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PROBLEMS FOR VULNERABLE ROAD USERS IN GREAT BRITAIN, THE NETHERLANDS AND SWEDEN

M.R. Tight, O.M.J. Carsten & D. Sherborne

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DRIVE Project V1031

An Intelligent Traffic System for Vulnerable Road Users

PROBLEMS FOR VULNERABLE ROAD USERS IN GREAT BRITAIN, THE NETHERLANDS AND SWEDEN

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1. INTRODUCTION

In many countries in Europe pedal cycle and pedestrian travel are important transport modes for the population. However, given the vulnerable nature of these modes of transport, the number of accidents involving pedestrians and cyclists is high, and in particular the number of killed and seriously injured victims is high. Technical measures to improve safety and efficiency focus almost exclusively on motorized traffic, disregarding the needs of non-motorized traffic participants. In order to determine how technical measures, such as Road Traffic Informatics (RTI) applications, can be used to increase the safety and mobility of pedestrians and cyclists, more information is needed about the causes of accidents to these groups.

The aim of this report is to compare the findings of three previous reports (Tight, Carsten and Sherborne, 1989; Van Schagen and Rothengatter, 1989; and Ekman and Draskóczy, 1989), which examined the problems faced by vulnerable road users (VRUs) in Britain, the Netherlands and Sweden, and in one city from each of those countries, namely Bradford, Groningen and Växjö. The aim of these reports was to examine a number of the attributes of accidents which involve VRUs and the characteristics of their travel, in order to identify areas where safety and mobility improvements may be obtained. It is not intended that this report should provide a general comparison of the safety and mobility problems faced by VRUs in the three countries, but rather a review of those issues that are related to the RTI measures envisaged by the present research programme (DRIVE Project V1031). This project is aimed at improving VRU safety and mobility both directly, through the enhancement of signalized junctions and pedestrian crossings, and indirectly, through the creation of a model of the traffic system incorporating vulnerable road users. It is intended that this model will permit the routing and guidance of motorized vehicles in such a way as to enhance VRU safety and reduce VRU annoyance and delay from traffic. Both the direct and the indirect measures envisaged will only be relevant to VRU safety and mobility on main roads in urban areas; they are unlikely to be applicable to residential streets or minor roads unless these have substantial VRU flows. The report therefore concentrates (in so far as existing information permits) on VRU safety and mobility on main roads and on VRU use of facilities that are intended to be upgraded through the planned RTI measures.

This report is split into two main sections, the first of which examines comparisons of safety and mobility at the national level, and the second examines such comparisons at the local (city) level. The analyses undertaken in this report concerning the national level are largely based upon published information, while at the local level, due mainly to the lack of any regularly published information, a number of special tabulations have been made. The information given in the tables is for the most up-to-date year available.

As with most international comparisons, this study encountered a number of compatibility problems when trying to bring together data from the three countries involved. These included problems of definition, problems of interpretation and differences in the levels of inaccuracy and underreporting of accident statistics. It is not intended to expand upon the possible effects of such problems at this point, as these have been adequately covered in other reports (see for example Tight et al, 1986). Where possible comparable data have been used in the analyses which

follow, however on occasions it was not possible to produce exactly comparable data, and in such cases mention is made of this in the text.

2. COMPARISON AT THE NATIONAL LEVEL

The three countries involved in these comparisons differ in a number of ways. Of the three, Britain has the highest population with 54.5 million people in 1981, followed by the Netherlands with about 14.5 million in 1987, and lastly Sweden with about 8.4 million people in 1987. However, in terms of size Sweden is very much the largest country (449,793 km^2), followed by Britain (229,523 km^2), and finally the Netherlands (40,883 km^2). Hence, the density of population in Sweden is considerably lower than in either of the other countries. There are also many other differences between the countries, including differences in culture, differences in the law as it relates to road users, and differences in the infrastructure and facilities provided for road users. It is not intended to describe these in detail here (indeed some have already been described in the reports for each of the countries mentioned above), though where it is thought that some such difference may have had an effect upon the level of safety or mobility in one of the countries, mention will be made of it as part of the relevant analysis.

2.1. SAFETY

Table 2.1 shows the total number of casualties in each of the three countries and the proportions of pedestrian and cyclist casualties. It can be seen that VRU casualties make up about a quarter of all casualties in each of the three countries. However, the relative seriousness of the cyclist and pedestrian problems differ between the countries. In Britain about two-thirds of the VRU casualties are pedestrians, compared to the Netherlands where only about a quarter of the VRU casualties are pedestrians. Sweden falls somewhere between the two with roughly even proportions of VRU casualties being pedestrians and cyclists. It should be noted at this point that in each of the countries there is a problem of underreporting of accidents, and that this is likely to be particularly severe for vulnerable road users compared to other motorised traffic. The relative extent of this problem is not known in each of the three countries, though some further discussion of the extent of the problem in each country is given in Tight, Carsten and Sherborne (1989), Van Schagen and Rothengatter (1989) and Ekman and Draskóczy (1989).

Table 2.1: Proportions of pedestrian and cyclist casualties in the three countries

	GB (1987)	Sweden (1987)	Netherlands (1987)
Total casualties	311,473	21,254	50,674
% pedestrian casualties	18	9	8
% cyclist casualties	8	11	23

Table 2.2 shows the numbers of pedestrian and cyclist casualties in each of the three countries by severity of injury. For pedestrian casualties it is noticeable that both Sweden and the Netherlands have much higher proportions of fatal and seriously injured casualties than Britain. There is a particularly high proportion of fatalities in Sweden compared to both of the other countries. These variations are unlikely to be due to differences in the definition of severity of casualties, as the definitions used for the three countries are similar. This table also shows a similar pattern for pedal cyclists, with both Sweden and the Netherlands having a much higher proportion of fatal and serious casualties than in Britain, though in the case of pedal cyclist fatalities the proportions are very similar in Sweden and the Netherlands, which is unlike the situation for pedestrians.

Table 2.2: Pedestrian and cyclist casualties.

	GB (1987)	Sweden (1987)	Netherlands (1987)
Pedestrians			
Fatalities	1,703	144	172
Serious injury	16,057	701	1,543
Slight injury	39,693	1,111	2,488
Total	57,453	1,956	4,203
Pedal cyclists			
Fatalities	280	58	312
Serious injury	4,851	652	3,093
Slight injury	21,063	1,656	8,208
Total	26,194	2,366	11,613

Table 2.3 shows the numbers of pedestrian and pedal cycle casualties occurring in urban and non-urban areas for each of the three countries. It can be seen that in Britain a higher proportion of pedestrian casualties are injured in urban areas than is the case in either Sweden or the Netherlands. This difference no doubt explains to a large extent the greater severity of accidents in Sweden and the Netherlands compared to Great Britain which was noted above. This is backed up by the very similar proportions of fatalities and non-fatalities occurring on urban roads in each of the three countries. It is also the case for pedal cyclists, that if only urban accidents are considered then there is very little difference in the severity of injury to casualties between the three countries.

Table 2.3: Vulnerable road users by urban and non-urban areas and severity (figures in the table are numbers of casualties in each category).

	GB (1987)	Sweden (1987)	Netherlands (1987)
Pedestrians			
Urban areas			
Fatalities	1,362	91	126
Non-fatalities	53,322	1,622	3,648
Total	54,684	1,713	3,774
Non-urban areas			
Fatalities	341	53	46
Non-fatalities	2,428	190	383
Total	2,769	243	429
Pedal cyclists			
Urban areas			
Fatalities	168	36	191
Non-fatalities	23,251	2,063	9,477
Total	23,419	2,099	9,668
Non-urban areas			
Fatalities	112	22	121
Non-fatalities	2,632	245	1,824
Total	2,774	267	1,945

Tables 2.4 and 2.5 show the numbers and proportions of pedestrian and pedal cycle casualties by age group and by country. It was possible for this table to obtain exactly comparable data for Britain and the Netherlands, but not for Sweden. However, for some of the age groupings Swedish data were available, and in other cases it was possible to create a new grouping for which data were available for all three countries. Considering firstly the data which are available for all three countries a number of important differences are apparent. The Netherlands has a very high proportion of pedestrian casualties in the age group 0–9 years compared

to the other countries, particularly Sweden. Both the Netherlands and Britain have about twice the proportion of child pedestrian casualties (0–14 years) as Sweden. Conversely there is a much higher proportion of adult pedestrian casualties (20+) in Sweden than in either of the other two countries. In Britain, 51.3% of pedal cycle casualties are under the age of 20 years, compared to only 39.5% in the Netherlands and 33.5% in Sweden. However, in the Netherlands 17.9% of pedal cycle casualties are 60 years and over compared to only 5.6% in Britain. This may point to there being very few adult pedal cyclists in Britain compared to the Netherlands, perhaps due to some extent to topographical differences between the two countries.

Table 2.4: Numbers of VRU casualties by age.

	GB (1987)		Sweden (1987)		Netherlands (1987)	
Age group	Ped	PC	Ped	PC	Ped	PC
0–4	3,000	136	–	–	328	109
5–9	8,249	1,922	–	–	831	595
0–9	**11,249**	**2,058**	**194**	**99**	**1,159**	**704**
10–14	**8,685**	**5,336**	**151**	**360**	**432**	**1,974**
15–19	**7,233**	**5,863**	**197**	**324**	**331**	**1,884**
20–29	8,143	5,356	–	–	477	1,820
30–59	10,931	5,806	–	–	884	3,108
60+	10,280	1,454	–	–	897	2,074
20+	**29,354**	**12,616**	**1,402**	**1,573**	**2,258**	**7,002**
Unknown	**932**	**321**	**12**	**10**	**23**	**49**
Total	**57,453**	**26,194**	**1,956**	**2,366**	**4,203**	**11,613**

Table 2.5: Percent of VRU casualties by age (known ages only).

	GB (1987)		Sweden (1987)		Netherlands (1987)	
Age group	Ped	PC	Ped	PC	Ped	PC
0–4	5.3	0.5	–	–	7.8	0.9
5–9	14.6	7.4	–	–	19.9	5.1
10–14	15.3	20.6	–	–	10.3	17.1
15–19	12.8	22.7	–	–	7.9	16.3
20–29	14.4	20.7	–	–	11.4	15.7
30–59	19.3	22.4	–	–	21.1	26.9
60+	18.2	5.6	–	–	21.5	17.9
Total	100.0	100.0	–	–	100.0	100.0
Age group						
0–9	19.9	7.9	9.9	4.2	27.7	6.0
10–14	15.3	20.6	7.7	15.2	10.3	17.1
15–19	12.8	22.7	10.1	13.7	7.9	16.3
20+	51.9	48.7	71.7	66.5	54.0	60.5
Total	100.0	100.0	100.0	100.0	100.0	100.0

Table 2.6 shows the number of pedestrian casualties which occur on crossing facilities by country. No data are available for Sweden, but it is considered worthwhile including just the comparison between Britain and the Netherlands. The figures for the Netherlands are for all casualties, not just pedestrian casualties, however it is known that only about 5% of the casualties were not pedestrians. The table shows that a much higher proportion of pedestrian casualties in the Netherlands occur on crossing facilities compared to Britain. This may be due both to differences in the types of crossing facilities in the two countries, and also to the rate of usage of such facilities. In Britain, at least, there is some evidence (for certain age groups of pedestrians) that pedestrian crossing facilities are having a positive effect and reducing the risk per crossing for pedestrians (Tight, 1987). In the Netherlands, despite the fact that the laws regarding pedestrian crossings are roughly similar to those in Britain, it is felt that there may be a problem of perception on the part of both drivers and pedestrians as to exactly who has right of way in certain situations. It is felt that such problems may be at least in part the cause of the high rate of accidents at crossing facilities, in particular zebra crossings.

Table 2.6: Pedestrian casualties by crossing facility.

	GB (1987)		Sweden (1987)		Netherlands[1] (1987)	
	N	%	N	%	N	%
On crossing facility[2]	4,799	8.4	–	–	761	17.2
Not on crossing facility	52,654	91.6	–	–	3,658	82.8
Total	57,453	100.0	–	–	4,419	100.0

2.2. MOBILITY

There is very little mobility data which can be extracted from published data sources for the three countries involved in this study. However, the limited amount which can be obtained will be discussed here. It should be noted that the data for the Netherlands excludes trips made by children under 12 years, and the data for Sweden is only for persons aged 15–84 years. Also the data for Sweden were only available for journeys (round trips), however for the purposes of these analyses these figures have been multiplied by a factor of two to give a rough estimate of the number of trips made.

Table 2.7 shows the number of trips per person per day by main mode of travel for each of the three countries. This shows that on average the Dutch make more trips per day than either the British or the Swedes. In terms of pedal cycle trips the average Swede makes nearly five times as many trips per day as the average British person. However, the average Dutch person makes nearly 14 times as many pedal cycle trips per day as the average person in Britain. This trend is reversed somewhat in the case of pedestrians, with the British making more such trips than either the Dutch or the Swedish, though the differences in pedestrian trips are by no means as great as the differences in pedal cycle trips. More VRU trips in total are made in the Netherlands than in Britain or in Sweden.

[1]Statistics do not distinguish between pedestrian and other casualties. Therefore all casualties in accidents involving pedestrians are counted as pedestrians.

[2]Excludes uncontrolled central refuges.

Table 2.7: Trips per person per day by main mode of travel.

	GB (1985–86)	Sweden[3] (1984–85)	Netherlands[4] (1986)
Car (driver)	0.87	1.14	1.13
Car (passenger)	0.54	0.42	0.48
Public transport	0.31	0.34	0.18
Pedal cycle	0.07	0.32	0.95
Pedestrian	0.95	0.66	0.60
Other	0.05	0.04	0.09
All	2.80	2.92	3.43

Table 2.8 shows the distance travelled per person per day by main mode of travel for each of the three countries. This shows that in total the Swedes and the Dutch travel further than the British. Given the information supplied in Table 2.7, this means that the average trip length of people in Sweden is somewhat longer than in either of the other countries, perhaps reflecting the much lower densities of population in Sweden than in Britain and the Netherlands. In terms of pedal cycle travel, the Dutch travel just under 4 times as far on average as the Swedish, and just over 17 times as far on average as the British. In terms of the average distance per pedal cycle trip, the Dutch travel slightly further than either the British or the Swedish (3.3 km compared to 2.6 and 2.5 km respectively). The average distance travelled by pedestrians in Britain is slightly higher than in both the Netherlands and Sweden. However, in terms of the average distance travelled per pedestrian journey, the situation is remarkably similar in the three countries (1.1, 1.2 and 1.4 km in Britain, Sweden and the Netherlands respectively).

[3]Only travel by persons aged 15–84 is included. Sweden provides data at the journey level and defines a "journey" as a round trip; therefore the national estimates of number of journeys have been doubled to make the data comparable with the definition of a trip for the other two countries.

[4]Excludes trips by persons aged less than 12.

Table 2.8: Distance (km.) per person per day by main mode of travel.

	GB (1985–86)	Sweden[5] (1984–85)	Netherlands[6] (1986)
Car (driver)	10.60	19.30	15.44
Car (passenger)	6.99	8.20	8.40
Public transport	3.68	8.10	4.07
Pedal cycle	0.18	0.80	3.10
Pedestrian	1.06	0.80	0.86
Other	0.94	0.30	1.29
All	23.45	37.50	33.16

2.3. RISK

Figure 2.1 shows the risk of becoming a VRU casualty per head of population for each of the three countries. It can be seen that using this measure Sweden seems to be the safest country for VRUs, having about half the rate of casualties as the Netherlands and about one-third the rate of Britain. For pedestrians, Britain has about four times the rate of casualties per 100,000 population as both the Netherlands and Sweden. However, for cyclists Sweden in the safest country using this rate, whilst the situation in the Netherlands seems particularly dangerous.

Figure 2.2 shows the rate of pedestrian casualties per million kilometres walked by pedestrians and the rate of cyclist casualties per million kilometres cycled. This shows that in Sweden and the Netherlands the risk for pedestrians is very similar, while in Britain the risk is about 3 times as high. For pedal cyclists the rates for the Netherlands and Sweden are again largely similar with the Netherlands only slightly lower than Sweden, but the rate for Britain is more than 10 times as high as that for the Netherlands.

It should also be noted that in all three countries VRUs are very much overrepresented in the casualty figures, though the degree to which they are overrepresented differs. In Britain less than 1% of the total distance travelled is by pedal cycle, while they account for 8.4% of casualties. In the Netherlands 14.7% of the total distance travelled is by pedal cycle while cyclists account for 22.9% of the casualties. Finally, in Sweden 2.1% of the total distance travelled is by pedal cycle, while cyclists account for 11% of the casualties. The situation for pedal cyclists in Britain seems particularly dangerous, though in none of the countries is cycling a particularly safe mode of transport.

[5]Only travel by persons aged 15–84 is included.

[6]Excludes travel by persons aged less than 12.

Figure 2.1
VRU Casualties per 100,000 Population

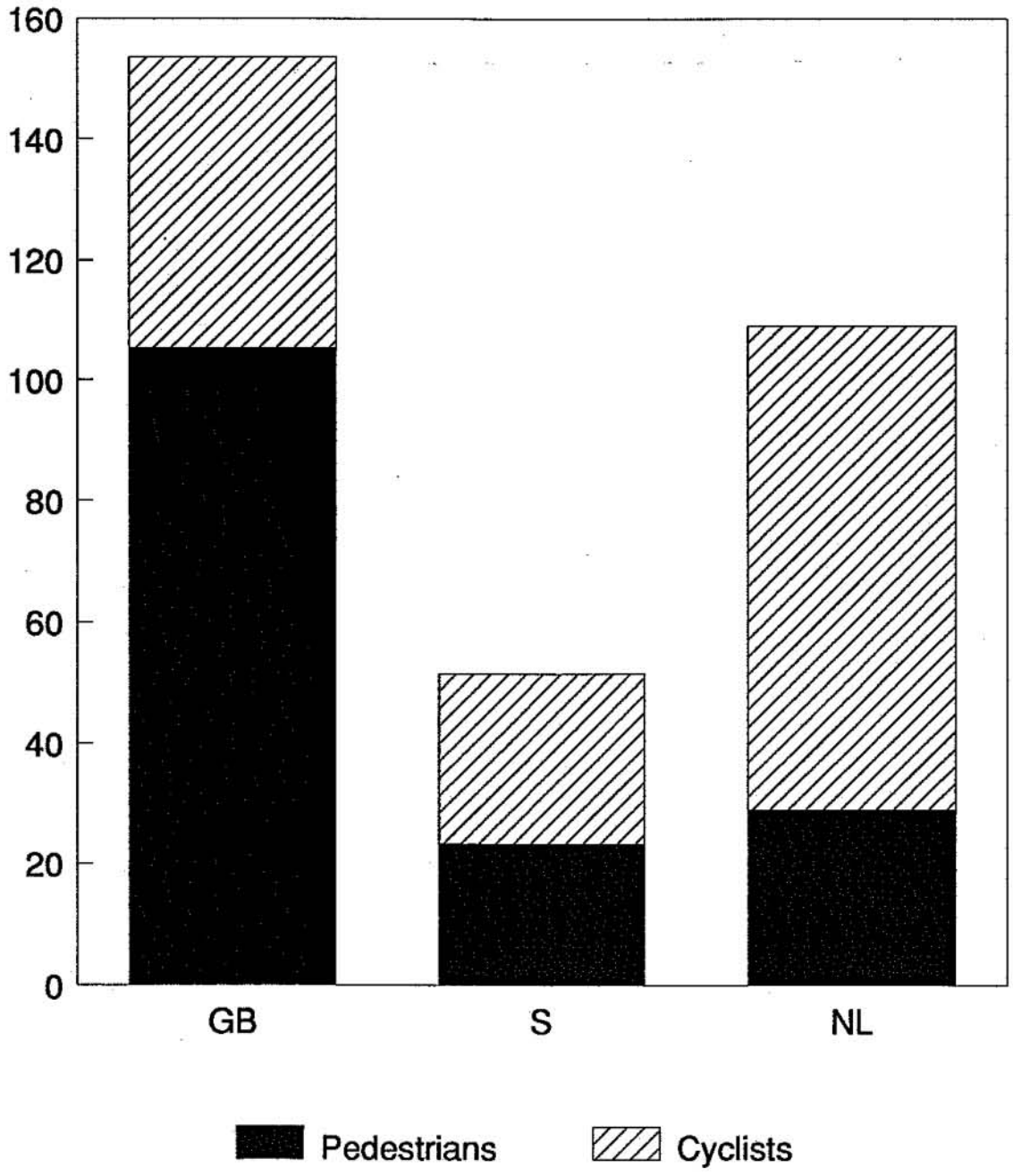
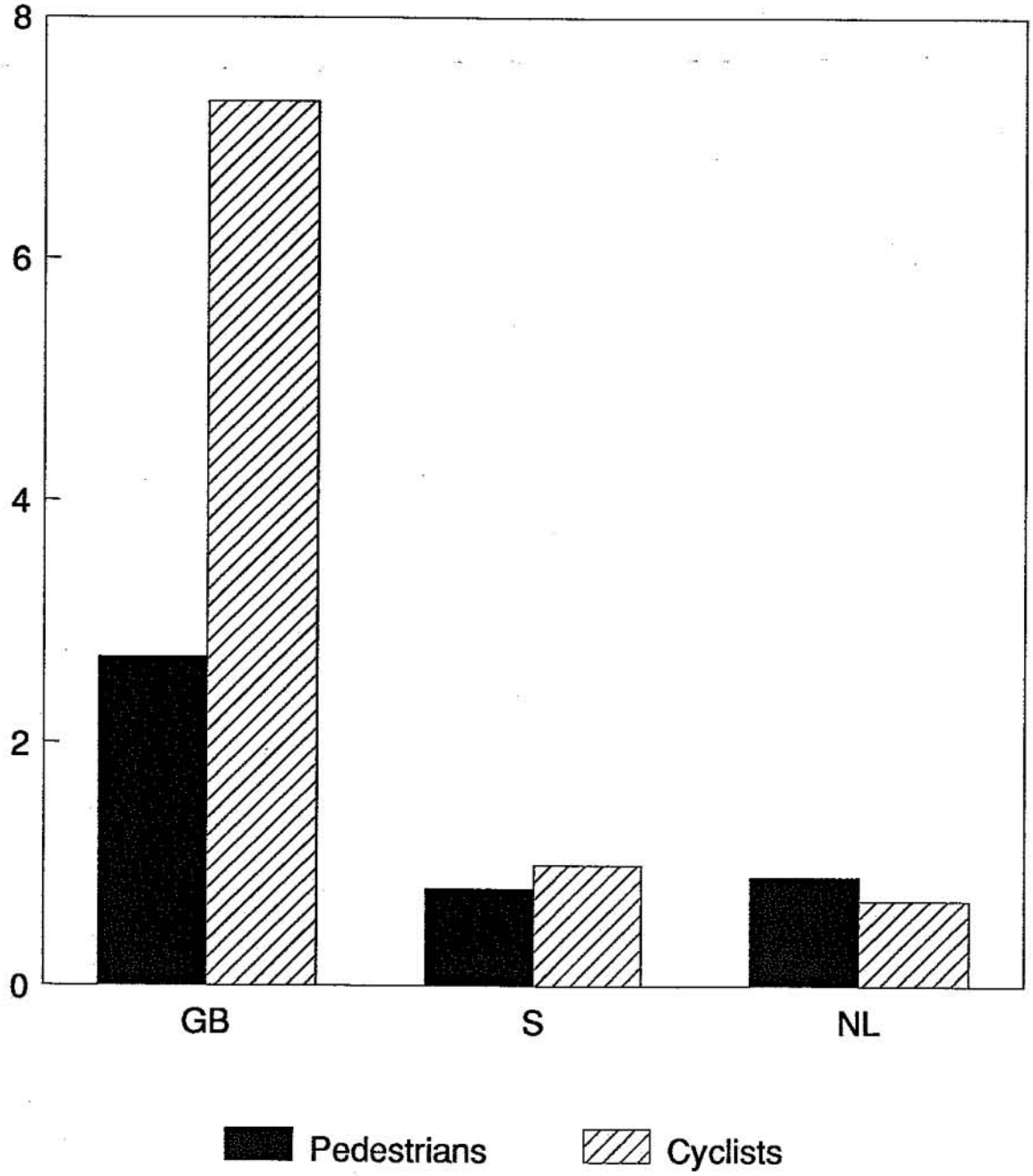


Figure 2.2
VRU Casualties per Million Kilometres



In Britain, about 6% of the total distance travelled is on foot, while pedestrians account for about 18.4% of casualties. In the Netherlands about 3.6% of the total distance travelled is on foot, while pedestrians account for 8.3% of casualties. Finally, in Sweden 2.1% of the total distance travelled is on foot, while pedestrians account for 9% of the casualties.

3. COMPARISON AT THE LOCAL LEVEL

This chapter makes comparisons between the situation for vulnerable road users in the three cities: Bradford[1], Växjö and Groningen. Given the small amount of detailed information on mobility in the three cities (see Tight, Carsten and Sherborne, 1989; Van Schagen and Rothengatter, 1989; and Ekman and Draskóczy, 1989), these comparisons deal solely with safety. A further limitation on the comparisons that could be made was the differences in definition of certain variables between the cities and the lack of data on some relevant information. The material presented here is of necessity limited to information that was common to all three cities. For each of the cities, only those accidents that occurred on urban roads according to the country's definition of urban, have been included.

Table 3.1: Pedestrian and cyclist casualties in the three cities.

	Bradford (1988)	Växjö (1983–87)	Groningen (10/87–9/88)
Pedestrians			
Fatalities	21	4	3
Serious injury	167	25	16
Slight injury	572	48	42
Total	760	77	61
Pedal cyclists			
Fatalities	1	4	1
Serious injury	14	45	61
Slight injury	116	86	162
Total	131	133	224

Table 3.1 shows the overall number of casualties to both pedestrians and pedal cyclists in the three cities. In both Växjö and Groningen cyclist injuries (though not fatalities) exceed pedestrian injuries, whereas in Bradford pedestrian casualties far exceed cyclist casualties. The population of Bradford is 458,000, that of Växjö is 68,000, and that of Groningen is 160,000. The rates of pedestrian casualties per 100,000 population are 165.9 for Bradford, 22.6 for Växjö and 38.1 for Groningen. Given the fact that, according to national figures, the annual pedestrian distance per person is about 25% more in Britain than in the Netherlands or Sweden (see

[1]It should be noted that, while the text uses the word "city" in referring to Bradford, the entity being described is actually the Bradford Metropolitan District.

Figure 3.1
VRU Casualties per 100,000 Population

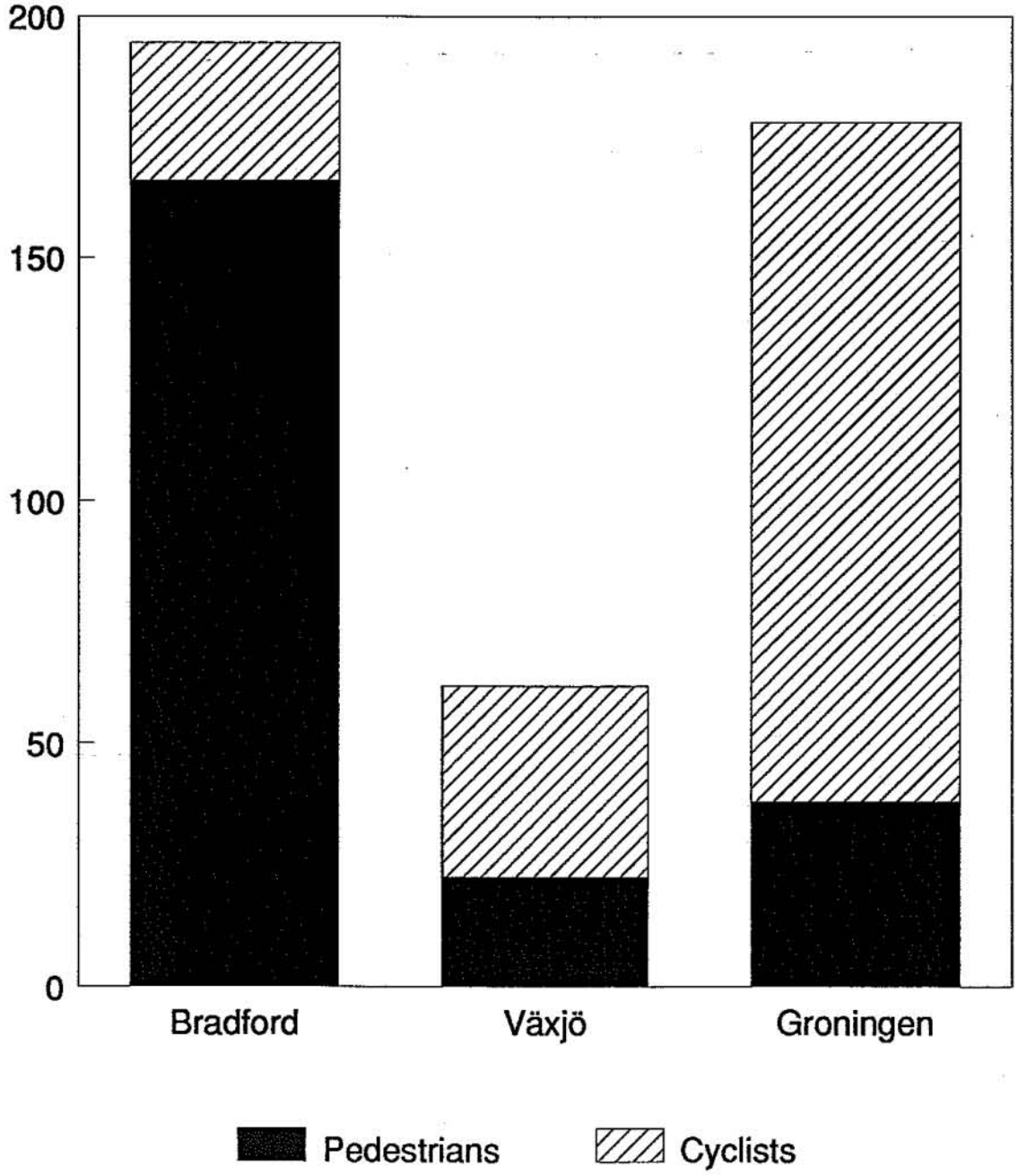
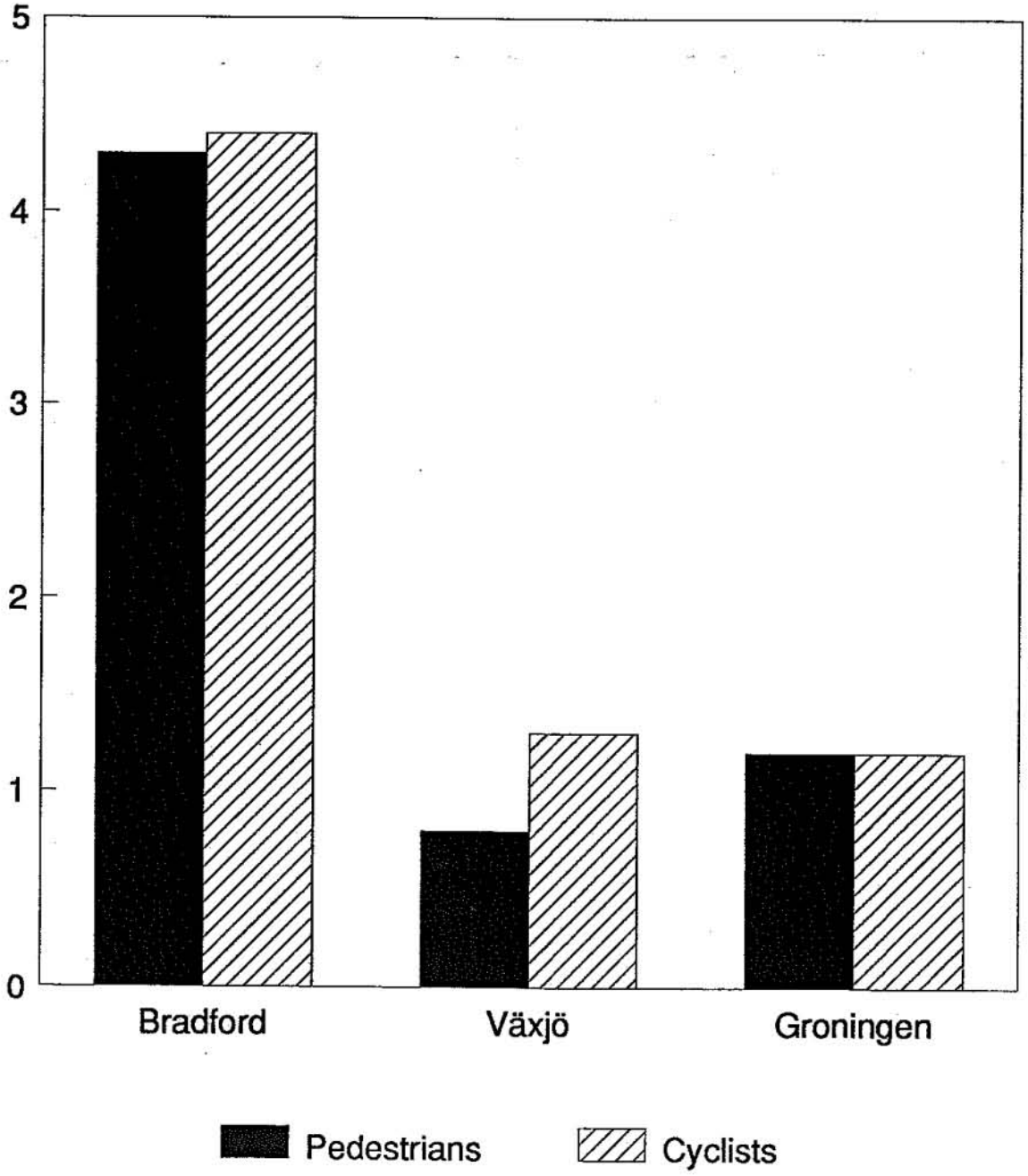


Figure 3.2
VRU Casualties per Million Kilometres



chapter 2), Växjö and Groningen stand out as having far better safety records for pedestrians than Bradford. The rate of cyclist casualties per 100,000 population is 28.6 for Bradford, 39.1 for Växjö and 140.0 for Groningen. Using the national exposure figures given in chapter 2, the total annual bicycle travel for Bradford can be estimated as 30.1 million km, for Växjö as 19.9 million km, and for Groningen as 181.0 million km. This gives estimated bicycle accident involvement rates per million km of 4.4 in Bradford, 1.3 in Växjö and 1.2 in Groningen. Figures 3.1 and 3.2 give a graphical representation of the annual rates per head of population and the rates per kilometre travelled. Differences between the national rates in Figure 2.2 and the local rates in Figure 3.2 may be distorted because of the lack of data on local travel. Thus bicycle travel per person in Bradford may be less than the national average, and bicycle travel in Groningen may be more than the national average. It is possible to make some overall assessment, however: Växjö and Groningen appear to be about equally safe for vulnerable road users in terms of distance travelled, but Bradford has a substantially greater problem.

While Bradford has the most pedestrian casualties, only 2.8% of its pedestrian casualties are fatal as compared to 4.9% in Groningen and 5.2% in Växjö. Växjö has the highest fatality rate for cyclists: 3.0% compared to 0.8% in Bradford and 0.4% in Groningen. The split between serious and slight injuries indicates that in Växjö an injured pedestrian or an injured cyclist is more likely to have serious injuries than in Bradford or Groningen. The split needs to be treated with caution, however, since the procedure for identifying "serious" and "slight" injuries varies between the three countries: in Britain the reporting police officer makes the interpretation, whereas in Sweden and the Netherlands the categorization is based on hospital information.

Table 3.2: Pedestrian and cyclist casualties in the three cities by junction/non-junction.

	Bradford (1988)		Växjö (1983–87)		Groningen (10/87–9/88)	
	N	%	N	%	N	%
Pedestrians						
At junction	261	34.3	50	64.9	23	37.7
Not at junction	499	65.7	22	28.6	38	62.3
Unknown	0	0.0	5	6.5	0	0.0
Total	760	100.0	77	100.0	61	100.0
Pedal cyclists						
At junction	32	24.4	92	69.2	128	57.1
Not at junction	99	75.6	41	30.8	96	42.9
Total	131	100.0	133	100.0	224	100.0

Table 3.2 shows vulnerable road user casualties in the three cities split between junction accidents and non-junction accidents. In Bradford and Groningen, two-

thirds of pedestrian casualties occur in non-junction accidents, whereas in Växjö two-thirds of pedestrian casualties occur in junction accidents. Three-quarters of Bradford's pedal cyclist casualties occur away from junctions, but in Groningen and even more so in Växjö most pedal cyclist casualties occur at junctions. It would appear that junction-related remedial measures are likely to be more effective in reducing pedestrian casualties in Växjö compared to Bradford and Groningen, and more effective in reducing cyclist casualties in Växjö and Groningen compared to Bradford. This does not mean that junction-related remedial measures will not be effective in Bradford. This is because junction accidents are more clustered than non-junction accidents and therefore treatments at relatively few locations will have more impact than in the case of the scattered non-junction accidents.

Table 3.3: Pedestrian and cyclist casualties in the three cities by age.

	Bradford (1988)		Växjö (1983–87)		Groningen (10/87–9/88)	
Age group	Ped	PC	Ped	PC	Ped	PC
0–4	52	2	2	0	1	0
5–9	162	20	2	6	7	5
10–14	149	27	3	12	5	24
15–19	71	28	3	36	6	35
20–29	79	27	16	21	9	65
30–59	125	22	15	37	14	55
60+	122	5	36	21	18	39
Unknown	0	0	0	0	1	1
Total	760	131	77	133	61	224

Table 3.4: Percent of pedestrian and cyclist casualties in the three cities by age (known ages only).

	Bradford (1988)		Växjö (1983–87)		Groningen (10/87–9/88)	
Age group	Ped	PC	Ped	PC	Ped	PC
0–4	6.8	1.5	2.6	0.0	1.7	0.0
5–9	21.3	15.3	2.6	4.5	11.7	2.2
10–14	19.6	20.6	3.9	9.0	8.3	10.8
15–19	9.3	21.4	3.9	27.1	10.0	15.7
20–29	10.4	20.6	20.8	15.8	15.0	29.1
30–59	16.4	16.8	19.5	27.8	23.3	24.7
60+	16.1	3.8	46.7	15.8	30.0	17.5
Total	100.0	100.0	100.0	100.0	100.0	100.0

The distribution of casualties by age shown in Tables 3.3 and 3.4 indicates that almost half (48%) of pedestrian casualties in Bradford are under 15. The comparable figure for Växjö is 9% and for Groningen 22%. Both Växjö and, to a lesser extent, Groningen have a relatively high proportion of pedestrian casualties among those aged 60 and above. As regards cyclists, Bradford once again has a problem with the very young: 37% of cyclist injuries in Bradford are incurred by riders aged under 15, compared to 14% in Växjö and 13% in Groningen. The 20–29 age group is substantially underrepresented in Växjö as compared to the other two cities, and substantially overrepresented in Groningen, where it accounts for almost one-third of casualties. Cyclists aged 30 years and above account for about one-fifth of Bradford's cyclist casualties as opposed two-fifths of Växjö's and Groningen's. It is likely that a large part of these differences in age distribution of casualties is exposure-related. Bradford children may play more on heavily-travelled streets than children in the other cities, and in Groningen and Växjö adult riders almost certainly account for a greater share of bicycle traffic than in Bradford.

Table 3.5: Pedestrian and cyclist casualties in the three cities by day of the week.

	Bradford (1988)		Växjö (1983–87)		Groningen (10/87–9/88)	
Day of Week	Ped	PC	Ped	PC	Ped	PC
Mon–Thur	408	78	50	92	41	145
Friday	150	22	9	28	13	41
Saturday	123	13	12	9	3	21
Sunday	79	18	6	3	4	16
Total	760	131	77	132[2]	61	223

Table 3.6: Percent of pedestrian and cyclist casualties in the three cities by day of the week.

	Bradford (1988)		Växjö (1983–87)		Groningen (10/87–9/88)	
Day of Week	Ped	PC	Ped	PC	Ped	PC
Mon–Thur	53.7	59.5	64.9	69.7	67.2	65.0
Friday	19.7	16.8	11.7	21.2	21.3	18.4
Saturday	16.2	9.9	15.6	6.8	4.9	9.4
Sunday	10.4	13.7	7.8	2.3	6.6	7.2
Total	100.0	100.0	100.0	100.0	100.0	100.0

Tables 3.5 through 3.9 show the distribution of vulnerable road user casualties by day of the week and time of day. Looking at the distribution by day of the week in Tables 3.5 and 3.6, Bradford has a smaller share of vulnerable road user accidents in the Monday to Thursday period than the other two cities. Thus it would appear that Bradford has more of a "weekend" problem than Groningen or Växjö. Groningen has a particularly low share of pedestrian casualties on Saturdays and Sundays: 11% of Groningen's pedestrian casualties occur on Saturday and Sunday,

[2]One cyclist casualty occurred on an unknown day.

compared to 23% of Växjö's and 27% of Bradford's. For cyclist casualties, Bradford has the highest proportion occurring on Sundays, perhaps because the bicycle in Bradford is more often used as a recreational diversion rather than as a piece of basic transportation.

Table 3.7: Pedestrian and cyclist casualties in the three cities by time of day.

	Bradford (1988)		Växjö (1983–87)		Groningen (10/87–9/88)	
Time	Ped	PC	Ped	PC	Ped	PC
0000–0659	22	3	6	6	3	13
0700–0959	79	21	7	19	3	32
1000–1459	195	34	26	34	20	63
1500–1759	259	36	22	44	26	66
1800–2359	205	37	15	28	9	49
Unknown	0	0	1	2	0	0
Total	760	131	77	133	61	223

Table 3.8: Percent of pedestrian and cyclist casualties in the three cities by time of day (known times only).

	Bradford (1988)		Växjö (1983–87)		Groningen (10/87–9/88)	
Time	Ped	PC	Ped	PC	Ped	PC
0000–0659	2.9	2.3	7.9	4.6	4.9	5.8
0700–0959	10.4	16.0	9.2	14.5	4.9	14.3
1000–1459	25.7	26.0	34.2	26.0	32.8	28.3
1500–1759	34.1	27.5	28.9	33.6	42.6	29.6
1800–2359	27.0	28.2	19.7	21.4	14.8	22.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

The time of day figures in Tables 3.7 and 3.8 indicate that Växjö has the highest proportion of pedestrian casualties occurring at night (0000–0659), whereas

Groningen has the highest proportion of cyclist casualties in the same period. Bradford exceeds the other two cities in the proportion of pedestrian and cyclist casualties from 1800 to 2359, while Groningen has a particularly large proportion of pedestrian casualties between 1500 and 1759.

Table 3.9 shows the distribution of casualties by both day of the week and time of day. Naturally, some of the cell sizes are rather small. Some conclusions can be drawn, however. For example, while Bradford's share of nighttime vulnerable road user casualties was shown in Table 3.8 to be rather low, Bradford does have a particular pedestrian casualty problem early on Sundays. Most of these casualties actually occur between midnight and 3 a.m. Both Bradford and Groningen have peaks in their weekday (Monday–Friday) pedestrian casualties between 1500 and 1759, perhaps related to children's journeys home from school. In all three cities, particularly Groningen and Växjö, the weekday period for journeys home from work or school (1500–1759) seems to be more dangerous for cyclists than the period for journeys to work or school (0700–0959).

Table 3.9: Pedestrian and cyclist casualties in the three cities by hour of day and day of week.

Monday to Thursday

	Bradford (1988)		Växjö (1983–87)		Groningen (10/87–9/88)	
Time	Ped	PC	Ped	PC	Ped	PC
0000–0659	3	2	4	6	1	6
0700–0959	55	16	5	14	2	25
1000–1459	95	16	15	26	11	42
1500–1759	155	20	15	26	19	43
1800–2359	100	24	10	19	8	29
Unknown	0	0	1	1	0	0
Total	408	78	50	92	41	145

Friday

	Bradford		Växjö		Groningen	
Time	Ped	PC	Ped	PC	Ped	PC
0000–0659	7	1	0	0	0	2
0700–0959	20	4	1	5	1	7
1000–1459	37	6	3	3	9	10
1500–1759	49	5	3	13	3	14
1800–2359	37	6	2	7	0	8
Total	150	22	9	28	13	41

Saturday

	Bradford		Växjö		Groningen	
Time	Ped	PC	Ped	PC	Ped	PC
0000–0659	1	0	0	0	0	2
0700–0959	3	0	1	0	0	0
1000–1459	39	4	7	2	0	10
1500–1759	39	5	1	5	3	5
1800–2359	41	4	3	2	0	4
Total	123	13	12	9	3	21

Sunday

	Bradford		Växjö		Groningen	
Time	Ped	PC	Ped	PC	Ped	PC
0000–0659	11	0	2	0	2	3
0700–0959	1	1	0	0	0	0
1000–1459	24	8	1	3	0	1
1500–1759	16	6	3	0	1	4
1800–2359	27	3	0	0	1	8
Total	79	18	6	3	4	16

4. CONCLUSIONS

This report has identified a number of important differences and similarities between the national safety and mobility situations in each of the three countries, and also between the safety situations at a local level for one city in each country. The first such major difference between the countries was in the distribution of VRU casualties between pedal cyclists and pedestrians. In Britain pedestrians are the dominant VRU casualties, in the Netherlands it is cyclists, whilst Sweden falls somewhere in the middle with roughly even numbers of each. Another striking finding was the overall similarity in the proportions of VRU casualties between the three countries. Other fundamental differences include the amount of walking and cycling taking place in each country. The British tend to make more trips on foot than the Swedes and Dutch, whilst cycle trips are made more often in Sweden than in Britain, and substantially more often in the Netherlands. However, it has also been shown that the average length of both pedestrian and cycle trips are remarkably similar in the three countries. Overall, taking into account both the distance travelled, and the numbers of casualties it is shown that the risk of becoming a casualty is about three times as high for pedestrians in Britain as in Sweden of the Netherlands, but astoundingly is about 10 times as high for cyclists in Britain compared to the Netherlands and about 7 times as high for cyclists in Britain compared to Sweden.

At the local level, the overall annual casualty rates per head of population (see Figure 3.1) are roughly similar for Bradford (195 per 100,000 inhabitants) and Groningen (178), but substantially less in Växjö (62). However, the split between pedestrian and cyclist casualties in Bradford is very different from that in Groningen: in Bradford 85% of VRU casualties are to pedestrians, whereas in Groningen 79% of VRU casualties are to cyclists. The seemingly high rate of cyclist casualties in Groningen as compared to Bradford can be attributed to the very large difference in cyclist travel between the Netherlands and Britain. The difference in pedestrian casualties between the two cities cannot be explained away by exposure. Pedestrian travel in Bradford is considerably more dangerous than pedestrian travel in Växjö or Groningen. In all three cities, however, junction-related remedial measures have the potential to reduce accidents significantly.

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