROGB+	3.49	1.58	2.56	2.37	11.44	8.48	6.01
GB	2.90	1.87	2.39	2.18	10.78	7.41	5.75
Killed and seriously injured as percent of all casualties							
London	16.6	9.5	11.9	10.9	22.0	14.2	17.8
ROGB+	13.4	6.8	9.1	7.2	21.6	13.1	18.8
GB	14.5	7.8	10.1	8.4	21.7	13.4	18.6
*Table is based on 1985-91 to avoid the non-standard classification of accident severity in London in 1981-84. +ROGB = Rest of Great							

That the severity patterns for occupants and non-occupants involved in bus accidents are different is also illustrated by the Table 4. This shows that bus occupants account for only 0.7 percent of all road fatalities but 1.6 percent of fatal and serious injuries and 3.8 percent of all casualties. For non-occupants involved in bus accidents, the sequence moves the other way: they account for 4.9 percent of all road fatalities, 2.5 percent of fatal and serious injuries, and 2.2 percent of all casualties.

Are buses a safe mode?

The small number of fatalities among bus occupants accounts for the bus's reputation as a safe mode; indeed, the average number of passenger fatalities per passenger-kilometer for buses was half that for railways in 1981-90 (DOT, 1992a, Table 1.8). However, this impression is altered when fatalities to other road users are taken into account: between 1981 and 1991, there were seven times as many fatalities among non-occupants as occupants, and Jones (1991, Table 4d) shows that in 1990 buses had more non-occupant casualties per vehicle-kilometer on built-up roads among the vehicle classes. In addition, there are a relatively large number of slight casualties reported among bus occupants, though this is almost certainly partly because they are better reported than slight casualties among other road users.

Figure 1



5. Bus Accidents and Casualties on Built-up Roads in London

Comparison of general road accident rates on built-up roads in London with those in the rest of GB is not simple because of the dearth of regional traffic data. However, bus-kilometers in London and the rest of Great Britain can be estimated by splitting the total for Great Britain in proportion to local bus-kilometers and, thus, calculate the number of bus accidents per bus-kilometer.

Table 5 presents the results. The table shows that overall there were about three times as many reported accidents involving buses per bus-kilometer on built-up roads in London in 1981-91 as on built-up roads in the rest of Great Britain. This is made up of about 4.5 times as many one-vehicle-only (OVO) bus accidents per bus-kilometer and about twice as many accidents per bus-kilometer involving other road users. It is possible that there are differences in reporting levels between London and the rest of Great Britain, but there is no evidence on this.

Accidents involving buses and other road users

The latter difference - a factor of two in the rates for bus accidents other than OVO in London - is important and is perhaps of as much concern to road safety managers as to bus operators. This is because the available evidence about other road accidents in London indicates that London traffic generally has accident rates that are twice as high as those on built-up roads elsewhere. There were 36.8 fatal or serious accidents per hundred million per vehicle-kilometer on built-up principal roads in London in 1989-91 compared with 20.1 in Great Britain as a whole including London (DOT, 1992c, Table 9); corresponding figures for all severities were 197.3 per hundred million vehicle-kilometers in London and 105.6 in Great Britain. Downes (1987, p5) also finds much higher casualty rates in London. This suggests that the high accident rate for buses involving other road users in London is a consequence of general traffic conditions in London rather than for buses in particular.

Table 4

Casualties involving Buses as a Percent of all Road Casualties: Built-up Roads: Average 1981-1991							
	Occupants of Buses					Others in accidents involving buses	All casualties involving buses
	Bus-only accidents			Other Occupants	All Occupants		
	Board/Alight	Other	All				
Killed							
London	0.71	0.67	1.39	0.18	1.57	4.20	5.77
ROGB+	0.26	0.14	0.40	0.11	0.51	5.01	5.51
GB	0.33	0.23	0.56	0.12	0.69	4.87	5.56
Killed and seriously injured							
London	1.42	1.26	2.68	0.58	3.26	2.42	5.68
ROGB+	0.44	0.40	0.84	0.37	1.21	2.55	3.76
GB	0.62	0.56	1.17	0.41	1.58	2.52	4.10
All casualties							
London	1.72	2.35	4.07	1.42	5.49	2.00	7.49
ROGB+	0.68	1.20	1.88	1.42	3.30	2.27	5.57
GB	0.90	1.45	2.36	1.42	3.78	2.21	5.99
+ROGB = Rest of Great							

Table 5

Estimated Bus and Coach Road Accidents per Vehicle-Kilometer: London and Rest of Great Britain: Built-up Roads: Average 1981-1991			
	Number of accidents per billion veh-km		London ÷ Rest of Great Brit-ain
	London	Rest of GB	
One-vehicle-only accidents	6.41	1.43	4.47
One vehicle plus pedestrian(s)	1.25	0.63	1.98
Two-vehicles	2.86	1.47	1.95
Three or more vehicles	0.49	0.25	1.95
All except one-vehicle-only	4.60	2.35	1.96
All accidents	11.01	3.78	2.91

One-vehicle-only accidents

The difference in the rates per bus-kilometer for one-vehicle-only accidents is larger. However, OVO accidents involve casualties only to bus occupants, and, therefore, it seems sensible to measure OVO accident and casualty rates not per bus-kilometer but per passenger-journey taken as a proxy for occupant exposure. Each bus boarding is counted as a passenger-journey. (Passenger-kilometers might be a better

Table 6

One-vehicle-only Bus and Coach Accidents: Casualties per Local Passenger-Journey: London and Rest of Great Britain: Built-up Roads: Averages 1981-86 AND 1987-91			
	Boarding and alighting	Other one-vehicle-only	All one-vehicle-only
	Casualties per billion local passenger journeys		
Greater London			
1981-1986	991	1,604	2,055
1987-1991	481	986	1,468
1981-1991	759	1,029	1,788
Rest of Great Britain			
1981-1986	290	503	793
1987-1991	290	534	824
1981-1991	290	517	807
Ratios: Greater London ÷ Rest of Great Britain			
1981-1986	3.41	2.12	2.59
1987-1991	1.66	1.85	1.78
1981-1991	2.62	1.99	2.22

measure but are not available except for certain operators; however, there is evidence that the average local bus journey lengths in London and other urban areas are similar (DOT, 1992b, Table 3.2).)

Table 6, therefore, gives casualties per passenger-journey in bus OVO accidents in London and the rest of Great Britain. The number of OVO casualties per local passenger-journey over the whole period 1981--1991 was 2.2 times greater in London than in the rest of Great Britain; this is a lower multiple than for accidents per bus-kilometer, because average bus occupancies are higher in London. There was a marked improvement in London during the decade: the multiple for London fell from 2.6 in the first half to 1.8 in the second. Figure 2 plots the annual data points (ignore the fitted lines for the moment), and shows the improvement in London relative to the rest of Great Britain, though even at the end of the decade, the rate for London was substantially higher than elsewhere.

Routemaster buses

The relatively high level of occupant casualties in London has been attributed partly to the continued use of open-platform "Routemaster" buses (Rogers et al, 1988); the reduction in occupant casualties has been attributed to the reduction in the use of these buses in London (London Research Centre, 1993, p4). Routemaster buses are of traditional 1950s design with an open rear platform; they provide quick access, and passengers board and alight from them at traffic stops as well as bus stops. They are popular with passengers, but provide less protection than doored buses. They are the only remaining design of bus for which a conductor is necessary. Routemaster bus-kilometers are not measured explicitly, but the London Transport Annual Report (LT, annual) publishes "crewed" bus-kilometers (that is, with a conductor), which serves as a proxy.

Figure 3 plots on the same graph the proportion of local bus-kilometers in London that are crew-operated and the number of OVO bus casualties per 500,000 passenger-journeys - a re-scaling of the data plotted in Figure 2. The pattern of the two series is remarkably similar: both were fairly flat at the ends of the decade and fell sharply in the middle. The proportion of crewed bus-kilometers in London was about 50 percent at the beginning of the 1980s and fell to 10 percent at the end as Routemaster buses were withdrawn and replaced by buses suitable for one-person operation. However, because of their popularity and convenience, London Transport refurbished several hundred Routemasters at the end of the decade for continued operation on key routes serving the central area, and the proportion of crew-operated bus-kilometers stabilized.

Figure 2

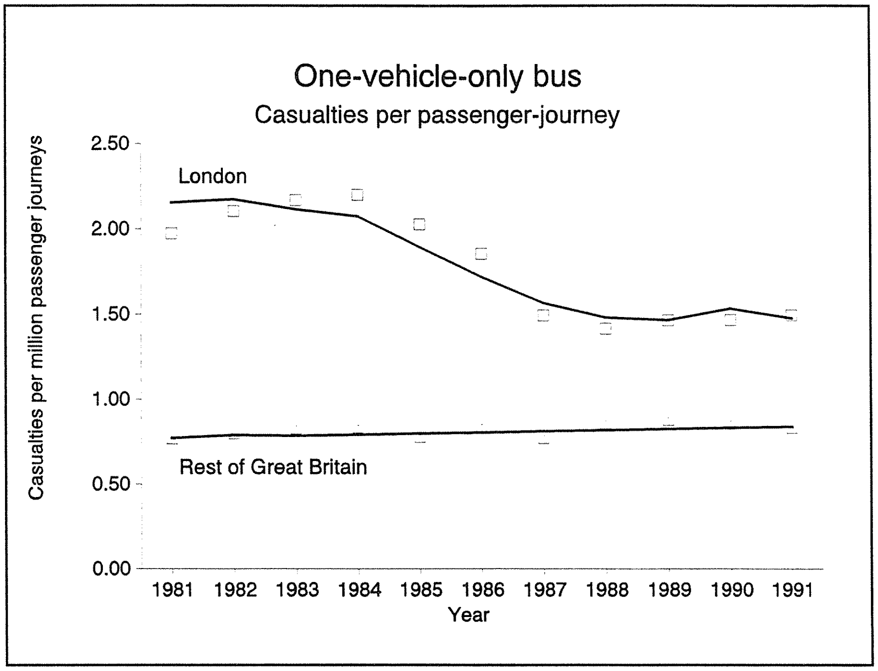
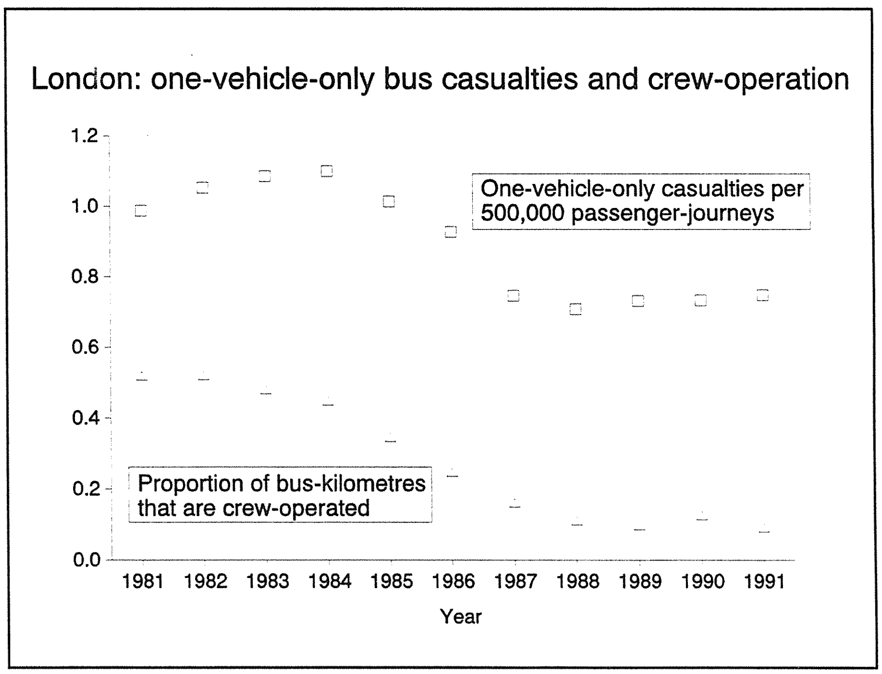


Figure 3



The similarity of the patterns of Routemaster bus operation and OVO casualty rates in London strongly suggests that Routemaster-type buses have higher OVO casualty rates than modern buses. We have quantified this in the following way. First, we note that in the rest of Great Britain there was almost no open-platform bus operation; the exception is that some ex-London Routemaster buses were introduced to a number of towns following de-regulation, but these are a very small proportion of the total. Next, we note from Figure 2 that the number of OVO casualties per passenger-journey was remarkably stable in 1981-1991 in the rest of Great Britain. In fact, there was a slight upward trend of about 0.8 percent per year represented by the fitted line in Figure 2. We have presumed that this trend would also have applied in London in the absence of Routemaster operation and then fitted the best curve to the London data using the proportion of bus-kilometers that are crew-operated as an explanatory variable. The fitted curve for London is shown in Figure 2. The equations of the two fitted curves follow:

Rest of Great Britain:

$$y = 0.768*\exp(0.00822t)$$

London:

$$y = 1.190*(1+1.548c)*\exp(0.00822t)$$

where y is the number of OVO casualties per million passenger-journeys; c is the proportion of crew-operated bus-kilometers; and t is the year, measured as t=1 for 1981 up to t=11 for 1991.

The ratio of the constants in the equations above gives the estimated OVO casualty rate per passenger-journey in London compared with that elsewhere on the assumption that London had the same type of buses. The ratio is 1.57, suggesting that London would have 57 percent more OVO casualties per passenger-journey even if no Routemaster buses were operated. The reason is not clear, but again it may be connected with general driving conditions in London. It has also been suggested that centre-door buses are more common in London and have more casualties than buses without centre doors. The coefficient of c in the London equation gives the relative number of extra OVO casualties per passenger-journey to be expected from Routemaster-type buses as compared with modern buses. The equation suggests that Routemaster buses have 155 percent more OVO casualties per passenger-journey than modern buses.

It is possible that this somewhat exaggerates the Routemaster effect because, since they are now concentrated in the central area, their average number of passenger boardings may be higher than that of other buses. However, it seems certain that their effect is substantial. Further evidence comes from Table 6, which shows that in the first half of the 1980s London's highest rate of OVO casualties relative to elsewhere was in boarding and alighting accidents, and that this category improved very sharply during the 1980s, from 3.4 times as many casualties per passenger-journey as elsewhere to 1.7 times as many. This category would be most directly affected by a reduction in the number of open-platform buses.

Numbers of casualties

We can interpret the findings of this section by estimating how many fewer casualties London would have if it had the same bus accident rates as the rest of Great Britain. Table 7 presents the results. We suppose first that the 10 percent of bus-kilometers still operated by Routemaster buses were replaced by buses of more modern design with no other changes, which saves about 14 percent of one-vehicle-only (OVO) occupant casualties. We next suppose that the OVO accident rate per passenger-journey could be reduced to that in the rest of Great Britain, which saves a further 31 percent of the present OVO occupant casualties. Lastly, we suppose that the accident rate per bus-kilometer involving other road users could be reduced to the level of built-up roads in the rest of Great Britain (about halved), which saves 49 percent of the occupant and non-occupant casualties in such accidents.

Table 7 shows that these achievements would save about two occupant fatalities per year to which the contribution from the replacement of Routemasters would be about 0.5 and about 10 non-occupant fatalities. The reduction in occupant fatalities would be small for reasons mentioned in section 4; the number is low in any case. The reduction in non-occupant fatalities would be greater, because injuries to

Table 7

Estimated Effect on Annual Casualties if London Had the Same Bus Accident Rates as the Rest of Great Britain					
	Average casualties per year 1988-91	Changes due to:			Total change
		Replacement of Route-masters	Same OVO+ accident rate* as ROGB+	Same non-OVO+ accident rate* as ROGB+	
Bus occupants:					
Fatalities	4.0	-0.5	-1.1	-0.2	-1.8
Serious Injuries	275.3	-27.7	-62.1	-35.3	-125.1
Slight Injuries	2,242.5	-207.2	-464.9	-353.8	-1,025.9
Other road users:					
Fatalities	20.0			-9.8	-9.8
Serious Injuries	223.3			-109.2	-109.2
Slight Injuries	848.3			-414.8	-414.8
Total:					
Fatalities	24.0	-0.5	-1.1	-10.0	-11.6
Serious Injuries	498.5	-27.7	-62.1	-144.5	-234.3
Slight Injuries	3,090.8	-207.2	-464.9	-768.7	-1,440.8

*The rate for one-vehicle-only accidents is measured as accidents per passenger-journey; the rate for other accidents is measured as accidents per bus-kilometer.
+OVO = one-vehicle-only; ROGB = Rest of Great Britain. Source: see text.

non-occupants involved in bus accidents are on average relatively more severe. The reductions in non-fatal injuries would be much larger, and the numbers of occupants and non-occupants would be more equal.

This is not to suggest that the reductions are achievable or even, in some cases, necessarily desirable. The most important feature of London's bus accident record is that the accident rate per bus-kilometer involving other road users is about twice the rate on built-up roads elsewhere; this causes most fatalities and serious injuries. However, London buses share this high accident rate with all London traffic, which suggests that the causes are wider than within the remit of bus operators. Traffic conditions in London may also in part explain the relatively high one-vehicle-only accident rate in London. The safety measure that is most clearly within the remit of bus operators would be to cease operation of open-platform Routemaster buses. However, this would reduce bus travel and might reduce overall safety if would-be passengers substituted walking. Therefore, even in that case, the wider safety effects are important as well as the direct effects.

6. The Effects of Bus Deregulation

Local buses were deregulated in Great Britain except London on 26 October 1986. There were no formal changes in the bus safety requirements, but there were fears that changes in the management of bus operations or financial pressures might lead to increased accidents. In principle, the effects of deregulation on accidents and casualties could be explored by comparing trends in bus accidents in built-up areas outside London with those for London and with those for cars and other vehicles outside London. In practice, the dearth of reliable exposure data and the different patterns of accidents between cars and buses and between London buses and non-London buses make these comparisons of doubtful value and liable to pick up effects other than those of deregulation. We have, therefore, based our main conclusions on the analysis of simple trends in bus accidents on built-up roads outside London using the statistical analysis program GLIM (generalized linear interactive modelling).

Numbers of bus accidents outside London

The simplest analysis is to investigate whether there are any jumps in the simple numbers of bus accidents of each category coinciding with deregulation from 1987 after allowing for any general trend. Table 8 shows that there are, indeed, some statistically significant jumps; Figure 4 indicates the nature of the analysis, and plots the data and the jumps for one-vehicle-only accidents and all other accidents involving buses. The statistical analysis estimates a fall in the number of one-vehicle-only accidents of 5.6 percent from 1987 and a rise in the number of other bus accidents of 7.5 percent entirely concentrated on 2-or-more-vehicle accidents.

The directions of these changes are what would be expected from the known changes in bus activity levels following deregulation. Deregulation led to a reduction in bus patronage below the previous trend; thus, there were fewer bus passengers exposed, which would be expected to lead to fewer OVO accidents. On the other hand, deregulation led to an increase in bus-kilometers and, therefore, more encounters between buses and other road users, which would be expected to lead to more accidents involving other road users.

Accidents per local passenger-journey

When a similar analysis is carried out with accidents per local passenger-journey as the dependent variable in place of the simple number of accidents, Table 8 shows that the jump in the number of OVO accidents disappears, suggesting that the change at deregulation was indeed directly proportional to the change in patronage. This conclusion is also confirmed by the data and fitted curve for OVO bus casualties (as distinct from accidents) per passenger-journey outside London, which is shown in Figure 2. As mentioned in section 5, the number of OVO casualties per passenger journey outside London has a slight upward trend of 0.8 percent per year, but there is no jump at the start of deregulation.

For accidents per passenger-journey involving other road users (all excluding OVO), the upward jump at deregulation is larger than the jump in the simple number; this is expected, because the reduced bus occupancies after deregulation imply that bus-kilometer per passenger-journey increased by more than bus-kilometer alone. However, bus-pedestrian accidents per passenger-journey show no significant change. This would be consistent with other results if a significant proportion of bus-pedestrian accidents involved ex-passengers or intending passengers.

Accidents per bus-kilometer

It is also useful to perform the analysis with accidents per bus-kilometer as the dependent variable, though the absence of reliable time-series of bus traffic on built-up roads at sub-national level makes this difficult. However, as was done in section 5, it is possible to estimate bus-kilometers in London and the rest of Great Britain by splitting the total national traffic (which itself is not precise) in proportion to local bus-kilometers. The results in Table 8 show as expected that OVO accidents per bus-kilometer fell sharply in

Table 8

BUS ACCIDENTS ON BUILT-UP ROADS EXCLUDING LONDON: ESTIMATED PROPORTIONAL JUMP CHANGES FROM TREND COINCIDING WITH DEREGULATION			
	Number of accidents	Accidents per local passenger-journey	Accidents per estimated bus-km
One-vehicle-only	-5.6%	No change	-17.3%
One bus/pedestrian	No change	No change	-11.8%
Two-vehicle	+9.1%	+11.7%	No change
All excluding OVO	+7.5%	+10.2%	-5.3%
Source: estimated using the Generalized Linear Interactive Modelling (GLIM) statistical program with the relevant data in Table A3.			

1987, because patronage per bus-kilometer fell sharply. However, there is also a result which is not in line with the changes in bus activity levels following deregulation: a fall of five percent in the number of accidents per bus-kilometer involving other road users. The main reason appears to be a fall in the number of one-bus-pedestrian accidents per bus-kilometer. This again may be partly because many pedestrians involved in bus-pedestrian accidents are ex-passengers or would-be passengers, and the number of passengers per bus-kilometer has fallen.

Given the uncertainties and the considerable scatter in the bus-kilometer data, we must be cautious about accepting the fall in accidents per bus-kilometer. We have, therefore, carried out further analyses at the level of Great Britain, which avoids requiring bus-kilometer data at the sub-national level but dilutes figures for the rest of Great Britain with those for London. The results are mixed, but perhaps the most convincing result comes from fitting a common trend to non-OVO car and bus accidents per vehicle-kilometer to allow for general traffic conditions and then testing for a jump in the bus series in 1987. There is a small but statistically significant jump: a fall of 2.5 percent in non-OVO bus accidents per vehicle-kilometer. Figure 1 plots the data and the fitted curves. When we estimate the effects of deregulation in London in the following section, we, therefore, accept that there was a fall in non-OVO accidents per bus-kilometer at the time of deregulation, and we cautiously put this at 2.5 percent. In addition to the point about pedestrian casualties above, the fall in accidents per bus-kilometer may also partly be due to the move towards smaller buses associated with deregulation; these have lower accident rates as Astrop et al (1991) have shown. To some extent London has already adopted smaller buses, which is another reason for caution in expecting a fall in accident rates if buses are deregulated in London.

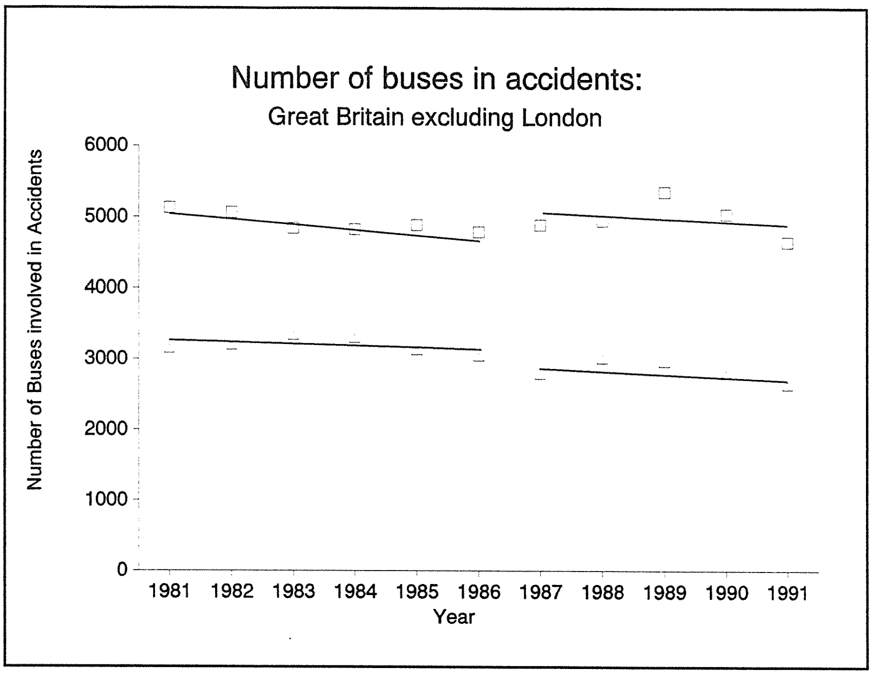
Has deregulation compromised safety?

The fall in accident rates per bus-kilometer is a move in the direction of improved safety associated with deregulation. There is nothing in the reported accident data to support the hypothesis that deregulation has been associated with increased accident rates. The main effects of deregulation on bus accidents are the direct effects of changes in bus patronage and bus-kilometers operated.

7. Bus Deregulation in London

Although it is obviously speculative, it is useful to illustrate the possible effects of deregulation on bus-related casualties in London by combining the conclusions on the effects of deregulation outside London with the casualty pattern in London. We suppose that deregulation leads to a 10 percent increase in bus-kilometers and a 10 percent reduction in bus use. These changes are in the direction and order of magnitude that have been attributed to deregulation elsewhere.

Figure 4



We suppose the 10 percent reduction in bus use leads to a 10 percent reduction in occupant casualties, both in one-vehicle-only and in other types of accident. We suppose the 10 percent increase in bus-kilometers leads to a 10 percent increase in casualties among other road users in accidents involving buses. However, we suppose that this is offset by a 2.5 percent reduction in accidents per bus-kilometer, taking the more conservative figure discussed above. Table 9 shows the results: there would be a net increase of one fatality per year, a decrease of 11 serious injuries, and a decrease of 160 slight injuries. The numbers of casualties of different severities move in different directions because the severity pattern among bus occupants and non-occupants is different.

This analysis gives a more favorable result for bus deregulation in London that it would if applied to the rest of Great Britain. This is for the somewhat perverse reason that the numbers of occupant casualties in London are relatively higher than elsewhere. Reducing bus patronage in London, therefore, gives a larger reduction in occupant casualties than it does elsewhere.

The analysis does not consider wider effects than accidents involving buses. There is some evidence (Fairhurst, 1993) that bus deregulation has been associated with higher car ownership outside London, which would have safety consequences. However, the most important wider safety effects would probably be through the effects of deregulation on pedestrian activity, which are not known. If there were fewer bus passengers, there would probably also be less walking to bus stops, which would lead to fewer pedestrian casualties; on the other hand, there might be more walking in substitution for bus travel, which would lead to more casualties.

Deregulation in London also raises the wider statutory framework concerning safety. London Transport (LT) currently has a duty to provide or secure the provision of services "with due regard to...efficiency, economy and safety of operation" (London Regional Transport Act 1984, section 2(2)). There is no corresponding duty on service procurers outside London, and they have no jurisdiction over commercial services. LT currently closely monitors the safety of its own bus services and of services operated under contract by other operators, and acts to promote safety measures identified. There could be safety effects if these activities were discontinued after deregulation in London.

Table 9

ILLUSTRATIVE CALCULATION OF EFFECT ON CASUALTIES OF CHANGES IN BUS ACTIVITY LEVELS FOLLOWING DEREGULATION: LONDON					
	Average casualties per year 1988-91	Changes due to:			Total change
		10% reduction in passengers	10% increase in bus-km	2.5% reduction in accidents per bus-km	
Bus occupants:					
Fatalities	4.0	-0.4			-0.4
Serious injuries	275.3	-27.5			-27.5
Slight injuries	2,242.5	-224.3			-224.3
Other road users:					
Fatalities	20.0		+2.0	-0.5	+1.5
Serious injuries	223.3		+22.3	-5.6	+16.7
Slight injuries	848.3		+84.8	-21.2	+63.6
Total					
Fatalities	24.0				+1.1
Serious injuries	498.5				-10.8
Slight injuries	3,090.8				-160.6

8. Conclusions

Bus accidents on built-up roads in Great Britain

Buses have about 26 times as many reported one-vehicle-only accidents per vehicle-kilometer on built-up roads as cars. This is no doubt mainly because bus one-vehicle-only accidents including boarding and alighting accidents and injuries to people within buses, which have no parallel for other vehicles. Buses also have about 1.7 times as many accidents per vehicle-kilometer involving other road users as cars. Reported bus occupant casualties are more numerous than non-occupant casualties in accidents involving buses but are on average much less severe. There were seven times as many non-occupant as occupant fatalities in 1981-91.

Bus accidents on built-up roads in London

The accident rate per bus-kilometer on built-up roads in London involving other road users is about twice the rate elsewhere. This is in line with general road accident rates and is presumably a reflection of traffic conditions in London. The one-vehicle-only (OVO) accident rate per bus passenger-journey in London is estimated to be about 1.6 times that elsewhere for similar bus types; this may also be due to traffic conditions in London. The OVO accident rate for open-platform Routemaster buses is estimated to be about 2.6 times that of doored buses. However, because occupant casualties are less severe on average than non-occupant bus casualties, reducing the OVO bus accident rates in London would have less effect on fatal and serious casualties than reducing the rate of bus accidents involving other road users.

Bus deregulation

Bus deregulation outside London is estimated to have led to an increase in the number of bus accidents involving other road users and a decrease in the number of one-vehicle-only accidents. The direction of both these changes is in line with the changes in bus activity levels associated with deregulation. Deregulation reduced bus patronage and consequently reduced the number of occupant casualties; it increased bus-kilometers and, consequently, increased the number of accidents involving buses and other road users. The only detected effect of deregulation that is not in line with changes in activity levels is a slight reduction in the accident rate per bus-kilometer outside London. It is suggested that the reasons may be, first, the reduction in bus passengers, who may be involved in some bus-pedestrian accidents, and, secondly, the trend to smaller buses, which have lower accident rates.

There is no evidence in the findings to support the hypothesis that weaker safety management or financial pressures on operators following deregulation have compromised bus safety.

Bus deregulation and London

If bus deregulation in London leads to an increase in bus-kilometers and a decrease in bus patronage, as it has elsewhere, the net effect on casualties could be a slight increase in the number of fatalities and a larger decrease in the number of less serious injuries. This is because non-occupant casualties are less numerous than occupant ones but on average are more severe.

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TABLE A1: ACTIVITY INDICATORS (in billions)

	Local Bus Passenger-journeys			Local Bus Vehicle-kilometers					Motor Traffic on Built-up Roads in GB		
				London					Vehicle-kilometers		
	London	Rest of GB	Great Britain	OPO*	Crewed	All	Rest of GB	Great Britain	Buses	Cars	All
1981	1.079	4.615	5.694	0.136	0.145	0.281	1.861	2.142	2.23	113.05	140.04
1982	1.041	4.477	5.518	0.128	0.137	0.265	1.846	2.111	2.21	115.74	141.85
1983	1.087	4.500	5.587	0.138	0.126	0.264	1.853	2.117	2.27	114.96	139.81
1984	1.162	4.488	5.650	0.149	0.119	0.268	1.857	2.125	2.32	118.29	143.56
1985+	1.152	4.489	5.641	0.180	0.093	0.273	1.804	2.077	2.17	120.93	145.94
1986	1.164	4.177	5.341	0.210	0.068	0.278	1.882	2.160	2.19	127.38	153.04
1987	1.207	4.085	5.292	0.233	0.043	0.276	2.065	2.342	2.44	133.18	159.67
1988	1.211	4.004	5.215	0.254	0.031	0.285	2.104	2.390	2.61	142.73	170.85
1989	1.188	3.886	5.074	0.265	0.027	0.292	2.150	2.442	2.69	154.44	184.46
1990	1.178	3.674	4.852	0.267	0.037	0.304	2.141	2.445	2.70	153.49	183.04
1991	1.149	3.520	4.669	0.288	0.027	0.315	2.172	2.487	2.88	152.98	182.89
Averages											
81-86	1.114	4.458	5.572	0.157	0.115	0.272	1.851	2.122	2.23	118.39	144.04
87-91	1.187	3.834	5.020	0.261	0.033	0.294	2.126	2.421	2.66	147.36	176.18
Percent changes: average 1987-91 on 1981-86											
	6.5%	-14.0%	-9.9%	66.4%	-71.1%	8.4%	14.9%	14.1%	19.4%	24.5%	22.3%

*OPO = One-person-operated. +From 1985, the local bus data are for financial years (that is, lagged by three months from the calendar year), but this is ignored in the analysis. Sources: Bus and Coach Statistics 1991/2 (DOT, 1992b); London Transport Annual Report (annual); Transport Statistics Great Britain 1991 and 1992 (DOT, 1991 and 1992a).

TABLE A2: CASUALTIES IN ROAD ACCIDENTS: INVOLVING BUSES AND OTHERS AND OTHERS: GREATER LONDON AND REST OF GREAT BRITAIN: BUILT-UP ROADS: 1981-1991

	Greater London									Rest of Great Britain								
	Occupants of Buses in...					Others in Bus Accidents		All involving Buses	All Road Casualties	Occupants of Buses in...					Others in Bus Accidents		All involving Buses	All Casualties
	Bus-only Accidents			Other Accidents	All Accidents	Pedestrians	Other Road Users			Bus-only Accidents			Other Accidents	All Accidents	Pedestrians	Other Road Users		
	Board/ Alight	Other	All							Board/ Alight	Other	All						
Killed																		
1981	2	1	3	2	5	10	8	23	504	5	3	8	2	10	74	47	131	2436
1982	6	3	9	2	11	6	10	27	497	4	12	16	2	18	80	73	171	2527
1983	2	4	6	1	7	12	13	32	505	9	1	10	2	12	86	43	141	2384
1984	8	7	15	1	16	13	8	37	530	7	2	9	3	12	69	36	117	2395
1985	5	2	7	1	8	6	6	20	445	7	1	8	3	11	59	43	113	2245
1986	1	5	6	0	6	12	5	23	479	7	3	10	7	17	58	49	124	2184
1987	5	3	8	0	8	15	2	25	417	1	1	2	1	3	54	50	107	2128
1988	2	3	5	1	6	10	4	20	405	4	3	7	0	7	65	30	102	2041
1989	2	2	4	0	4	14	6	24	408	8	0	8	3	11	59	47	117	2084
1990	1	2	3	0	3	9	6	18	376	3	3	6	1	7	70	32	109	2027
1991	1	1	2	1	3	24	7	34	338	7	5	12	3	15	61	31	107	1837
Annual Average																		
81-86	4.0	3.7	7.7	1.2	8.8	9.8	8.3	27.0	493.3	6.5	3.7	10.2	3.2	13.3	71.0	48.5	132.8	2361.8
87-91	2.2	2.2	4.4	0.4	4.8	14.4	5.0	24.2	388.8	4.6	2.4	7.0	1.6	8.6	61.8	38.0	108.4	2023.4
81-91	3.2	3.0	6.2	0.8	7.0	11.9	6.8	25.7	445.8	5.6	3.1	8.7	2.5	11.2	66.8	43.7	121.7	2208.0
Killed and Seriously Injured																		
1981	113	62	175	29	204	96	90	390	7274	206	181	387	169	556	581	589	1726	45373
1982	114	89	203	41	244	65	107	416	8161	187	164	351	164	515	580	634	1729	46058
1983	119	83	202	27	229	69	83	381	7211	202	182	384	162	546	611	483	1640	42051
1984	152	108	260	33	293	77	77	447	7718	190	153	343	136	479	535	463	1477	43527
1985	183	124	307	30	337	102	69	508	9212	159	167	326	142	468	531	449	1448	40340
1986	136	96	232	30	262	103	72	437	8479	171	156	327	156	483	523	470	1476	38781
1987	114	123	237	52	289	144	82	515	9113	154	127	281	127	408	497	436	1341	35374
1988	106	120	226	67	293	145	105	543	9095	165	193	358	123	481	468	421	1370	34235
1989	79	121	200	71	271	140	98	509	8876	166	138	304	135	439	495	381	1315	33652

TABLE A2: CASUALTIES IN ROAD ACCIDENTS: INVOLVING BUSES AND OTHERS AND OTHERS: GREATER LONDON AND REST OF GREAT BRITAIN: BUILT-UP ROADS: 1981-1991

	Greater London									Rest of Great Britain								
	Occupants of Buses in...					Others in Bus Accidents		All involving Buses	All Road Casualties	Occupants of Buses in...					Others in Bus Accidents		All involving Buses	All Casualties
	Bus-only Accidents			Other Accidents	All Accidents	Pedestrians	Other Road Users			Bus-only Accidents			Other Accidents	All Accidents	Pedestrians	Other Road Users		
	Board/ Alight	Other	All							Board/ Alight	Other	All						
1990	88	112	200	78	278	141	103	522	8500	119	120	239	122	361	458	331	1150	32080
1991	93	107	200	75	275	136	105	516	7557	127	112	239	113	352	412	317	1081	27434
Annual Average																		
81-86	136	94	230	32	262	85	83	430	8009	186	167	353	155	508	560	515	1583	42688
87-91	96	117	213	69	281	141	99	521	8628	146	138	284	124	408	466	377	1251	32555
81-91	118	104	222	48	270	111	90	471	8291	168	154	322	141	463	517	452	1432	38082
All Casualties																		
1981	1256	874	2130	769	2899	447	710	4056	52515	1421	2058	3479	2346	5825	1859	2588	10272	179749
1982	1077	1114	2191	766	2957	329	691	3977	55799	1296	2215	3511	2368	5879	1853	2500	10232	184695
1983	1136	1223	2359	677	3036	353	571	3960	51474	1385	2279	3664	2423	6087	1819	2100	10006	173411
1984	1202	1354	2556	622	3178	361	504	4043	52067	1270	2412	3682	2523	6205	1771	2093	10069	183134
1985	1087	1249	2336	595	2931	392	459	3782	49537	1207	2220	3427	2610	6037	1781	2182	10000	178033
1986	845	1315	2160	598	2758	403	531	3692	49708	1190	2251	3441	2333	5774	1740	2301	9815	178295
1987	654	1149	1803	618	2421	431	504	3356	47485	1086	1998	3084	2393	5477	1685	2439	9601	172245
1988	603	1112	1715	677	2392	452	571	3415	48014	1198	2175	3373	2687	6060	1667	2288	10015	177185
1989	549	1191	1740	882	2622	486	644	3752	50519	1186	2170	3356	2961	6317	1678	2557	10552	185927
1990	514	1214	1728	781	2509	522	629	3660	49687	1066	2025	3091	2820	5911	1668	2457	10036	185214
1991	537	1182	1719	845	2564	450	612	3626	44711	1019	1851	2870	2545	5415	1475	2188	9078	171162
Annual Average																		
81-86	1101	1188	2289	671	2960	381	578	3918	51850	1295	2239	3534	2434	5968	1804	2294	10066	179553
87-91	571	1170	1741	761	2502	468	592	3562	48083	1111	2044	3155	2681	5836	1635	2386	9856	178347
81-91	860	1180	2040	712	2752	421	584	3756	50138	1211	2150	3362	2546	5908	1727	2336	9971	179005

Source: Dept of Transport road accident database; assembled from Road Accidents Great Britain (DOT, annual) and special tables.

TABLE A3: NUMBERS OF BUSES AND CARS INVOLVED IN ACCIDENTS: GREAT BRITAIN, GREATER LONDON AND REST OF GREAT BRITAIN: BUILT-UP ROADS: 1981-1991

	Great Britain											
	Number of Buses						Number of Cars					
	One-vehicle Accidents		Two-vehicle Accidents	3-vehicle or more*	All except One-vehicle Only	All Acci-dents	One-vehicle Accidents		Two-vehicle Acci-dents	3-vehicle or more Acci dents*	All except One-vehicle Only	All Acci-dents
	Only	Plus pedes-trians					Only	Plus pedes-trians				
1981	5152	1853	4093	746	6692	11844	11435	38982	113835	31923	184740	196175
1982	5256	1725	4001	726	6452	11708	11718	39831	121011	32675	193517	205235
1983	5563	1669	3811	640	6120	11683	9354	41374	115579	29618	186571	195925
1984	5660	1659	3721	611	5991	11651	10281	43227	121828	33046	198101	208382
1985	5285	1709	3674	645	6028	11313	10321	42209	120287	32121	194617	204938
1986	5024	1686	3681	645	6012	11036	10274	42324	124666	34126	201116	211390
1987	4436	1645	3838	679	6162	10598	9527	40308	123375	34643	198326	207853
1988	4580	1647	4002	717	6366	10946	9471	41264	129447	36814	207525	216996
1989	4540	1738	4527	759	7024	11564	9622	43093	139208	38669	220970	230592
1990	4349	1733	4252	696	6681	11030	9567	43594	140493	40474	224561	234128
1991	4202	1582	3986	640	6208	10410	8940	39268	132794	38498	210560	219500
Annual Average												
81-86	5323	1717	3830	669	6216	11539	10564	41325	119534	32252	193110	203674
87-91	4421	1669	4121	698	6488	10910	9425	41505	133063	37820	212388	221814
81-91	4913	1695	3962	682	6340	11253	10046	41407	125684	34782	201873	211919
	Greater London											
1981	2032	370	1009	184	1563	3595	2032	8666	27988	7849	44503	46535
1982	2091	282	941	171	1394	3485	2204	9089	31436	8488	49013	51217
1983	2255	315	830	139	1284	3539	1825	9208	29599	7585	46392	48217
1984	2394	327	723	119	1169	3563	1944	9504	30148	8178	47830	49774
1985	2192	363	661	116	1140	3332	1912	8941	28569	7629	45139	47051
1986	2012	366	732	128	1226	3238	1932	8999	29173	7986	46158	48090
1987	1679	391	751	133	1275	2954	1719	8495	28678	8053	45226	46945
1988	1598	410	857	154	1421	3019	1669	8537	29792	8473	46802	48471

TABLE A3: NUMBERS OF BUSES AND CARS INVOLVED IN ACCIDENTS: GREAT BRITAIN, GREATER LONDON AND REST OF GREAT BRITAIN: BUILT-UP ROADS: 1981-1991

	Great Britain											
	Number of Buses						Number of Cars					
	One-vehicle Accidents		Two-vehicle Accidents	3-vehicle or more*	All except One-vehicle Only	All Acci-dents	One-vehicle Accidents		Two-vehicle Acci-dents	3-vehicle or more Acci dents*	All except One-vehicle Only	All Acci-dents
	Only	Plus pedes-trians					Only	Plus pedes-trians				
1989	1604	438	1055	177	1670	3274	1699	9041	31921	8867	49829	51528
1990	1584	480	994	163	1637	3221	1587	8823	32086	9244	50153	51740
1991	1592	422	979	157	1558	3150	1510	7787	29348	8508	45643	47153
Annual Average												
81-86	2163	337	816	143	1296	3459	1975	9068	29486	7953	46506	48481
87-91	1611	428	927	157	1512	3124	1637	8537	30365	8629	47531	49167
81-91	1912	379	867	149	1394	3306	1821	8826	29885	8260	46972	48793
	Rest of Great Britain											
1981	3120	1483	3084	562	5129	8249	9403	30316	85847	24074	140237	149640
1982	3165	1443	3060	555	5058	8223	9514	30742	89575	24187	144504	154018
1983	3308	1354	2981	501	4836	8144	7529	32166	85980	22033	140179	147708
1984	3266	1332	2998	492	4822	8088	8337	33723	91680	24868	150271	158608
1985	3093	1346	3013	529	4888	7981	8409	33268	91718	24492	149478	157887
1986	3012	1320	2949	517	4786	7798	8342	33325	95493	26140	154958	163300
1987	2757	1254	3087	546	4887	7644	7808	31813	94697	26590	153100	160908
1988	2982	1237	3145	563	4945	7927	7802	32727	99655	28341	160723	168525
1989	2936	1300	3472	582	5354	8290	7923	34052	107287	29802	171141	179064
1990	2765	1253	3258	533	5044	7809	7980	34771	108407	31230	174408	182388
1991	2610	1160	3007	483	4650	7260	7430	31481	103446	29990	164917	172347
Annual Average												
81-86	3161	1380	3014	526	4920	8081	8589	32257	90049	24299	146605	155194
87-91	2810	1241	3194	541	4976	7786	7789	32969	102698	29191	164858	172646
81-91	3001	1317	3096	533	4945	7947	8225	32580	95799	26522	154901	163127

*The split of three-or-more-vehicle accidents between London and the Rest of Great Britain is estimated.