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PUBLISHED PROJECT REPORT PPR026

ACCIDENT ANALYSIS ON RURAL ROADS – A TECHICAL GUIDE

Version: 1

By TRL Limited

Prepared for: Project Record: **S410K**

Client: Road Safety Division, Department for Transport

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ACCIDENT ANALYSIS ON RURAL ROADS

A Technical Guide

CONTENTS

1. INTRODUCTION

Purpose

1.1 This manual was developed to help address problems local authority engineers have had with addressing accidents on rural roads, namely:

a) how to prioritise between sites with the same (low) accident frequencies

b) how to justify and go about rural accident analysis

c) how best to identify and incorporate non-site-specific strategies into remedial programmes.

1.2 This technical guide expands upon the methods for broadening the traditional approach to accident analysis as outlined in the Department for Transport's publication 'A Road Safety Good Practice Guide' (DTLR, 2001). In particular, this guide provides a methodology to target accidents on rural roads (see paragraph 2.1) as effectively as possible. Other important publications relating to road safety and to rural road safety strategies include 'New directions in speed management' (DTLR, 2000a), 'Tomorrow's Roads: Safer for Everyone', (DTLR, 2000b) and 'Guidelines for rural safety management' (IHT, 1999).

1.3 This guide provides:

- a synopsis of the accident problems on rural roads in Great Britain;
- a step by step accident analysis technique;
- investigatory levels for rural roads above which it is recommended that treatment should be considered (including some relating to Vulnerable Road Users (see paragraph 2.2));
- a worked example to explain the methodology;
- blank tables (paper and electronic versions) to help road safety engineers carry out their own analyses;
- The "ARRIL" software which has been developed by TRL to automate much of the analysis procedure.

Scope

1.4 The guide is intended as a tool to assist engineers in the initial stages of problem identification and analysis and is NOT intended to:

- be prescriptive
- totally automate the process of problem identification
- replace local expertise and judgement
- tackle the final, detailed stages of accident analysis or offer solutions

1.5 The guide does, however, provide an outline methodology and national rural accident data not readily available previously elsewhere.

Potential

1.6 It is hoped that this guide will evolve and develop over time to:

- remain up-to-date
- best suit the needs of road safety engineers
- be tailored to the individual needs of authorities in terms of the data provided and software compatibility

1.7 There is also the potential to develop training workshops and software enhancements and to link in with monitoring and appraisal techniques for a holistic approach.

Structure

1.8 The main text contains the following chapters:

- Chapter 2 gives definitions for terms used in subsequent chapters.
- Chapter 3 gives a general background to accident analysis methodology.
- Chapter 4 explains why there is a need to analyse rural roads separately from urban roads and also a need for specifically rural investigatory levels (see paragraph 2.3) to facilitate in the identification and prioritisation of rural accident problems. Some national statistics relating to rural roads are also provided.
- Chapter 5 explains how to identify and prioritise problems, and includes the methodology which is the basis of the worked example in Appendix B.
- Chapter 6 provides some information on where to go for solutions.
- Chapter 7 gives details of referenced documents.

1.9 There are seven Appendices to the manual:

- Appendix A gives tables of investigatory levels for rural roads. These tables enable easy comparisons to be made between the national accident percentages on different road/carriageway types.

- Appendix B comprises a worked example following through the accident analysis process.

- Appendix C gives blank tables for road safety engineers to photocopy and use for their own accident analyses. They are also available on the accompanying diskette as Excel spreadsheets which can be copied and filled in on-screen. These use the same investigatory levels given in the tables in Appendix A but for ease of use are given as one table for each road class and carriageway type (see paragraph 2.4). For example,

Appendix C, Table 1a has the rural investigatory levels for only single-carriageway A roads. (The tables also feature in the worked example in Appendix B.)

- Appendix D offers some advice on a test for statistical significance between two proportions.
- Appendix E raises some STATS19 data issues.
- Appendix F contains details of the types and characteristics of accidents on rural roads that involve Vulnerable Road Users (see paragraph 2.2).
- Appendix G contains the User Guide to the ARRIL software which can be used to automate much of the accident analysis process.

FAST TRACK TO WORKED EXAMPLE

Chapters 3 to 7 below contain background information which will be of particular use as an introduction for those new to rural accident analysis, but also highlights recent developments and research findings.

However, for those who are familiar with the contents of chapters 3 to 6 and who wish to access the worked example directly, Appendix B contains sufficient information to guide an engineer through the analysis process.

2. DEFINITIONS

2.1 ***Rural (or 'non-built-up') roads*** are defined as those with speed limits of 50miles/h or more. Roads through villages with speed limits of 20, 30 or 40miles/h are not included. A ***rural road*** may or may not have buildings alongside it. (***Urban (or 'built-up')*** roads are defined as those with speed limits of 40miles/h or less.)

2.2 ***Vulnerable Road Users (VRUs)*** are defined (in this document) as either pedestrians, pedal cyclists, two-wheeled motor vehicle riders, or children under 16 years of age. Other types of VRU were not included as the accident data relating to them was not available. However, it is hoped that equestrians, for example, may be included in future editions.

2.3 ***Investigatory level*** is defined as a numerical value used to gauge the size of an accident problem (such as accidents/year, accidents/vehicle-km). The values need to be understood and used with care, as suggested in this guidance.

2.4 ***Road class and Carriageway type*** - These relate to the definitions given in STATS19 and STATS 20.(DETR, 2000) Road type letters ('A', 'B', 'C' or 'Unclassified') do not necessarily reflect the network road hierarchy. It should be noted that where the carriageway type was recorded as 'Roundabout' or '1 Way' in a STATS19 accident record, that accident was allocated to the dual-carriageway 'A' road set if the road was an 'A' road and to the appropriate single-carriageway road set if the road was 'B', 'C' or 'Unclassified'.

2.5 ***Routes*** are defined as adjoining road sections with broadly similar characteristics and traffic. Although a route can be any length, it is recommended that they be greater than 2.5 kilometres as shorter routes are most likely to have widely varying accident rates.

2.6 ***Exposure to risk*** is defined as the opportunity for accidents to occur.

2.7 ***Accident risk*** is a general term for the likelihood of an accident occurring, given a certain level of exposure.

2.8 ***Control areas*** are chosen to have similar characteristics to a local (Study) area for the purpose of making data comparisons. Very often national data will be suitable and readily available in Road Casualties in Great Britain 2002: Annual report (DfT, 2002). Other areas which could be suitable as Control areas might include the rest of the county, a group of neighbouring counties etc.

2.9 ***Accident severity ratio (also known as 'severity index')*** is defined as the sum of those accidents that resulted in fatal or serious injury divided by all accidents.

2.10 ***Casualty severity ratio*** is defined as the sum of those casualties who were killed or seriously injured divided by all casualties.

2.11 ***TWMV*** - Two Wheeled Motor Vehicle, includes mopeds and all sizes of motorcycles.

2.12 ***Accident types and contributory factors*** - The analysis of the types of accident and the factors contributing to their occurrence is a vital step to reach an understanding of why accidents occur and how to treat the problem. Some of the most important aspects to be studied include accident and casualty severity, weather and road surface condition, lighting, road layout and

junction type, vehicle manoeuvres, vehicle types, vehicle speeds, driver compliance with the Highway Code, driver age and gender, pedestrian involvement etc.

3. BACKGROUND

3.1 Local authority engineers and others responsible for road safety need to regularly assess the problems occurring on their network. One of the elements in the assessment will involve studying accident patterns over a period of time according to location, circumstances and the vehicles and casualties involved. The relative size of the problems and the ability to tackle them must be assessed and suitable, cost-effective solutions devised and planned. The whole accident analysis cycle is summarised in Flow Chart 1 below (the elements shaded pink are those covered in this document).

3.2 This has proved a successful approach and road safety engineering budgets have been spent accordingly although, of course, factors such as the vehicle capacity of the road, land development, policy issues and environmental matters often affect the budgeting decisions as well.

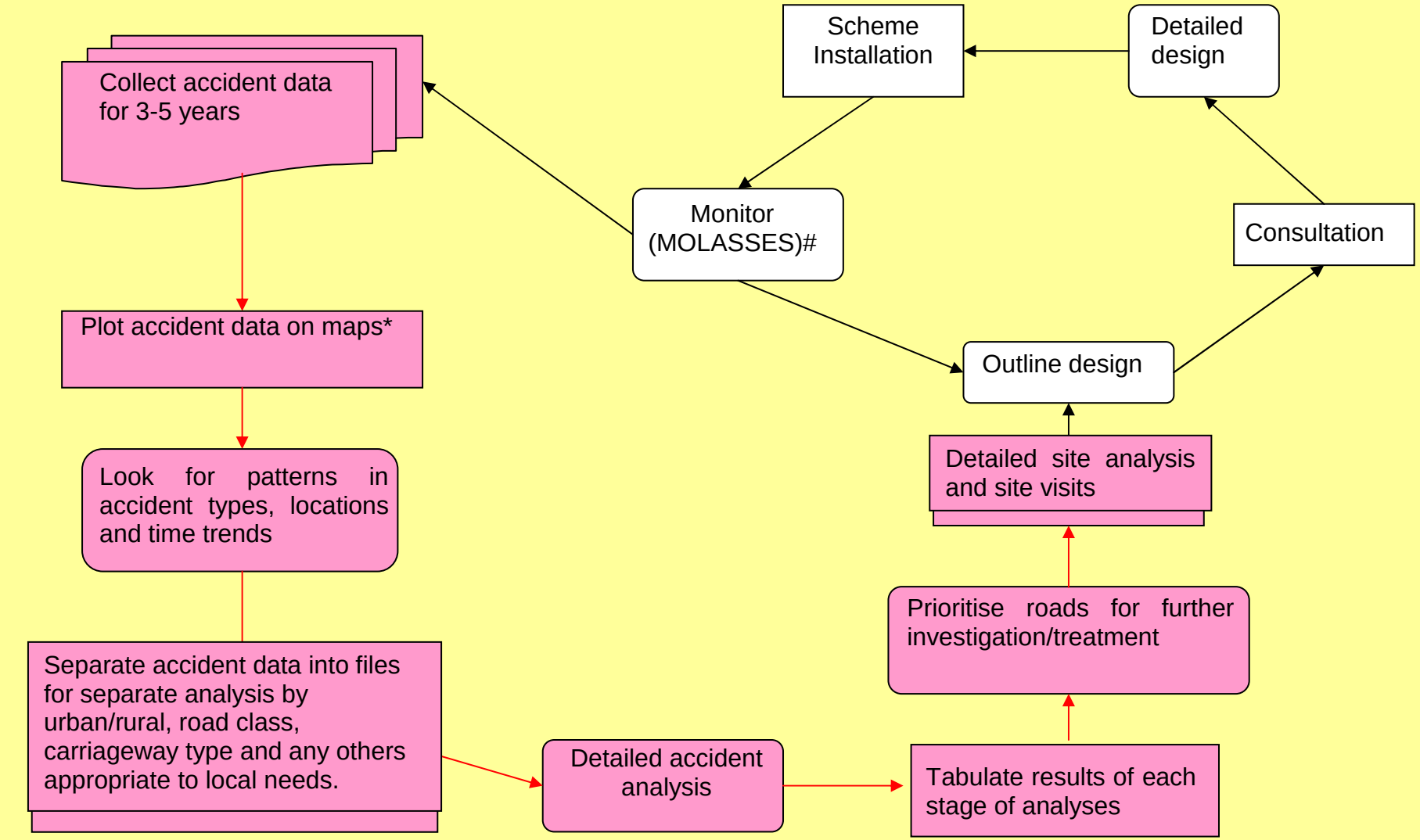
3.3 Many local authorities now programme their work to take other factors into account (as part of a speed management plan, for example) and to adopt any of four strategic approaches:

- **Single site action** (addressing a specific site with a much higher than average concentration of accidents of a particular type);
- **Mass action** (addressing all locations having a similar accident problem over the whole area under consideration with an appropriate proven remedial measure - e.g. at all T-junctions);
- **Area action** (addressing a number of problems over a network of roads in one part of the total area under consideration);
- **Route treatment** (addressing a number of problems on one or more routes (see paragraph 2.5) with high accident frequencies or rates).

3.4 Methods for such approaches have been well-documented elsewhere (for example by the IHT (1990 and 1999), and RoSPA (1995).

3.5 Over time, most of the worst accident sites, selected on the basis of number of accidents per year over a short length of road, have been 'cured'. Accidents now tend to be spread more evenly across whole areas.

Flow Chart 1: The Accident Analysis Cycle



* manually or electronically using accident analysis software or by linking an accident database with a GIS system.
# MOLASSES *MO*nitoring *LO*cal *A*uthority *S*afety *S*chem*ES* See www.trl.co.uk/molasses for details.

3.6 For this reason, 'mass action', 'route action' or 'area action' remedial treatments may be preferable to treatments at a few specific sites. The treatments selected may be chosen to tackle one or more particular types of accident, rather than all accidents. The use of low-cost measures may result in these other approaches being just as cost-effective as the traditional site-specific approach. In addition, some accident problems (such as those involving driver impairment) may be tackled more effectively through enforcement, training and publicity methods than by engineering alone.

3.7 And, with the government's integrated transport policy, there are now good reasons to broaden the approach to include analysis of:

- urban and rural accidents separately (see paragraphs 4.1 to 4.4 below)
- accident numbers *and* accident rates for all classes of road user, including Vulnerable Road Users (see paragraphs 4.12 to 4.22 below)
- each class of road separately (see paragraphs 4.15 to 4.16 below).

3.8 The term '*locality*' will from now on refer to either short or long sections of road, or to a network of roads.

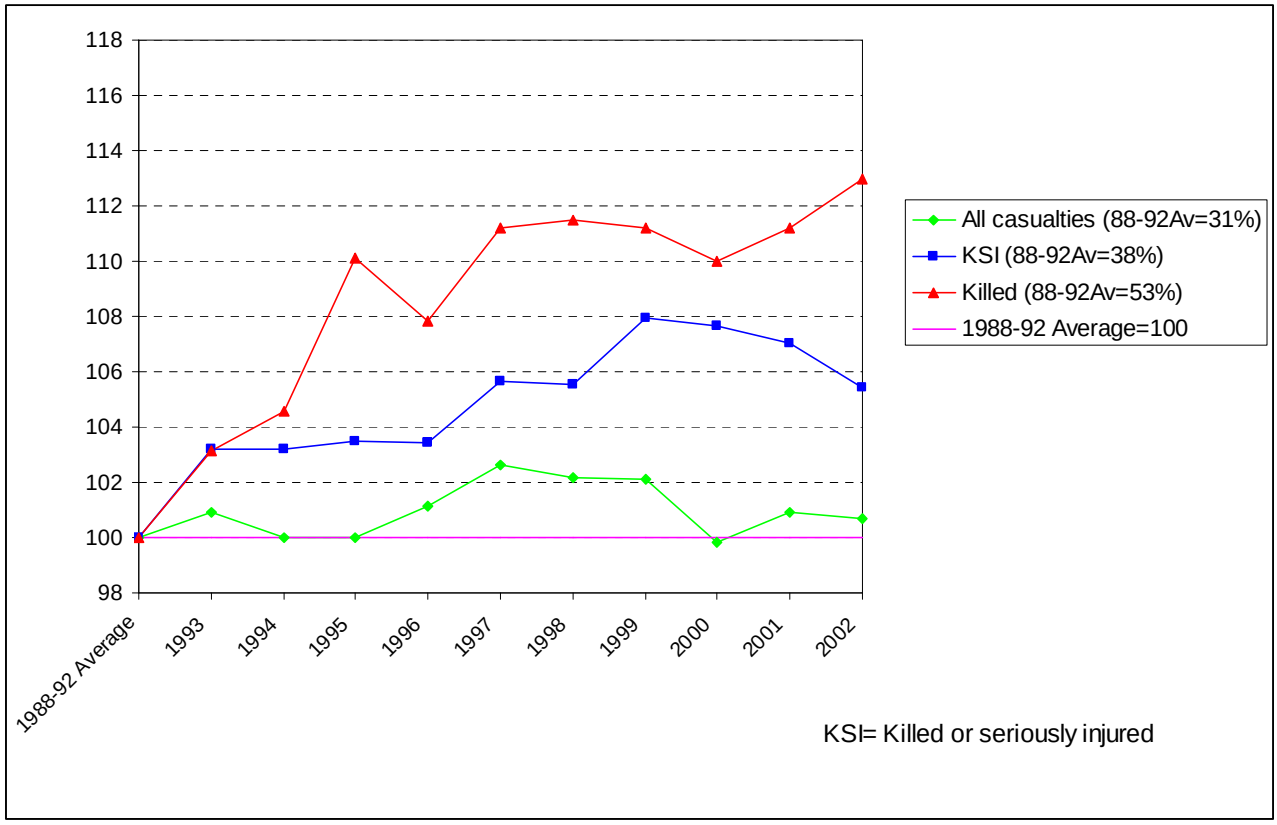
4. ACCIDENT AND CASUALTY ANALYSIS ON RURAL ROADS

Why rural roads?

4.1 Although rural accidents account for only 31% of all casualties, these accidents contribute 44% of the total cost of injury accidents in Great Britain because they result in more serious injuries than on urban roads. Currently 53% of all fatalities occur on rural roads.

4.2 Fig. 1 below shows the trend in the proportion of casualties on rural roads compared with the 1988-1992 averages, by casualty severity.

Fig 1: Indices of the proportion of all casualties that were on rural roads (including motorways), by injury severity (1993 to 2002)



4.3 Rural roads (excluding those through villages) are, in the main, less likely than urban ones to be treated with safety engineering schemes. The main reasons for this are that:

- local authorities tend to identify specific sites and localities for treatment on the grounds of injury accident numbers;

BUT

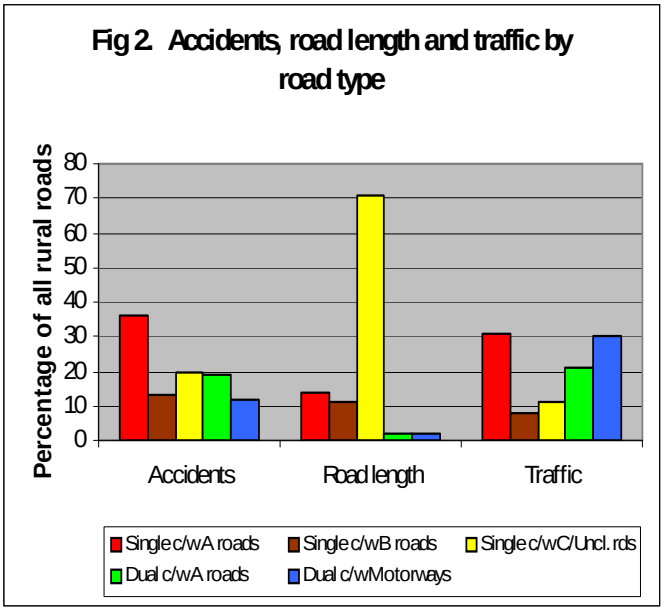
- accidents in rural areas are even more likely than those in urban areas to be widely scattered.

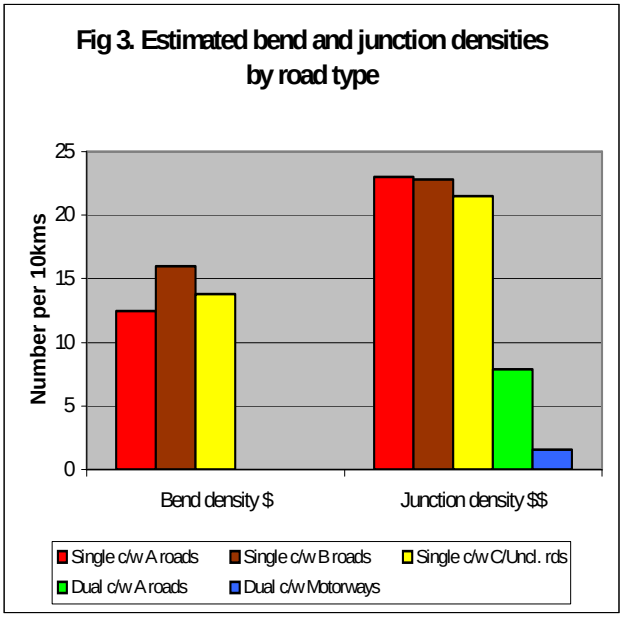
4.4 The severity and cost of rural accidents and the largely untapped potential for treatment are good reasons to spend more resources tackling rural accident problems. Another good practical and financial reason for considering the separate analysis of urban and rural roads is that the 'Highway Maintenance Code of Good Practice' (LAA, 1989) recommends creating a

highway maintenance management strategy and a maintenance road hierarchy of urban and rural roads separately, and further broken down by traffic flow and composition. Efficiencies will result if maintenance and safety scheme programmes can work together.

Rural accident statistics

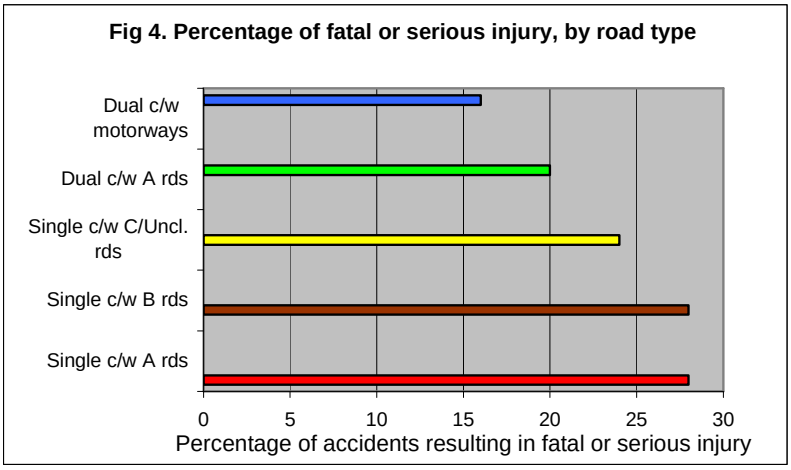
4.5 It is useful to set the scene by considering some important rural statistics. Fig 2 shows, nationally, averaged over 1994 -95, for each road class category, the accidents, road lengths and traffic. Fig 3 shows *estimated* numbers of bends and junctions per km. Fig 4 shows the percentages of all rural accidents involving fatal or serious injury. The figures show that the highest proportion of accidents and the greatest severities occur on single-carriageway 'A' roads. However, most rural roads are 'C' or 'Unclassified' roads. The greatest proportions of traffic are observed on single-carriageway 'A' roads and motorways.





c/w = carriageway
Uncl. = Unclassified

$ estimated for single c/w roads only
$$ estimated



Rural investigatory levels - the principles

4.6 If the size of an accident problem on a particular road exceeds the relevant investigatory level (e.g. accidents/year or accidents/vehicle-km), then that road is selected for more detailed analysis and, perhaps, subsequent treatment.

4.7 Investigatory levels suitable for urban (but not rural) roads may be well known to local authority road safety engineers from their knowledge of their local network. Investigatory levels suitable for use in rural accident analysis[1] (including some relating to Vulnerable Road Users) have been developed, as detailed by Barker et al (1999) and are summarised in tables in Appendix A. 'Road Casualties Great Britain' and 'Transport Statistics Great Britain' (DfT 2002a, 2002b) and 'The COBA manual' (Highways Agency, 1996) also contain useful data.

4.8 The investigatory levels given in Appendix A are based on national data, using mean values, and are given for each class of *rural* road. Separate investigatory levels are given for dual-carriageway and for single-carriageway roads. This is for three main reasons:

- historical data availability;
- vehicle flows tend to be much higher on dual-carriageway than on single-carriageway roads;
- the potential for treatment may be higher for single-carriageway roads due to the relatively high build-quality and high cost of treating dual-carriageway roads.

4.9 Care must be taken when using intervention levels. If a value for a particular road exceeds the corresponding investigatory level it does not, of course, *prove* that a problem exists as the investigatory level represents a national average level. Most roads will not have values equal to the mean and a particular local value may reflect different levels of exposure locally from nationally. Where the national investigatory level exceeds a local value, this could equally well camouflage a particular local problem.

4.10 It is also important to remember that investigatory levels are based upon data from a recent period. At the national level, these values will be fairly stable from year to year but will need to be re-evaluated for suitability at a future date. More caution will be necessary for some values than others, for example, icy/snowy values may be based on a particularly mild/severe winter and it may be prudent to examine other information about relationships between accident rates and winter indexes.

4.11 Nevertheless, the use of investigatory levels is a valuable method of identifying accident characteristics that warrant further investigation.

Importance of exposure

4.12 Although it is important to tackle the largest number of accidents and casualties possible with the budgets available, it is important to note that, despite this, this does not necessarily

[1] Investigatory levels suitable for motorway and trunk road accident analysis are provided annually to Route Managers under the Highways Agency Safety Strategy.

mean treating the localities with most accidents. This is because localities with a high accident risk (i.e. the localities that do not necessarily have the largest number of accidents, but do show a greater propensity for accidents than one would expect for a given level of exposure to risk (see paragraph 2.6)) are the localities that are most likely to be amenable to treatment.

4.13 Although the most important components of exposure are likely to be road length and vehicle flow, others will often be important too, especially when considering certain types of accidents. Pedestrian flow, pedal cycle flow, horse movements, junction and bend density (the number of junctions or bends per km of road) are examples.

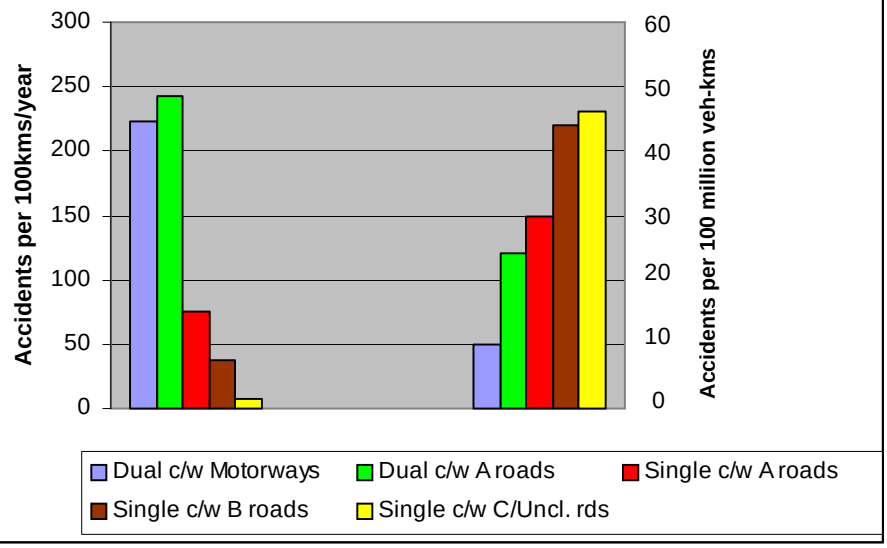
4.14 In the case of rural roads (and particularly Vulnerable Road Users on rural roads) this approach is especially important as, although accident and casualty numbers may be low, the accident risk associated with them is very high.

Road class and carriageway type

4.15 The relationship between accidents and vehicle flows is not a linear one (e.g. see Walmsley and Summersgill, 1998). For this reason, it is recommended that roads with very different flow levels are *not* studied together. In the absence of detailed flow data, a good alternative approach is to categorise the road for analysis, according to its road class and carriageway type (see paragraph 2.4). Typically, accident and flow data are readily available by class of road. Consequently, rural investigatory levels have been developed separately for each class of rural road and carriageway type. (See Appendix A.)

4.16 The importance of adopting this approach is demonstrated in Fig. 5. While dual-carriageways have higher accident numbers per km than single-carriageway roads, they have much *lower* accident *rates* (per vehicle-km). Similarly, single-carriageway 'A' roads have higher accident numbers per km than single-carriageway 'C/Unclassified' roads but much lower accident rates (Fig. 5).

Fig 5. Accidents per km and per vehicle-km



Proxies for exposure variables

4.17 Often (especially for Vulnerable Road Users) there will be no suitable exposure data available. In these instances suitable proxies need to be found.

4.18 Sometimes, accident risk (see paragraph 2.7) can be calculated in terms of 'per head of population' or 'population density', or 'per trip' or 'per licensed vehicle' etc, instead of per vehicle-km travelled.

4.19 Another option not often considered is to use comparisons with another Control (see paragraph 2.8) area where exposure levels (such as the amount of cycling, for example) are considered similar to those in the area under study. The use of these comparisons removes the need to collect exposure data explicitly.

4.20 The method of comparing accident types between areas identifies accident types that feature disproportionately more often in the target area than their expected frequencies from the Control area would suggest.

4.21 To illustrate: If only 5% of all accidents in the Study area involve pedal cycles then, in terms of accident numbers, it is not immediately apparent that this is a high priority accident problem. Now, suppose we find that only 1% of all accidents in a similar Control area involve pedal cycles. Assuming that the level of cycling is similar in the two areas, it is evident that cycle accidents in the Study area deserve further investigation and explanation. It is possible that such an accident type (because of its abnormally high level of risk) will be more amenable to preventative engineering treatments than another accident type with a higher observed *and expected* frequency of accidents.

4.22 Statistical tests may be used to evaluate whether the difference between the proportions of each accident type are unlikely to be due to chance (i.e. the difference between 5% and 1% in the example above). The statistical test used will depend on whether the Control area is mutually exclusive of the Study area - see Appendix D for details.

Vulnerable road users

4.23 Vulnerable Road Users are especially at risk on rural roads. The casualty severity ratio (see paragraph 2.10) is 50% higher on rural roads than on urban roads (0.21 compared with 0.14). For VRUs the difference is even greater.

4.24 Table 1 below gives the casualty severity ratios for VRUs injured on rural roads in Great Britain, by road class (1994-95 average values).

Table 1: Rural casualty severity ratios for VRUs, by road class (1994-5 averages)

Rural roads (speed limit ≥ 50miles/h)		Carriageway type and road class							
		Dual-carriageway			Single-carriageway				All
		M/way	A	All dual	A	B	C/Uncl	All single	All rural
Casualty severity ratios	TWMV riders	0.31	0.31	0.31	0.45	0.44	0.41	0.44	0.41
	Pedal cyclists	0.14[2]	0.32	0.32	0.32	0.30	0.34	0.32	0.32
	Pedestrians	0.60	0.55	0.56	0.50	0.41	0.35	0.43	0.46
	Children <16 years old	0.10	0.13	0.12	0.17	0.17	0.16	0.17	0.15
	Child pedal cyclists <16years old	-	0.32	0.32	0.28	0.29	0.29	0.29	0.29
	Child pedestrians <16 years old	0.89	0.55	0.57	0.49	0.45	0.34	0.43	0.45
	All rural casualties	0.13	0.17	0.15	0.24	0.23	0.20	0.22	0.20

4.25 Where appropriate, data for VRUs have been included in the blank tables in Appendix C and in the tables in the worked example in Appendix B. Appendix F contains more detailed data tables for accidents involving VRUs. Some key results are summarised below.

4.26 For pedal cyclists and TWMVs (see paragraph 2.11), roundabouts are particularly dangerous, with almost half of both the pedal cyclist and TWMV accidents on rural dual-carriageway A roads occurring at roundabouts (see Carriageway type note, paragraph 2.4). By comparison, in rural areas only 8% of all accidents occur at roundabouts.

4.27 About a fifth of the accidents involving TWMVs and pedal cycles on rural single-carriageway roads occur at or within 20m of T or Y junctions.

4.28 Over a quarter of the TWMVs involved in accidents on single-carriageway A roads and about two fifths of the TWMVs on B, C and Unclassified roads are on a bend when the accident occurs.

4.29 On rural single-carriageway roads about a quarter of pedestrian accidents occur on unlit roads at night and about a third are on wet roads.

4.30 Child pedestrians are particularly at risk on rural roads with between a third and nine tenths (8 out of the 9 child pedestrian casualties on Motorways) either killed or seriously injured.

[2] There were 23 accidents involving pedal cyclists recorded as having occurred on Motorways in the 2 year period.

5. IDENTIFYING AND PRIORITISING PROBLEMS

5.1 Accident and casualty analysis is a complex procedure because the factors affecting accident occurrence are numerous and not independent. Ideally, the direction that a comprehensive accident analysis takes will be led by the recorded accident data. It should be carried out by experienced road safety engineers who understand the relative importance of different types of result and are able to identify and balance conflicting levels of accident risk.

5.2 In practice, it may be useful to follow a guided path (such as that summarised in paragraph 5.3 below and detailed in Appendix C) which ensures that the key areas and types of accident are addressed. Further analyses should be carried out whenever budgets and the relevant expertise are available, and particularly if it is clear that special problems exist.

5.3 The basic approach for rural (or urban) accident analyses can be summarised in the following steps:

- Look at injury accident data for the relevant area for a period of 3-5 years[3]. The location of accidents should be plotted on maps; this can be done with a GIS system or an accident analysis package.
- Examine accident patterns in terms of type, contributory factors (see paragraph 2.12) and location, considering accident numbers and rates, for each class of road. [4]
- Identify any significant changes in accident trends and factors over time.
- For each road in the area, tabulate key results as you carry out the detailed analyses.
- Prioritise roads for further investigation/treatment.

5.4 Any changes to the local network in terms of the road length under study should also be taken into account. For example, the introduction of lower speed limits in villages and the new responsibilities for non-core trunk roads may both affect the proportion of rural and urban roads (and so casualties) in the network year by year.

5.5 It is important to consider not only the local picture but the wider picture too. For example, over the same period[5]:

a) Have accident frequencies changed nationally (or over another large area, such as the neighbouring county)?
b) Have traffic levels changed?

[3] If accident numbers are high (hundreds or thousands) then one year's data may be sufficient. However, if numbers are small and the data are broken down further into small groups by type of accident, for example, then the data will vary too much between years or localities for meaningful comparisons to be made and may be misleading. Much more than 3-5 years data will lead to a tendency for changes in flow and significant changes in the network to affect the accident picture.

[4] This should include an analysis of types relevant to local and national targets and performance indicators in Local Transport Plans - i.e. will include accidents involving child casualties, vulnerable road user casualties and analyses by severity.

[5] DTLR (2001) gives advice on possible sources of information.

c) Has the composition of traffic changed?

d) What other local or national events may have affected accident frequencies?

5.6 Factors affecting d) in the paragraph above may include almost anything from the installation or maintenance (e.g. resurfacing) of a scheme (within the last 3-5 years), to temporary road closures, to a large sporting event, to a petrol shortage, to a new law or publicity campaign.

5.7 The information used regarding accident rates during the prioritisation process will vary, depending on the situation and on the quantity and reliability of exposure data that are available. The use of more than one approach to identifying accident problems will often be appropriate.

5.8 When ranking problems, a balanced assessment of all the data has to be achieved, based on:

- accident rate (see paragraphs 4.12 to 4.22 above)
- number of accidents
- the severity of injuries sustained in accidents.

5.9 It may be helpful to tabulate the results of the analysis to assess the relative seriousness of problems to help prioritise them. This will be particularly useful to identify any overall problems emerging, such as an abundance of speed-related problems, or skidding problems, or bend accidents etc and may provide justification for a mass action treatment (see paragraph 3.3 above).

5.10 A worked example showing how to analyse the accidents in an area is provided here in Appendix B.

6. FINDING SOLUTIONS

6.1 The next step in tackling the road safety problem involves carrying out further detailed investigations of localities that have been identified as having problems. A Road Safety Good Practice Guide (DTLR, 2001), gives more information and advice about the next stages including:

- Detailed investigation
- Visits to localities
- Possible treatments
- Outline and detailed design of treatment scheme
- Scheme installation
- Monitoring

6.2 This guide is designed to give help in identifying where there may be an accident problem. It does not offer solutions to these problems as they will be specific to each area.

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APPENDIX A: RURAL INVESTIGATORY LEVELS

The development of the following rural investigatory levels is detailed in TRL Report 425 (Barker et al, 1999). Note the advice and words of caution about the use of investigatory levels given in chapters 1 and 4 of this guide.

Table A1: Rural investigatory levels, by road class

See sections 1, 2.1, 2.3 and 2.4 of TRL Report 425 (Barker et al, 1999) for definitions and assumptions.

Rural roads (speed limit ≥ 50miles/h)		Road class and carriageway type							
		Dual-carriageway			Single-carriageway				All rural
		M/way	A	All dual	A	B	C/Uncl	All single	
Accidents per year	All accidents per 100kms	223	243	235	75	37	8	21	30
	Non- junction accidents per 100kms	178	108	136	43	22	6	13	18
	Junction accidents per 100 junctions (estimated)	277	170	182	14	6	1	4	5
	Bend accidents per 100 bends (estimated)	-	-	-	15	8	3	5	
	Accidents per 10^8 veh-kms (all accident severities)	10	24	16	30	44	46	35	26
	Accidents per 10^8 veh-kms (fatal accidents)	0.2	0.6	0.4	1.2	1.3	0.9	1.2	0.8
	Accidents per 10^8 veh-kms (serious accidents)	1	4	3	7	11	10	8	5
	Accident severity ratio (severity index)	0.16	0.20	0.18	0.28	0.28	0.24	0.27	0.24

The proportions of individual accident types, which constitute investigatory levels, are given in full in TRL Report 304 (Barker et al, 1998). The most applicable values have been reproduced in Tables A2 to A5 below. Values relating specifically to Vulnerable Road Users have been highlighted 'VRU' in the left margins.

Table A2: Percentage of all accidents of various types on rural, single-carriageway roads in Great Britain (1994/95), by road class

It should be noted that where the carriageway type was recorded as 'Roundabout' or '1 Way', that accident was allocated to the dual-carriageway A road set if the road class was 'A' and to the appropriate single-carriageway road set if the road class was B, C or Unclassified.

	Accident variable (STATS19)	Percentage of all accidents:	Road class			
			A	B	C / Uncl	All
			%	%	%	%
VRU	Pedestrians	Involved at least one pedestrian injury	3.2	3.4	4.3	3.6
VRU	Age of casualty	Involved at least 1 child injury (age<16yrs)	9.1	9.0	10.6	9.6
	No. of vehicles involved	Only involved 1 vehicle	26.4	35.8	37.1	31.2
		Involved 3 or more vehicles	18.5	10.4	5.9	13.4
	Road surface	Dry	55	52.9	53.3	54.2
		Wet	39.9	40.5	38.9	39.7
		Ice/snow	4.7	6.2	7.4	5.8
	Lighting	Occurred in daylight	72.2	69.8	70.9	71.1
		Occurred at night on an unlit road	18.9	23.4	23.3	21.0
	Junction types	Not at a junction	57.2	62.2	71.9	62.2
		At or within 20m of a junction	42.8	37.8	28.1	37.8
		At a private drive junction	8.1	6.9	5.1	7.0
		At a T/Y junction	24.0	21.2	15.8	21.1
		At a crossroads	6.6	6.4	4.2	5.8

Table A3: Percentage of all vehicles involved in all accidents of various types on rural, single-carriageway roads in Great Britain (1994/95), by road class

It should be noted that where the carriageway type was recorded as 'Roundabout' or '1 Way', that accident was allocated to the dual-carriageway A road set if the road class was 'A' and to the appropriate single-carriageway road set if the road class was B, C or Unclassified.

Accident variable (STATS19)	Percentage of all accident-involved vehicles:	Road class			
		A	B	C/Uncl.	All
		%	%	%	%
Vehicle types	Pedal cycle	1.7	2.7	3.6	2.4
	Two-wheeled motor vehicle	5.5	6.8	6.1	5.9
	Light goods vehicle	5.3	5.1	5.2	5.2
	Public service vehicle/heavy goods vehicle	7.3	5.2	4.9	6.3
Driver age and sex	Male drivers/riders under 25 years old	15.9	19.5	22.3	18.2
	Male drivers/riders over 59 years old	8.0	6.9	5.5	7.2
	Male drivers/riders (all ages)	72.1	70.9	70.1	71.4
	Female drivers/riders under 25 years old	6.2	6.9	7.0	6.5
	Female drivers/riders over 59 years old	2.1	2.0	1.8	2.0
	Female drivers/riders (all ages)	24.9	26.0	26.1	25.4
Vehicle manoeuvre	Parked	1.6	2.0	1.8	1.7
	Waiting to go ahead	6.9	3.3	2.3	5.0
	Stopping	3.9	2.0	1.6	3.0
	Turning right	10.0	9.4	6.4	8.9
	Waiting to turn right	3.5	2.2	1.0	2.6
	Overtaking a moving vehicle on its offside	6.9	5.0	2.6	4.9
	Going ahead on a bend	17.3	28.6	38.1	24.8
	Going ahead - other	45.9	42.6	41.6	44.2

Table A4: Percentage of all accidents of various types on rural, dual-carriageway roads in Great Britain (1994/95), by road class

It should be noted that where the carriageway type was recorded as 'Roundabout' or '1 Way', that accident was allocated to the dual-carriageway A road set if the road class was 'A' and to the appropriate single-carriageway road set if the road class was B, C or Unclassified.

Accident variable (STATS19)	Percentage of all accidents:	Road class		
		M & A(M) %	A %	All %
VRU Pedestrians	Involved at least one pedestrian injury	1.4	2.9	2.4
VRU Age of casualty	Involved at least 1 child injury (age<16yrs)	7.5	7.4	7.4
No. of vehicles involved	Only involved 1 vehicle	25.0	25.2	25.1
	Involved 3 or more vehicles	26.2	16.2	20.1
Road surface	Dry	65.3	61.7	63.1
	Wet	31.6	34.5	33.4
	Ice/snow	2.7	3.5	3.2
Lighting	Occurred in daylight	72.5	71.8	72.0
	Occurred at night on an unlit road	12.9	10.1	11.2
Junction types	Not at a junction	78.5	44.5	57.5
	At or within 20m of a junction	21.5	55.5	42.5
	On a slip road	10.3	8.2	9.0
	At a T/Y junction	N/A	9.5	-
	At a roundabout	9.2	29.0	21.4

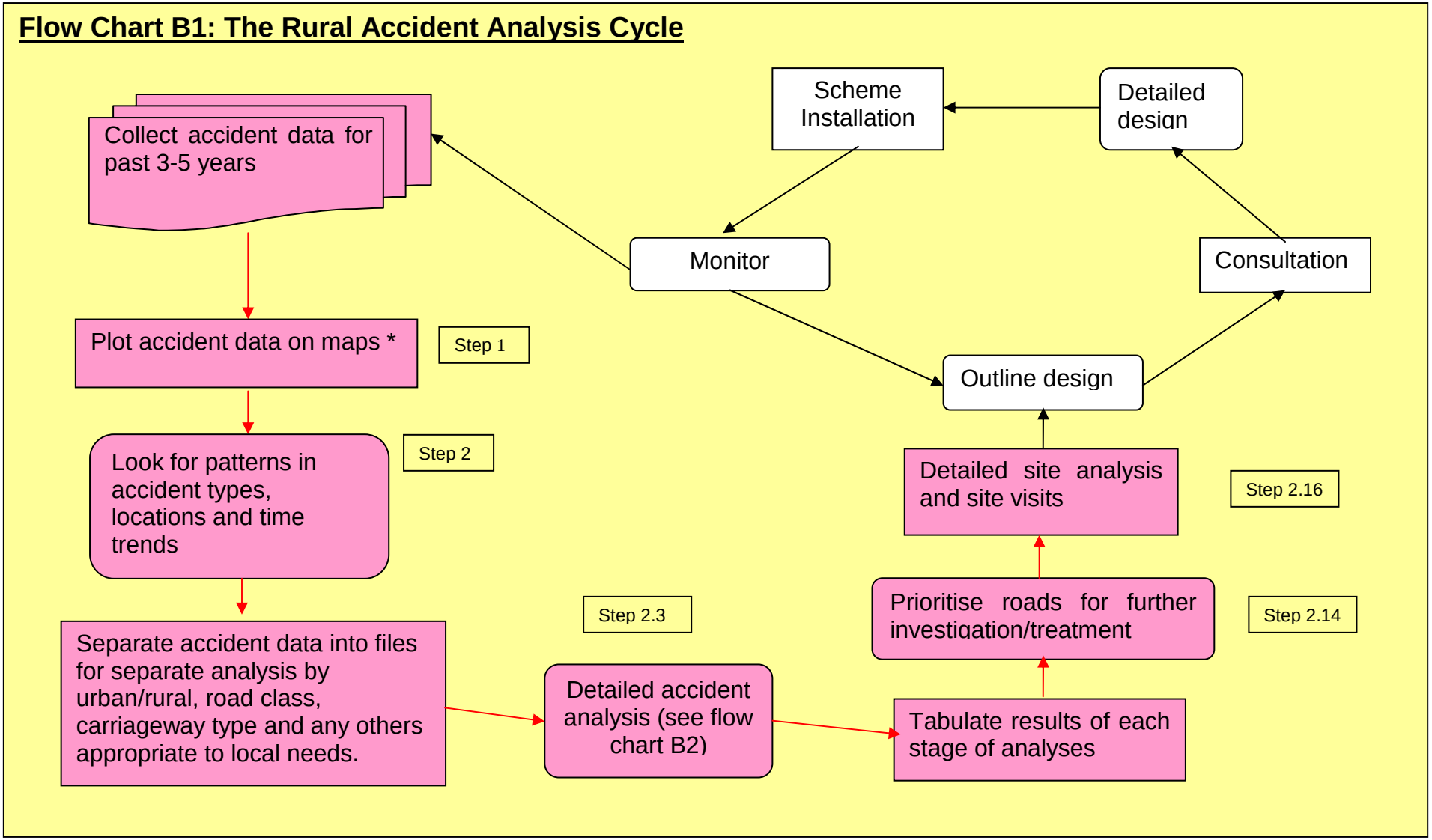
Table A5: Percentage of all vehicles involved in all accidents of various types on rural, dual-carriageway roads in Great Britain (1994/95), by road class

It should be noted that where the carriageway type was recorded as 'Roundabout' or '1 Way', that accident was allocated to the dual-carriageway A road set if the road class was 'A' and to the appropriate single-carriageway road set if the road class was B, C or Unclassified.

Accident variable (STATS19)	Percentage of all accident-involved vehicles:	Road class		
		M & A(M) %	A %	All %
Vehicle types	Pedal cycle	0.07	2.3	1.4
	Two-wheeled motor vehicle	2.2	5.1	3.9
	Light goods vehicle	6.1	5.1	5.5
	Public service vehicle/heavy goods vehicle	13.8	8.7	10.8
Driver age and sex	Male drivers/riders under 25 years old	10.4	12.8	11.8
	Male drivers/riders over 59 years old	5.1	6.5	5.9
	Male drivers/riders (all ages)	75.0	70.6	72.5
	Female drivers/riders under 25 years old	4.7	6.0	5.5
	Female drivers/riders over 59 years old	0.9	1.6	1.3
	Female drivers/riders (all ages)	21.2	25.9	24.0
Vehicle manoeuvre	Waiting to go ahead	15.2	12.5	13.6
	Stopping	10.4	7.4	8.6
	Changing lane	7.4	4.8	5.9
	Turning right	N/A	5.2	-
	Turning left	N/A	2.4	-
	Overtaking a moving vehicle on its offside	3.8	3.6	3.7
	Going ahead on a bend	2.6	5.1	4.1
	Going ahead - other	57.0	52.3	54.3

APPENDIX B: RURAL ACCIDENT ANALYSIS - WORKED EXAMPLE

The whole rural accident analysis cycle is shown in *Flow chart B1* below. The stages discussed in this example are those shaded/coloured pink. This worked example considers accidents in a fictional study area - xyzshire which, for simplicity, has only single-carriageway roads.

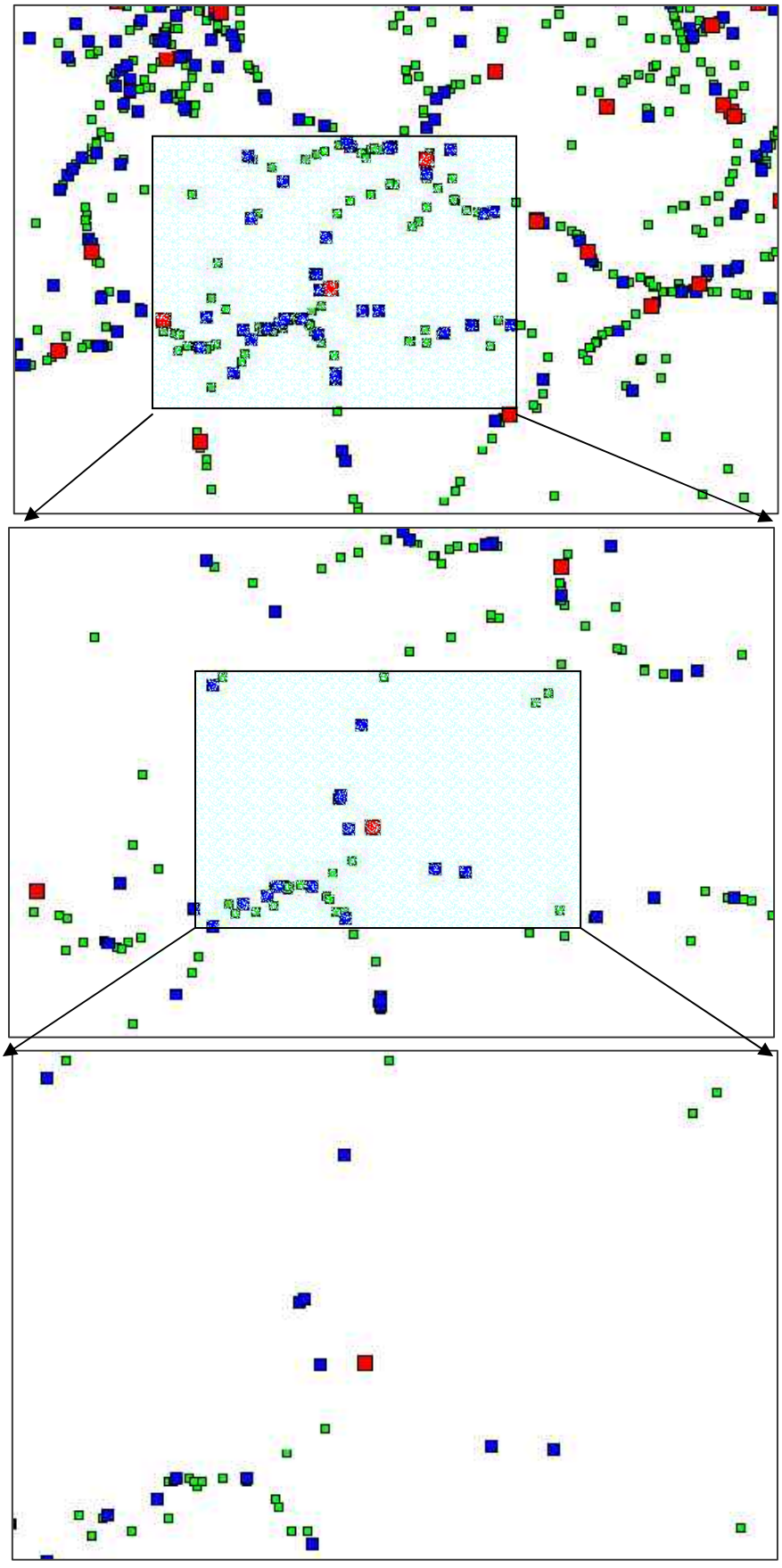


STEP 1: ACCIDENT PLOTS

1. Look at injury accident data for the relevant area. Data should be plotted on maps; this can be done with a GIS system or by using an accident analysis program. Examine accident patterns in terms of type and location.

2. Three example accident plots are given below (*Fig B1*). They were plotted using the TRL STATS19 accident analysis program MAAP for WINDOWS (2000) and accident data for a sample rural area. The plots are at three different scales to see the overall pattern and to examine the accidents at specific locations more closely. The plots can portray the different types of accidents simply by using different colours, here showing the different accident severities. Accidents are generally well-scattered to the extent that the road network is easily identifiable but, if not, accidents can also be plotted directly onto a map of the area.

Fig B1: Accidents in a rural area plotted at 3 different scales
(see Paragraph 2)



STEP 2: DETAILED ACCIDENT ANALYSIS

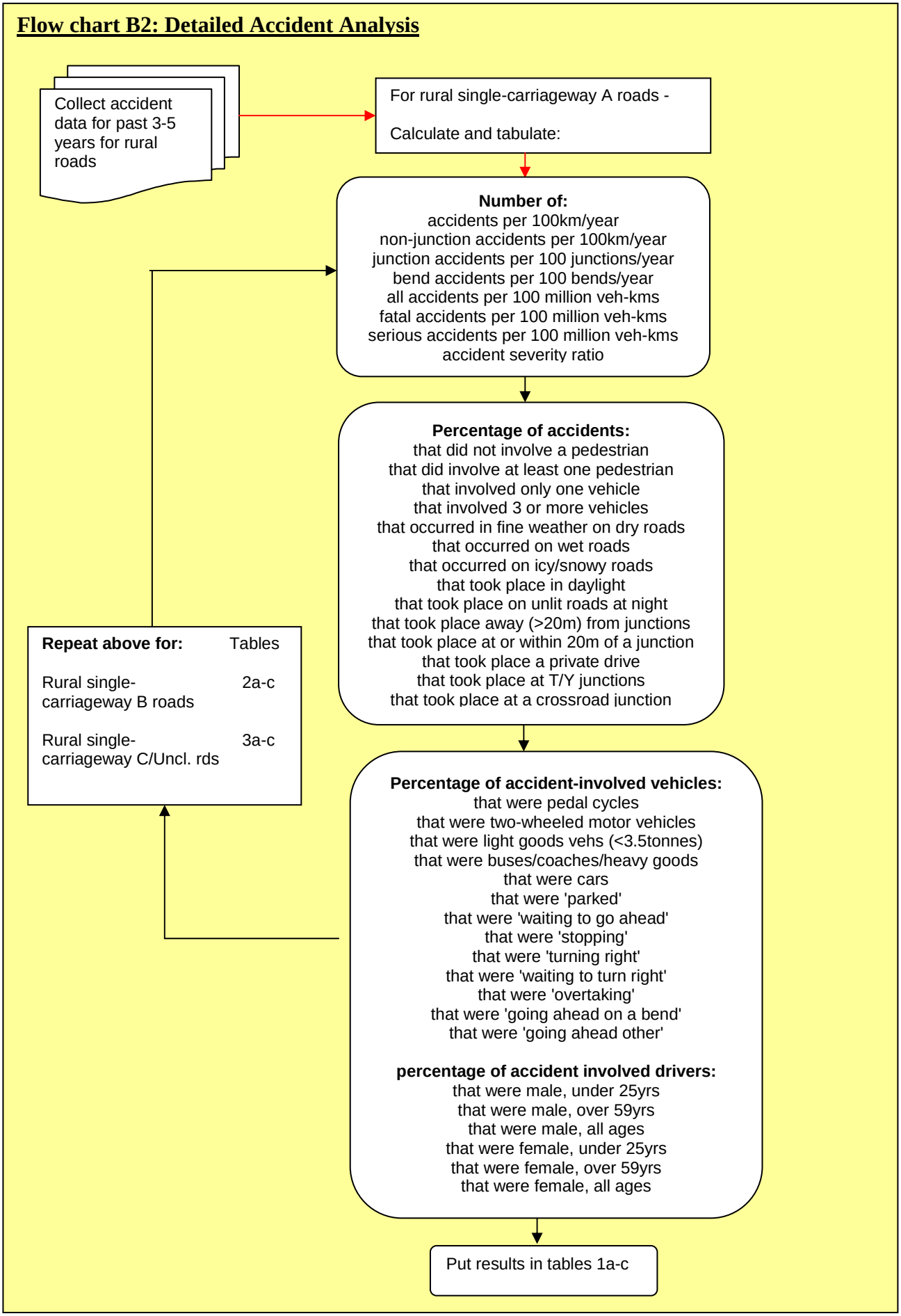
1. Accident and casualty analysis is a complex procedure because the factors affecting accident occurrence are numerous and not independent. Ideally, the direction that a comprehensive accident analysis takes will be led by the recorded accident data and carried out by experienced road safety engineers who understand the relative importance of different types of result and are able to identify and balance conflicting levels of accident risk.

2. However, as a starting point, it is useful, at the very least, to go through a methodical approach looking at important accident types such as those suggested for rural single-carriageway roads in *Flow chart B2* below.

3. In order to follow the process shown in *Flow chart B2* it is necessary to calculate the number of accidents occurring with regard to various accident types. This may require considerable resources, especially if the numbers are calculated manually.

4. A computer program 'ARRIL' has been created which automates much of the process shown in *Flow chart B2*. The ARRIL program can be installed from the disk provided with this document, As ARRIL may significantly reduce the amount of effort required to carry out the analysis, it is strongly recommended that the ARRIL User-guide (presented in Appendix G) is read before undergoing the process shown in *Flow Chart B2*.

Flow chart B2: Detailed Accident Analysis



5. The national rural investigatory levels given in Appendix A are also made available in tables 1-5abc (with one road class given in each table) in Appendix C and are, in fact, the national average values for rural roads.

6. It may be helpful to make copies of the tables in Appendix C for the roads in the area, and work through the relevant elements for A, B, and C/Unclassified, single-carriageway roads, tabulating the results as you go in tables 1-3abc (as can be seen in tables 1-3abc following). (For dual-carriageway road analyses fill in tables 4-5abc.) It should be noted that some of the categories used in the accident types and vehicle manoeuvres are different for dual-carriageways from those used for single-carriageways. These tables are also available on the diskette as Excel spreadsheets (d c_w *ruralaccanalysis.xls* for dual-carriageway roads and s c_w *ruralaccanalysis.xls* for single-carriageway roads) to be copied and filled in on-screen.

7. Calculate local values.

8. If data are unavailable in the study area for one stage, move on to the next stage. It is likely that not all the investigatory levels can be used for each road during the prioritisation process, because of the situation and on the quantity and reliability of exposure data that are available. In other words, it may not be possible to fill all the lines of every table.

9. Compare local values with national rural investigatory levels.

10. Where local values exceed the national investigatory levels, calculate by how much each level is exceeded (in terms of a percentage excess so that undue bias is not given to larger values). If the Excel spreadsheet is used, these excesses will be calculated and displayed automatically. Note the advice and words of caution about the use of investigatory levels given in chapters 1 and 4 of this guide.

11. Values for local roads which exceed the national investigatory levels, can therefore be identified and prioritised for further investigation and, perhaps, treatment.

12. Any changes to the local network in terms of the road length under study should also be taken into account. For example, the introduction of lower speed limits in villages and the new responsibilities for non-core trunk roads may both affect the proportion of rural and urban roads (and so casualties) in the network year by year.

13. It is important to consider not only the local picture but the wider picture too. For example, over the same period[6]:

    a) Have accident frequencies changed nationally (or over another large area, such as the neighbouring county)?

    b) Have traffic levels changed?

    c) Has the composition of traffic changed?

    d) What other local or national events may have affected accident frequencies?

[6] DTLR (2001) gives advice on possible sources of information.

12. Factors affecting d) in the paragraph above may include almost anything from the installation of a scheme (within the last 3-5 years), to temporary road closures, to a large sporting event, to a petrol shortage, to a new law or publicity campaign.

13. The information used regarding accident rates during the prioritisation process will vary, depending on the situation and on the quantity and reliability of exposure data that are available. The use of more than one approach to identifying accident problems will often be appropriate.

14. When ranking problems, a balanced assessment of all the data has to be achieved, based on:

    a) accident rate (see paragraphs 4.12 to 4.22 above)

    b) number of accidents

    c) the severity of injuries sustained in accidents.

15. This example is designed to give help in identifying where there may be an accident problem. It does not offer solutions to these problems.

16. The next step in tackling the road safety problem involves carrying out further detailed investigations of localities that have been identified as having problems.

    DTLR (2001) gives more information and advice about the next stages including:

    - Detailed investigation
    - Visits to localities
    - Possible treatments
    - Outline and detailed design of treatment scheme
    - Scheme installation
    - Monitoring

Example Tables 1-3abc follow.

Table 1a

Road:		A211		A231	
Investigatory level category	**Investigatory level (national)**	freq. in this category	% excess (see note 3 below)	freq. in this category	% excess (see note 3 below)
accidents per 100km/year	75	75	-	71	-
non-junction accidents per 100km/year	43	43	-	43	-
junction accidents per 100 junctions/year (see note 1 below)	14	11	-	13	-
bend accidents per 100 bends/year (see note 1 below)	15	22	47.0%	15	-
accidents per 10^8 veh-kms (all accident severities)	30	30	-	30	-
accidents per 10^8 veh-kms (fatal accidents)	1.2	1	-	1	-
accidents per 10^8 veh-kms (serious accidents)	7	7	-	7	-
accident severity ratio (ksi/total - see note 2 below)	0.28	0.28	-	0.28	-

note 1 : Estimated values; only valid for whole routes or areas

note 2 : accident severity ratio= number of fatal and serious accidents/ total number of accidents

note 3 : % excess=((value in (local) column - value in (national) column)/value in (national) column) x100%

Table 1b

	Road:		A211			A 231		
	Total number of accidents in 5 years on this road		70			77		
	Investigatory level category	**Investigatory level (national)**	no. of accidents in this category	% of total above (local)	% excess (see note)	no. of accidents in this category	% of total above (local)	% excess (see note)
VRU	accidents that did involve at least one pedestrian	3.2%	2	2.9%	-	2	2.6%	-
VRU	accidents that did involve at least one child (age <16yrs)	9.1%	5	7.1%	-	7	9.1%	-
	accidents that involved only one vehicle	26.4%	23	32.9%	24.5%	20	26.0%	-
	accidents that involved 3 or more vehicles	18.5%	12	17.1%	-	14	18.2%	-
	accidents that occurred in fine weather on dry roads	55.0%	36	51.4%	-	34	44.2%	-
	accidents that occurred on wet roads	39.9%	26	37.1%	-	28	36.4%	-
	accidents that occurred on icy/snowy roads	4.7%	3	4.3%	-	3	3.9%	-
	accidents that took place in daylight	72.2%	50	71.4%	-	54	70.1%	-
	accidents that took place on unlit roads at night	18.9%	13	18.6%	-	14	18.2%	-
	accidents that took place away (>20m) from junctions	57.2%	42	60.0%	4.9%	43	55.8%	-
	accidents that took place at or within 20m of a junction	42.8%	29	41.4%	-	31	40.3%	-
	accidents that took place a private drive	8.1%	5	7.1%	-	6	7.8%	-
	accidents that took place at T/Y junctions	24.0%	16	22.9%	-	18	23.4%	-
	accidents that took place at a crossroad junction	6.6%	4	5.7%	-	5	6.5%	-

note: % excess=((value in (local) column - value in (national) column)/value in (national) column) x100%

Table 1c

	Road:	A211			A231		
	Total number of accident-involved vehicles in 5 years on this road	70			77		
	Investigatory level category	**Investigatory level (national)**	no. of vehicles in this category	% of total above (local)	% excess (see note)	no. of vehicles in this category	% of total above (local)	% excess (see note)
VRU	accident-involved vehicles that were pedal cycles	1.7%	1	1.4%	-	1	1.3%	-
VRU	accident-involved vehicles that were two-wheeled motor vehicles	5.5%	5	7.1%	29.9%	4	5.2%	-
	accident-involved vehicles that were light goods vehs (<3.5tonnes)	5.3%	3	4.3%	-	3	3.9%	-
	accident-involved vehicles that were buses/coaches/heavy goods	7.3%	5	7.1%	-	5	6.5%	-
	accident-involved vehicles that were 'parked'	1.6%	1	1.4%	-	1	1.3%	-
	accident-involved vehicles that were 'waiting to go ahead'	6.9%	4	5.7%	-	5	6.5%	-
	accident-involved vehicles that were 'stopping'	3.9%	2	2.9%	-	3	3.9%	-
	accident-involved vehicles that were 'turning right'	10.0%	6	8.6%	-	6	7.8%	-
	accident-involved vehicles that were 'waiting to turn right'	3.5%	2	2.9%	-	2	2.6%	-
	accident-involved vehicles that were 'overtaking a moving vehicle on its offside'	6.9%	4	5.7%	-	4	5.2%	-
	accident-involved vehicles that were 'going ahead on a bend'	17.3%	12	17.1%	-	13	16.9%	-
	accident-involved vehicles that were 'going ahead other'	45.9%	31	44.3%	-	23	29.9%	-
	accident-involved drivers that were male, under 25yrs	15.9%	15	21.4%	35%	12	15.6%	-
	accident-involved drivers that were male, over 59yrs	8.0%	5	7.1%	-	6	7.8%	-
	accident-involved drivers that were male, all ages	72.1%	49	70.0%	-	52	67.5%	-
	accident-involved drivers that were female, under 25yrs	6.2%	4	5.7%	-	4	5.2%	-
	accident-involved drivers that were female, over 59yrs	2.1%	1	1.4%	-	1	1.3%	-
	accident-involved drivers that were female, all ages	24.9%	17	24.3%	-	19	24.7%	-

note: % excess=((value in (local) column - value in (national) column)/value in (national) column) x100%

* overtaking is the single STATS19 category of 'overtaking a moving vehicle on its offside'

Table 2a

Accident Frequencies

	Road:	B2345		B3021	
Investigatory level category	**Investigatory level (national)**	freq. in this category	% excess (see note 3 below)	freq. in this category	% excess (see note 3 below)
accidents per 100km/year	37	37	-	35	-
non-junction accidents per 100km/year	22	22	-	22	-
junction accidents per 100 junctions/year (see note 1 below)	6	5	-	5	-
bend accidents per 100 bends/year (see note 1 below)	8	12	50.0%	10	25.0%
accidents per 10^8 veh-kms (all accident severities)	44	79	80.0%	79	80.0%
accidents per 10^8 veh-kms (fatal accidents)	1.3	1	-	1.3	-
accidents per 10^8 veh-kms (serious accidents)	11	11	-	11	-
accident severity ratio (ksi/total - see note 2 below)	0.28	0.30	7.0%	0.28	-

note 1 : Estimated values; only valid for whole routes or areas

note 2 : accident severity ratio= number of fatal and serious accidents/ total number of accidents

note 3 : % excess=((value in (local) column - value in (national) column)/value in (national) column) x100%

Table 2b

Accidents by Type

	Road:	B2345			B3021		
	Total number of accidents in 5 years on this road		60			45	
	Investigatory level category	**Investigatory level (national)**	no. of accidents in this category	% of total above (local)	% excess (see note)	no. of accidents in this category	% of total above (local)	% excess (see note)
VRU	accidents that did involve at least one pedestrian	3.4%	2	3.3%	-	1	2.2%	-
VRU	accidents that did involve at least one child (age <16yrs)	9.0%	5	8.3%	-	4	8.9%	-
	accidents that involved only one vehicle	35.8%	21	35.0%	-	16	35.6%	-
	accidents that involved 3 or more vehicles	10.4%	6	10.0%	-	4	8.9%	-
	accidents that occurred in fine weather on dry roads	52.9%	31	51.7%	-	23	51.1%	-
	accidents that occurred on wet roads	40.5%	29	48.3%	19.3%	22	48.9%	20.7%
	accidents that occurred on icy/snowy roads	6.2%	5	8.3%	34.4%	2	4.4%	-
	accidents that took place in daylight	69.8%	41	68.3%	-	31	68.9%	-
	accidents that took place on unlit roads at night	23.4%	14	23.3%	-	12	26.7%	14.0%
	accidents that took place away (>20m) from junctions	62.2%	42	70.0%	12.5%	28	62.2%	-
	accidents that took place at or within 20m of a junction	37.8%	22	36.7%	-	16	35.6%	-
	accidents that took place a private drive	6.9%	4	6.7%	-	4	8.9%	28.8%
	accidents that took place at T/Y junctions	21.2%	12	20.0%	-	9	20.0%	-
	accidents that took place at a crossroad junction	6.4%	3	5.0%	-	2	4.4%	-

note: % excess=((value in (local) column - value in (national) column)/value in (national) column) x100%

Table 2c

Accident-involved vehicles

	Road:		B23			B3021		
	Total number of accident-involved vehicles in 5 years on this road		60			52		
	Intervention level category	**intervention level (national)**	no. of vehicles in this category	% of total above (local)	% excess (see note)	no. of vehicles in this category	% of total above (local)	% excess (see note)
VRU	accident-involved vehicles that were pedal cycles	2.7%	1	1.7%	-	2	3.8%	42.5%
VRU	accident-involved vehicles that were two-wheeled motor vehicles	6.8%	4	6.7%	-	3	5.8%	-
	accident-involved vehicles that were light goods vehs (<3.5tonnes)	5.1%	3	5.0%	-	2	3.8%	-
	accident-involved vehicles that were buses/coaches/heavy goods	5.2%	3	5.0%	-	2	3.8%	-
	accident-involved vehicles that were 'parked'	2.0%	1	1.7%	-	1	1.9%	-
	accident-involved vehicles that were 'waiting to go ahead'	3.3%	3	5.0%	51.5%	1	1.9%	-
	accident-involved vehicles that were 'stopping'	2.0%	2	3.3%	66.7%	1	1.9%	-
	accident-involved vehicles that were 'turning right'	9.4%	5	8.3%	-	4	7.7%	-
	accident-involved vehicles that were 'waiting to turn right'	2.2%	1	1.7%	-	1	1.9%	-
	accident-involved vehicles that were 'overtaking a moving vehicle on its offside'*	5.0%	5	8.3%	66.7%	2	3.8%	-
	accident-involved vehicles that were 'going ahead on a bend'	28.6%	21	35.0%	22.4%	17	32.7%	14.3%
	accident-involved vehicles that were 'going ahead other'	42.6%	27	45.0%	5.6%	19	36.5%	-
	accident-involved drivers that were male, under 25yrs	19.5%	12	20.0%	-	12	23.1%	18.3%
	accident-involved drivers that were male, over 59yrs	6.9%	4	6.7%	-	3	5.8%	-
	accident-involved drivers that were male, all ages	70.9%	42	70.0%	-	32	61.5%	-
	accident-involved drivers that were female, under 25yrs	6.9%	4	6.7%	-	3	5.8%	-
	accident-involved drivers that were female, over 59yrs	2.0%	1	1.7%	-	1	1.9%	-
	accident-involved drivers that were female, all ages	26.0%	15	25.0%	-	11	21.2%	-

note: % excess=((value in (local) column - value in (national) column)/value in (national) column) x100%

*Overtaking is the single STATS19 categry of 'overtaking a moving vehicle on its offside'

Table 3a

Accident Frequencies

	Road:	C211		C233		C234	
Investigatory level category	**Investigatory level (national)**	freq. in this category	% excess (see note 3 below)	freq. in this category	% excess (see note 3 below)	freq. in this category	% excess (see note 3 below)
accidents per 100km/year	8	10	25.0%	7	-	15	88.0%
non-junction accidents per 100km/year	6	6	-	5	-	6	-
junction accidents per 100 junctions/year (see note 1 below)	1	1	-	0.8	-	1	-
bend accidents per 100 bends/year (see note 1 below)	3	4	33.0%	3	-	6	100.0%
accidents per 10^8 veh-kms (all accident severities)	46	126	174.0%	45	-	61	33.0%
accidents per 10^8 veh-kms (fatal accidents)	0.9	1.1	22.0%	0.9	-	0.9	-
accidents per 10^8 veh-kms (serious accidents)	10	10	-	10	-	10	-
accident severity ratio (ksi/total - see note 2 below)	0.24	0.26	8.0%	0.24	-	0.24	-

note 1 : Estimated values; only valid for whole routes or areas

note 2 : accident severity ratio= number of fatal and serious accidents/ total number of accidents

note 3 : % excess=((value in (local) column - value in (national) column)/value in (national) column) x100%

Table 3b

Accidents by Type

	Road:		C211			C233			C234		
	Total number of accidents in 5 years on this road		43			15			69		
	Investigatory level category	**Investigatory level (national)**	no. of accidents in this category	% of total above (local)	% excess (see note)	no. of accidents in this category	% of total above (local)	% excess (see note)	no. of accidents in this category	% of total above (local)	% excess (see note)
VRU	accidents that did involve at least one pedestrian	4.3%	1	2.3%	-	0	0.0%	-	3	4.3%	-
VRU	accidents that did involve at least one child (age <16yrs)	10.6%	4	9.3%	-	1	6.7%	-	7	10.1%	-
	accidents that involved only one vehicle	37.1%	15	34.9%	-	4	26.7%	-	25	36.2%	-
	accidents that involved 3 or more vehicles	5.9%	2	4.7%	-	0	0.0%	-	7	10.1%	71.9%
	accidents that occurred in fine weather on dry roads	53.3%	17	39.5%	-	6	40.0%	-	35	50.7%	-
	accidents that occurred on wet roads	38.9%	15	34.9%	-	4	26.7%	-	25	36.2%	-
	accidents that occurred on icy/snowy roads	7.4%	3	7.0%	-	1	6.7%	-	5	7.2%	-
	accidents that took place in daylight	70.9%	29	67.4%	-	8	53.3%	-	46	66.7%	-
	accidents that took place on unlit roads at night	23.3%	10	23.3%	-	3	20.0%	-	15	21.7%	-
	accidents that took place away (>20m) from junctions	71.9%	30	69.8%	-	9	60.0%	-	47	68.1%	-
	accidents that took place at or within 20m of a junction	28.1%	11	25.6%	-	3	20.0%	-	18	26.1%	-
	accidents that took place a private drive	5.1%	2	4.7%	-	0	0.0%	-	3	4.3%	-
	accidents that took place at T/Y junctions	15.8%	4	9.3%	-	2	13.3%	-	10	14.5%	-
	accidents that took place at a crossroad junction	4.2%	1	2.3%	-	0	0.0%	-	2	2.9%	-

note: % excess=((value in (local) column - value in (national) column)/value in (national) column) x100%

Table 3c

	Road:		C211			C233			C234		
	Total number of accident-involved vehicles in 5 years on this road		42			12			67		
	Investigatory level category	**Investigatory level (national)**	no. of vehicles in this category	% of total above (local)	% excess (see note)	no. of vehicles in this category	% of total above (local)	% excess (see note)	no. of vehicles in this category	% of total above (local)	% excess (see note)
VRU	accident-involved vehicles that were pedal cycles	3.6%	1	2.4%	-	0	0.0%	-	2	3.0%	-
VRU	accident-involved vehicles that were two-wheeled motor vehicles	6.1%	2	4.8%	-	1	8.3%	-	4	6.0%	-
	accident-involved vehicles that were light goods vehs (<3.5tonnes)	5.2%	2	4.8%	-	0	0.0%	-	3	4.5%	-
	accident-involved vehicles that were buses/coaches/heavy goods	4.9%	3	7.1%	45.8%	1	8.3%	-	3	4.5%	-
	accident-involved vehicles that were 'parked'	1.8%	1	2.4%	-	0	0.0%	-	1	1.5%	-
	accident-involved vehicles that were 'waiting to go ahead'	2.3%	1	2.4%	-	0	0.0%	-	1	1.5%	-
	accident-involved vehicles that were 'stopping'	1.6%	1	2.4%	-	0	0.0%	-	1	1.5%	-
	accident-involved vehicles that were 'turning right'	6.4%	2	4.8%	-	1	8.3%	-	4	6.0%	-
	accident-involved vehicles that were 'waiting to turn right'	1.0%	1	2.4%	138.1%	0	0.0%	-	1	1.5%	-
	accident-involved vehicles that were 'overtaking' *	2.6%	1	2.4%	-	0	0.0%	-	1	1.5%	-
	accident-involved vehicles that were 'going ahead on a bend'	38.1%	16	38.1%	-	4	33.3%	-	25	37.3%	-
	accident-involved vehicles that were 'going ahead other'	41.6%	17	40.5%	-	5	41.7%	-	26	38.8%	-
	accident-involved drivers that were male, under 25yrs	22.3%	10	23.8%	-	3	25.0%	-	15	22.4%	-
	accident-involved drivers that were male, over 59yrs	5.5%	3	7.1%	29.9%	1	8.3%	-	4	6.0%	-
	accident-involved drivers that were male, all ages	70.1%	29	69.0%	-	7	58.3%	-	46	68.7%	-
	accident-involved drivers that were female, under 25yrs	7.0%	3	7.1%	-	1	8.3%	-	4	6.0%	-
	accident-involved drivers that were female, over 59yrs	1.8%	1	2.4%	32.3%	0	0.0%	-	1	1.5%	-
	accident-involved drivers that were female, all ages	26.1%	11	26.2%	-	3	25.0%	-	16	23.9%	-

note: % excess=((value in (local) column - value in (national) column)/value in (national) column) x100%

*Overtaking is the single STATS19 categry of 'overtaking a moving vehicle on its offside'

STEP 3: CLOSER EXAMINATION OF VULNERABLE ROAD USER ACCIDENTS

1. Carry out a more detailed study of accidents involving vulnerable road users using the data given in Appendix F, whenever appropriate - (i.e. when the local values exceed the national values in Table F1, Appendix F which brings together all the VRU values that appear in Tables 1-5abc).

2. In our example only TWMVs on the A211 were over-represented (Table 1c). From further analysis using Appendix F Table F5b it was found that there were more accidents than expected on wet roads and on bends.

STEP 4: PRIORITISE ROADS FOR FURTHER INVESTIGATION/TREATMENT

1. This step is best carried out by drawing together all the local results that exceed the national rural investigatory levels into a summary table, as shown in Fig B2 below. This will make it much easier to get an overall feel for the relative size of problems on different roads and facilitate prioritisation. In Fig B2, the following outcomes are of interest:

    - C211 would be given higher ranking than C234 because of the high numbers of accidents per vehicle-km (despite having lower accident numbers and accidents/km/year)

    - B2345 would be given higher ranking than B3021 because of higher severities and numbers of accidents (despite both having the same numbers of accidents per vehicle-km)

    - The table indicates that a mass action bend treatment may be appropriate for the whole area

    - The table also indicates that problems on the A211 may be largely related to speed and/or loss of control.

2. Compare the results with those for previous years.

3. Finally, taking all the facts into consideration, rank by size and number of accidents, where relevant, as shown in the final line of Fig. B2, where five roads have been selected for further investigation (as outlined in Step2, paragraph 16 above) and two have not, as, at first sight, there are no over-represented accident types.

	Fig B2: XYZSHIRE - EXAMPLE TABLE Road /Carriageway type: Road No.:		Single 'A' rds		Single 'B' rds		Single 'C' rds		
			A211	A231	B2345	B3021	C211	C233	C234
	Total number of accidents in 5 years		70	77	60	45	42	12	67
	Intervention level category		**Percentage excess over national intervention levels**						
	all accidents	per 100km/year	-	-	-	-	25%	-	88%
	accidents that occurred away (>20m) from junctions	per 100km/year	-	-	-	-	-	-	-
	accidents that took place at or within 20m of a junction	per 100junctions/yr	-	-	-	-	-	-	-
	accidents with 1 or more vehs were 'going ahead on a bend'	per 100bends/year	47%	-	50%	25%	33%	-	100%
	all accidents	per 10^8 vehicle-kms	-	-	80%	80%	174%	-	33%
	fatal accidents	per 10^8 vehicle-kms	-	-	-	-	22%	-	-
	serious accidents	per 10^8 vehicle-kms	-	-	-	-	-	-	-
	accident severity ratio (=[fatal+serious]/ all accidents)		-	-	7%	-	8%	-	-
VRU	accidents that did involve a pedestrian	(percentage of)	-	-	-	-	-	-	-
VRU	accidents that did involve a child (age <16yrs)	(percentage of)	-	-	-	-	-	-	-
	accidents that involved only one vehicle	(percentage of)	24%	-	-	-	-	-	-
	accidents that involved 3 or more vehicles	(percentage of)	-	-	-	-	-	-	72%
	accidents that occurred on dry roads	(percentage of)	-	-	-	-	-	-	-
	accidents that occurred on wet roads	(percentage of)	-	-	19%	21%	-	-	-
	accidents that occurred on icy/snowy roads	(percentage of)	-	-	34%	-	-	-	-
	accidents that took place in daylight	(percentage of)	-	-	-	-	-	-	-
	accidents that took place on unlit roads at night	(percentage of)	-	-	-	14%	-	-	-
	accidents that took place away (>20m) from junctions	(percentage of)	5%	-	12%	-	-	-	-
	accidents that took place at or within 20m of a junction	(percentage of)	-	-	-	-	-	-	-
	accidents that took place a private drive	(percentage of)	-	-	-	29%	-	-	-
	accidents that took place at T/Y junctions	(percentage of)	-	-	-	-	-	-	-
	accidents that took place at a crossroad junction	(percentage of)	-	-	-	-	-	-	-
VRU	accident-involved vehicles that were pedal cycles	(percentage of)	-	-	-	42%	-	-	-
VRU	accident-involved vehicles that were two-wheeled motor vehicles	(percentage of)	30%	-	-	-	-	-	-
	accident-involved vehicles that were light goods vehs (<3.5tonnes)	(percentage of)	-	-	-	-	-	-	-
	accident-involved vehicles that were buses/coaches/heavy goods	(percentage of)	-	-	-	-	46%	-	-
	accident-involved vehicles that were 'parked'	(percentage of)	-	-	-	-	-	-	-
	accident-involved vehicles that were 'waiting to go ahead'	(percentage of)	-	-	51%	-	-	-	-
	accident-involved vehicles that were 'stopping'	(percentage of)	-	-	67%	-	-	-	-
	accident-involved vehicles that were 'turning right'	(percentage of)	-	-	-	-	-	-	-
	accident-involved vehicles that were 'waiting to turn right'	(percentage of)	-	-	-	-	138%	-	-
	accident-involved vehicles that were 'overtaking'	(percentage of)	-	-	67%	-	-	-	-
	accident-involved vehicles that were 'going ahead on a bend'	(percentage of)	-	-	22%	14%	-	-	-
	accident-involved vehicles that were 'going ahead other'	(percentage of)	-	-	6%	-	-	-	-
	accident-involved drivers that were male, under 25yrs	(percentage of)	35%	-	-	18%	-	-	-
	accident-involved drivers that were male, over 59yrs	(percentage of)	-	-	-	-	30%	-	-
	accident-involved drivers that were male, all ages	(percentage of)	-	-	-	-	-	-	-
	accident-involved drivers that were female, under 25yrs	(percentage of)	-	-	-	-	-	-	-
	accident-involved drivers that were female, over 59yrs	(percentage of)	-	-	-	-	32%	-	-
	accident-involved drivers that were female, all ages	(percentage of)	-	-	-	-	-	-	-
	Priority ranking		**5**	**-**	**2**	**3**	**1**	**-**	**4**

C211 given higher ranking than C234 because of the high numbers of accidents per vehicle-km (despite having lower accident numbers and accidents/km/year)
B2345 given higher ranking than B3021 because of higher severities and numbers of accidents (despite both having the same numbers of accidents per vehicle-km)
Table also indicates that a mass action bend treatment may be appropriate for the whole area and that A211 problems may be largely speed related.

APPENDIX C: BLANK TABLES FOR USE IN RURAL ACCIDENT ANALYSIS

Note that these tables may also be found in electronic form in the Excel files on diskette:

d c_w *ruralaccanalysis.xls* for dual-carriageway roads

and

s c_w *ruralaccanalysis.xls* for single-carriageway roads

Note the advice and words of caution about the use of investigatory levels given in chapters 1 and 4 of this guide.

Table 1a **Rural Single Carriageway A roads**

Page -

Accident Frequencies

Road:									
Investigatory level category	**Investigatory level (national)**	freq. in this category	% excess (see note 3 below)	freq. in this category	% excess (see note 3 below)	freq. in this category	% excess (see note 3 below)	freq. in this category	% excess (see note 3 below)
accidents per 100km/year	75								
non-junction accidents per 100km/year	43								
junction accidents per 100 junctions/year (see note 1 below)	14								
bend accidents per 100 bends/year (see note 1 below)	15								
accidents per 10^8 veh-kms (all accident severities)	30								
accidents per 10^8 veh-kms (fatal accidents)	1.2								
accidents per 10^8 veh-kms (serious accidents)	7								
accident severity ratio (ksi/total - see note 2 below)	0.28								

note 1 : Estimated values; only valid for whole routes or areas

note 2 : accident severity ratio= number of fatal and serious accidents/ total number of accidents

note 3 : % excess=((value in (local) column - value in (national) column)/value in (national) column) x100%

Table 1b **Rural Single Carriageway A roads** **Page -**

Accidents by Type

	Road:													
	Total number of accidents in 5 years on this road													
	Investigatory level category	**Investigatory level (national)**	no. of accidents in this category	% of total above (local)	% excess (see note)	no. of accidents in this category	% of total above (local)	% excess (see note)	no. of accidents in this category	% of total above (local)	% excess (see note)	no. of accidents in this category	% of total above (local)	% excess (see note)
VRU	accidents that did involve at least one pedestrian	3.2%												
VRU	accidents that did involve at least one child (age<16yrs)	9.1%												
	accidents that involved only one vehicle	26.4%												
	accidents that involved 3 or more vehicles	18.5%												
	accidents that occurred in fine weather on dry roads	55.0%												
	accidents that occurred on wet roads	39.9%												
	accidents that occurred on icy/snowy roads	4.7%												
	accidents that took place in daylight	72.2%												
	accidents that took place on unlit roads at night	18.9%												
	accidents that took place away (>20m) from junctions	57.2%												
	accidents that took place at or within 20m of a junction	42.8%												
	accidents that took place a private drive	8.1%												
	accidents that took place at T/Y junctions	24.0%												
	accidents that took place at a crossroad junction	6.6%												

note: % excess=((value in (local) column - value in (national) column)/value in (national) column) x100%

Table 1c **Rural Single Carriageway A roads** **Page -**

Accident-involved vehicles

	Road:													
	Total number of accident-involved vehicles in 5 years on this road													
	Investigatory level category	**Investigatory level (national)**	no. of vehicles in this category	% of total above (local)	% excess (see note)	no. of vehicles in this category	% of total above (local)	% excess (see note)	no. of vehicles in this category	% of total above (local)	% excess (see note)	no. of vehicles in this category	% of total above (local)	% excess (see note)
VRU	accident-involved vehicles that were pedal cycles	1.7%												
VRU	accident-involved vehicles that were two-wheeled motor vehicles	5.5%												
	accident-involved vehicles that were light goods vehs (<3.5tonnes)	5.3%												
	accident-involved vehicles that were buses/coaches/heavy goods	7.3%												
	accident-involved vehicles that were 'parked'	1.6%												
	accident-involved vehicles that were 'waiting to go ahead'	6.9%												
	accident-involved vehicles that were 'stopping'	3.9%												
	accident-involved vehicles that were 'turning right'	10.0%												
	accident-involved vehicles that were 'waiting to turn right'	3.5%												
	accident-involved vehicles that were 'overtaking' *	6.9%												
	accident-involved vehicles that were 'going ahead on a bend'	17.3%												
	accident-involved vehicles that were 'going ahead other'	45.9%												
	accident-involved drivers that were male, under 25yrs	15.9%												
	accident-involved drivers that were male, over 59yrs	8.0%												
	accident-involved drivers that were male, all ages	72.1%												
	accident-involved drivers that were female, under 25yrs	6.2%												
	accident-involved drivers that were female, over 59yrs	2.1%												
	accident-involved drivers that were female, all ages	24.9%												

note: % excess=((value in (local) column - value in (national) column)/value in (national) column) x100%

*** 'overtaking' is the single STATS19 category of 'overtaking a moving vehicle on its offside'**

Table 2a **Rural Single Carriageway B roads**

Page -

Accident Frequencies

Road:									
Investigatory level category	**Investigatory level (national)**	freq. in this category	% excess (see note 3 below)	freq. in this category	% excess (see note 3 below)	freq. in this category	% excess (see note 3 below)	freq. in this category	% excess (see note 3 below)
accidents per 100km/year	37								
non-junction accidents per 100km/year	22								
junction accidents per 100 junctions/year (see note 1 below)	6								
bend accidents per 100 bends/year (see note 1 below)	8								
accidents per 10^8 veh-kms (all accident severities)	44								
accidents per 10^8 veh-kms (fatal accidents)	1.3								
accidents per 10^8 veh-kms (serious accidents)	11								
accident severity ratio (ksi/total - see note 2 below)	0.28								

note 1 : Estimated values; only valid for whole routes or areas

note 2 : accident severity ratio= number of fatal and serious accidents/ total number of accidents

note 3 : % excess=((value in (local) column - value in (national) column)/value in (national) column) x100%

Table 2b **Rural Single Carriageway B roads** **Page -**

Accidents by Type

	Road:													
	Total number of accidents in 5 years on this road													
	Investigatory level category	**Investigatory level (national)**	no. of accidents in this category	% of total above (local)	% excess (see note)	no. of accidents in this category	% of total above (local)	% excess (see note)	no. of accidents in this category	% of total above (local)	% excess (see note)	no. of accidents in this category	% of total above (local)	% excess (see note)
VRU	accidents that did involve at least one pedestrian	3.4%												
VRU	accidents that did involve at least one child (age<16yrs)	9.0%												
	accidents that involved only one vehicle	35.8%												
	accidents that involved 3 or more vehicles	10.4%												
	accidents that occurred in fine weather on dry roads	52.9%												
	accidents that occurred on wet roads	40.5%												
	accidents that occurred on icy/snowy roads	6.2%												
	accidents that took place in daylight	69.8%												
	accidents that took place on unlit roads at night	23.4%												
	accidents that took place away (>20m) from junctions	61.2%												
	accidents that took place at or within 20m of a junction	38.8%												
	accidents that took place a private drive	6.9%												
	accidents that took place at T/Y junctions	21.2%												
	accidents that took place at a crossroad junction	6.4%												

note: % excess=((value in (local) column - value in (national) column)/value in (national) column) x100%

Table 2c **Rural Single Carriageway B roads** **Page -**

Accident-involved vehicles

	Road:													
	Total number of accident-involved vehicles in 5 years on this road													
	Investigatory level category	**Investigatory level (national)**	no. of vehicles in this category	% of total above (local)	% excess (see note)	no. of vehicles in this category	% of total above (local)	% excess (see note)	no. of vehicles in this category	% of total above (local)	% excess (see note)	no. of vehicles in this category	% of total above (local)	% excess (see note)
VRU	accident-involved vehicles that were pedal cycles	2.7%												
VRU	accident-involved vehicles that were two-wheeled motor vehicles	6.8%												
	accident-involved vehicles that were light goods vehs (<3.5tonnes)	5.1%												
	accident-involved vehicles that were buses/coaches/heavy goods	5.2%												
	accident-involved vehicles that were 'parked'	2.0%												
	accident-involved vehicles that were 'waiting to go ahead'	3.3%												
	accident-involved vehicles that were 'stopping'	2.0%												
	accident-involved vehicles that were 'turning right'	9.4%												
	accident-involved vehicles that were 'waiting to turn right'	2.2%												
	accident-involved vehicles that were 'overtaking' *	5.0%												
	accident-involved vehicles that were 'going ahead on a bend'	28.6%												
	accident-involved vehicles that were 'going ahead other'	42.6%												
	accident-involved drivers that were male, under 25yrs	19.5%												
	accident-involved drivers that were male, over 59yrs	6.9%												
	accident-involved drivers that were male, all ages	70.9%												
	accident-involved drivers that were female, under 25yrs	6.9%												
	accident-involved drivers that were female, over 59yrs	2.0%												
	accident-involved drivers that were female, all ages	26.0%												

note: % excess=((value in (local) column - value in (national) column)/value in (national) column) x100%

*** 'overtaking' is the single STATS19 category of 'overtaking a moving vehicle on its offside'**

Table 3a **Rural Single Carriageway C and Unclassified roads**

Page -

Accident Frequencies

Road:									
Investigatory level category	**Investigatory level (national)**	freq. in this category	% excess (see note 3 below)	freq. in this category	% excess (see note 3 below)	freq. in this category	% excess (see note 3 below)	freq. in this category	% excess (see note 3 below)
accidents per 100km/year	8								
non-junction accidents per 100km/year	6								
junction accidents per 100 junctions/year (see note 1 below)	1								
bend accidents per 100 bends/year (see note 1 below)	3								
accidents per 10^8 veh-kms (all accident severities)	46								
accidents per 10^8 veh-kms (fatal accidents)	0.9								
accidents per 10^8 veh-kms (serious accidents)	10								
accident severity ratio (ksi/total - see note 2 below)	0.24								

note 1 : Estimated values; only valid for whole routes or areas

note 2 : accident severity ratio= number of fatal and serious accidents/ total number of accidents

note 3 : % excess=((value in (local) column - value in (national) column)/value in (national) column) x100%

Table 3b **Rural Single Carriageway C and Unclassified roac** **Page -**

Accidents by Type

	Road:													
	Total number of accidents in 5 years on this road													
	Investigatory level category	**Investigatory level (national)**	no. of accident in this category	% of total above (local)	% excess (see note)	no. of accident in this category	% of total above (local)	% excess (see note)	no. of accident in this category	% of total above (local)	% excess (see note)	no. of accident in this category	% of total above (local)	% excess (see note)
VRU	accidents that did involve at least one pedestrian	4.3%												
VRU	accidents that did involve at least one child (age<16yrs)	10.6%												
	accidents that involved only one vehicle	37.1%												
	accidents that involved 3 or more vehicles	5.9%												
	accidents that occurred in fine weather on dry roads	53.3%												
	accidents that occurred on wet roads	38.9%												
	accidents that occurred on icy/snowy roads	7.4%												
	accidents that took place in daylight	70.9%												
	accidents that took place on unlit roads at night	23.3%												
	accidents that took place away (>20m) from junctions	71.9%												
	accidents that took place at or within 20m of a junction	28.1%												
	accidents that took place a private drive	5.1%												
	accidents that took place at T/Y junctions	15.8%												
	accidents that took place at a crossroad junction	4.2%												

note: % excess=((value in (local) column - value in (national) column)/value in (national) column) x100%

Table 3c **Rural Single Carriageway C and Unclassified roads**

Page -

Accident-involved vehicles

	Road:													
	Total number of accident-involved vehicles in 5 years on this road													
	Investigatory level category	**Investigatory level (national)**	no. of vehicles in this category	% of total above (local)	% excess (see note)	no. of vehicles in this category	% of total above (local)	% excess (see note)	no. of vehicles in this category	% of total above (local)	% excess (see note)	no. of vehicles in this category	% of total above (local)	% excess (see note)
VRU	accident-involved vehicles that were pedal cycles	3.6%												
VRU	accident-involved vehicles that were two-wheeled motor vehicles	6.1%												
	accident-involved vehicles that were light goods vehs (<3.5tonnes)	5.2%												
	accident-involved vehicles that were buses/coaches/heavy goods	4.9%												
	accident-involved vehicles that were 'parked'	1.8%												
	accident-involved vehicles that were 'waiting to go ahead'	2.3%												
	accident-involved vehicles that were 'stopping'	1.6%												
	accident-involved vehicles that were 'turning right'	6.4%												
	accident-involved vehicles that were 'waiting to turn right'	1.0%												
	accident-involved vehicles that were 'overtaking' *	2.6%												
	accident-involved vehicles that were 'going ahead on a bend'	38.1%												
	accident-involved vehicles that were 'going ahead other'	41.6%												
	accident-involved drivers that were male, under 25yrs	22.3%												
	accident-involved drivers that were male, over 59yrs	5.5%												
	accident-involved drivers that were male, all ages	70.1%												
	accident-involved drivers that were female, under 25yrs	7.0%												
	accident-involved drivers that were female, over 59yrs	1.8%												
	accident-involved drivers that were female, all ages	26.1%												

note: % excess=((value in (local) column - value in (national) column)/value in (national) column) x100%

*** 'overtaking' is the single STATS19 category of 'overtaking a moving vehicle on its offside'**

Table 4a **Motorways** **Page -**

Accident Frequencies

Road:									
Investigatory level category	**investigatory level (national)**	freq. in this category	% excess (see note 3 below)	freq. in this category	% excess (see note 3 below)	freq. in this category	% excess (see note 3 below)	freq. in this category	% excess (see note 3 below)
accidents per 100km/year	223								
non-junction accidents per 100km/year	178								
junction accidents per 100 junctions/year (see note 1 be	277								
accidents per 10^8 veh-kms (all accident severities)	10								
accidents per 10^8 veh-kms (fatal accidents)	0.2								
accidents per 10^8 veh-kms (serious accidents)	1								
accident severity ratio (ksi/total - see note 2 below)	0.16								

note 1 : Estimated values; only valid for whole routes or areas

note 2 : accident severity ratio= number of fatal and serious accidents/ total number of accidents

note 3 : % excess=((value in (local) column - value in (national) column)/value in (national) column) x100%

Table 4b **Motorways** **Page -**

Accidents by Type

	Road:													
	Total number of accidents in 5 years on this road													
	Investigatory level category	**Investigatory level (national)**	no. of accidents in this category	% of total above (local)	% excess (see note)	no. of accidents in this category	% of total above (local)	% excess (see note)	no. of accidents in this category	% of total above (local)	% excess (see note)	no. of accidents in this category	% of total above (local)	% excess (see note)
VRU	accidents that did involve at least one pedestrian	1.4%												
VRU	accidents that did involve at least one child (age <16yrs)	7.5%												
	accidents that involved only one vehicle	25.0%												
	accidents that involved 3 or more vehicles	26.2%												
	accidents that occurred in fine weather on dry roads	65.3%												
	accidents that occurred on wet roads	31.6%												
	accidents that occurred on icy/snowy roads	2.7%												
	accidents that took place in daylight	72.5%												
	accidents that took place on unlit roads at night	12.9%												
	accidents that took place away (>20m) from junctions	78.5%												
	accidents that took place at or within 20m of a junction	21.5%												
	accidents that took place a slip road	10.3%												
	accidents that took place at a roundabout	9.2%												

note : % excess=((value in (local) column - value in (national) column)/value in (national) column) x100%

Table 4c **Motorways** **Page -**

Accident-involved vehicles

	Road:													
	Total number of accident-involved vehicles in 5 years on this road													
	Investigatory level category	**Investigatory level (national)**	no. of vehicles in this category	% of total above (local)	% excess (see note)	no. of vehicles in this category	% of total above (local)	% excess (see note)	no. of vehicles in this category	% of total above (local)	% excess (see note)	no. of vehicles in this category	% of total above (local)	% excess (see note)
VRU	accident-involved vehicles that were pedal cycles	0.07%												
VRU	accident-involved vehicles that were two-wheeled motor vehicles	2.2%												
	accident-involved vehicles that were light goods vehs (<3.5tonnes)	6.1%												
	accident-involved vehicles that were buses/coaches/heavy goods	13.8%												
	accident-involved vehicles that were 'waiting to go ahead'	15.2%												
	accident-involved vehicles that were 'stopping'	10.4%												
	accident-involved vehicles that were 'changing lane'	7.4%												
	accident-involved vehicles that were 'overtaking' *	3.8%												
	accident-involved vehicles that were 'going ahead on a bend'	2.6%												
	accident-involved vehicles that were 'going ahead other'	57.0%												
	accident-involved drivers that were male, under 25yrs	10.4%												
	accident-involved drivers that were male, over 59yrs	5.1%												
	accident-involved drivers that were male, all ages	75.0%												
	accident-involved drivers that were female, under 25yrs	4.7%												
	accident-involved drivers that were female, over 59yrs	0.9%												
	accident-involved drivers that were female, all ages	21.2%												

note: % excess=((value in (local) column - value in (national) column)/value in (national) column) x100%

*** 'overtaking' is the single STATS19 category of 'overtaking a moving vehicle on its offside'**

Table 5a **Rural Dual Carriageway A roads and carriageway type 'Roundabout' on rural A roads** **Page -**

Accident Frequencies

Road:									
Intervention level category	**intervention level (national)**	freq. in this category	% excess (see note 3 below)	freq. in this category	% excess (see note 3 below)	freq. in this category	% excess (see note 3 below)	freq. in this category	% excess (see note 3 below)
accidents per 100km/year	243								
non-junction accidents per 100km/year	108								
junction accidents per 100 junctions/year (see note 1 be	170								
accidents per 10^8 veh-kms (all accident severities)	24								
accidents per 10^8 veh-kms (fatal accidents)	0.6								
accidents per 10^8 veh-kms (serious accidents)	4								
accident severity ratio (ksi/total - see note 2 below)	0.20								

note 1 : Estimated values; only valid for whole routes or areas

note 2 : accident severity ratio= number of fatal and serious accidents/ total number of accidents

note 3 : % excess=((value in (local) column - value in (national) column)/value in (national) column) x100%

Table 5b **Rural Dual Carriageway A roads and carriageway types 'Roundabout' and '1 way' on rural A roads** **Page -**

Accidents by Type

	Road:													
	Total number of accidents in 5 years on this road													
	Intervention level category	**intervention level (national)**	no. of accidents in this category	% of total above (local)	% excess (see note)	no. of accidents in this category	% of total above (local)	% excess (see note)	no. of accidents in this category	% of total above (local)	% excess (see note)	no. of accidents in this category	% of total above (local)	% excess (see note)
VRU	accidents that did involve at least one pedestrian	2.9%												
VRU	accidents that did involve at least one child (age <16yrs)	7.4%												
	accidents that involved only one vehicle	25.2%												
	accidents that involved 3 or more vehicles	16.2%												
	accidents that occurred in fine weather on dry roads	61.7%												
	accidents that occurred on wet roads	34.5%												
	accidents that occurred on icy/snowy roads	3.5%												
	accidents that took place in daylight	71.8%												
	accidents that took place on unlit roads at night	10.1%												
	accidents that took place away (>20m) from junctions	44.5%												
	accidents that took place at or within 20m of a junction	55.5%												
	accidents that took place on a slip road	8.2%												
	accidents that took place at T/Y junctions	9.5%												
	accidents that took place at a roundabout	29.0%												

note : % excess=((value in (local) column - value in (national) column)/value in (national) column) x100%

Table 5c **Rural Dual Carriageway A roads and carriageway types 'Roundabout' and '1 way' on rural A roads** **Page -**

Accident-involved vehicles

	Road:												
	Total number of accident-involved vehicles in 5 years on this road												
	Investigatory level category	**Investigatory level (national)**	no. of vehicles in this category	% of total above (local)	% excess (see note)	no. of vehicles in this category	% of total above (local)	% excess (see note)	no. of vehicles in this category	% of total above (local)	% excess (see note)	no. of vehicles in this category	% of total above (local)	% excess (see note)
VRU	accident-involved vehicles that were pedal cycles	2.3%												
VRU	accident-involved vehicles that were two-wheeled motor vehicles	5.1%												
	accident-involved vehicles that were light goods vehs (<3.5tonnes)	5.1%												
	accident-involved vehicles that were buses/coaches/heavy goods	8.7%												
	accident-involved vehicles that were 'waiting to go ahead'	12.5%												
	accident-involved vehicles that were 'stopping'	7.4%												
	accident-involved vehicles that were 'changing lane'	4.8%												
	accident-involved vehicles that were 'turning right'	5.2%												
	accident-involved vehicles that were 'turning left'	2.4%												
	accident-involved vehicles that were 'overtaking' *	3.6%												
	accident-involved vehicles that were 'going ahead on a bend'	5.1%												
	accident-involved vehicles that were 'going ahead other'	52.3%												
	accident-involved drivers that were male, under 25yrs	12.8%												
	accident-involved drivers that were male, over 59yrs	6.5%												
	accident-involved drivers that were male, all ages	70.6%												
	accident-involved drivers that were female, under 25yrs	6.0%												
	accident-involved drivers that were female, over 59yrs	1.6%												
	accident-involved drivers that were female, all ages	25.9%												

note: % excess=((value in (local) column - value in (national) column)/value in (national) column) x100%

*** 'overtaking' is the single STATS19 category of 'overtaking a moving vehicle on its offside'**

APPENDIX D: STATISTICAL TESTS

The RoSPA Road Safety Engineering Manual (RoSPA, 1995) Section 4.4 has worked examples of some statistical techniques which can be used to identify whether accident problems have 'statistical significance'. There are also statistical tests (including the 't' test, χ^2 test etc) in Appendix B of A Road Safety Good Practice Guide (DTLR, 2001). A test to establish whether two proportions are statistically significantly different from each other is given below.

Statistical test for comparing proportions

This test is used to determine whether proportions (of accident types, or of any other characteristic) in a Study area are significantly different from the proportion in a Control area. The null-hypothesis tested is that the proportion from the sample is the same as the proportion from the Control, and the test tells us if we can reject this hypothesis.

There are two situations to consider, firstly where the Study area is not contained within the Control area and secondly where it is within the Control area.

Suppose that we are interested in the proportion of all accidents that involve serious injury within a Study area as compared to a Control area. We test the hypothesis that the proportions are the same. If the number of all accidents in the Study area is n_s and in the Control area is n_c, and we observe m_s serious accidents in the Study area and m_c in the Control area, then:

1. Study area not within Control area

The proportion of accidents in the *Study* area that are serious is given by: $p_s = m_s / n_s$,
and the proportion in the *Control* area by: $p_c = m_c / n_c$
and the overall proportion in the *Total* area (both Study and Control areas) by:

$$p = (m_s + m_c) / (n_s + n_c)$$

The test statistic '**t**' is calculated by:

$$\mathbf{t} = (p_s - p_c) / (p(1-p) (1/n_s + 1/n_c))^{½}$$

with $(n_s + n_c - 2)$ degrees of freedom.
If the degrees of freedom are greater than 120, and **t** is greater than 1.96 then we can be 95% sure that the two proportions are from different populations.
If the degrees of freedom are less than 120 then it is necessary to look up the value of **t** in a **t** table. These can be found in the back of A Road Safety Good Practice Guide (DTLR, 2001) or most statistical hand books.

2. *Study area within Control area*

Suppose the Study area is a local authority area and national data are being used as a Control. Then, for the purposes of this test, the S*tudy* accidents need to be excluded from the *Control* and the numbers of accidents in the *Control* area is calculated as 'the *Total* (national) accidents - *Study* accidents'.

The proportion of accidents in the *Study* area that are serious is given by: $p_s = m_s / n_s$

and the proportion in the *Control* area by: $p_c = (m_c - m_s) / (n_c - n_s)$

and the overall proportion in the *Total* area by:

$$p = m_c / n_c$$

The test statistic '**t**' is calculated by:

$$\mathbf{t} = (p_s - p_c) / (p(1-p) (1/n_s + 1/(n_c - n_s)))^{½}$$

with $(n_c - 2)$ degrees of freedom.
If the degrees of freedom are greater than 120, and **t** is greater than 1.96 then we can be 95% sure that the two proportions are from different populations. (If n_c is large compared to n_s , then we can ignore the fact that the Study area is within the national area and use method 1).
If the degrees of freedom are less than 120 then it is necessary to look up the value of **t** in a **t** table. These can be found in the back of A Road Safety Good Practice Guide (DTLR, 2001) or most statistical hand books.

Example:

Suppose that we are interested in whether the proportion of accidents on rural roads that are at junctions in the Study area is different from the proportion nationally. Then consider the following (fictitious) data:-

	Rural junction accidents	All Rural accidents	Proportion at junctions
Total accidents nationally	32,000	80,000	0.400
Study area	3200	7750	0.4129

Since the study area (local) lies within the control area (national), approach 2 is the appropriate test. The null-hypothesis is that the proportion of rural accidents that are at junctions in the Study area is the same as the proportion of rural accidents elsewhere in the country that are at junctions.

The proportion in the *Study* area is given by: $p_s = 3200/7750=0.4129$
and the proportion in the *Control* area by: $p_c = (32{,}000-3200)/(80{,}000-7750)=0.3986$
and the overall proportion in the *Total* area by: $p = 32{,}000/80{,}000=0.400$

The test statistic '**t**' is calculated by:

$$\mathbf{t} = (0.4129-0.3986)/(0.4*(1-0.4)*(1/7750+1/(80{,}000-7750)))^{1/2}$$
$$= 2.44$$

with (80,000-2) i.e. 79,998 degrees of freedom

So since the number of degrees of freedom is greater than 120 and **t** is greater than 1.96, we can be at least 95% sure that the proportion of accidents at junctions in our rural study area is greater than the proportion at junctions on other rural roads. Therefore we would recommend that further

investigations are carried out to try and explain this result (see Barker et al (1999) for a more detailed explanation of how to interpret the result).

APPENDIX E: STATS19 DATA ISSUES

The nationally collected accident database STATS19 contains objective information about injury road accidents. A sample form can be found in the back of Road casualties in Great Britain 2002: Annual report (DfT, 2002). The document that accompanies the STATS19 form is STATS20 (DETR, 2000). STATS20 gives advice on the meaning of certain aspects of the form. The following points may also assist in any accident analysis:

- Many villages have 30miles/h or 40 miles/h speed limits[7]. They are therefore classified as urban even if the surrounding roads are rural and the land is predominantly not built on. Consequently, it is not possible to easily identify such localities from accident data, except with the use of maps.

- The 'road type' (was 'carriageway type') variable in STATS19 does not include the categories 'roundabout' and 'one way street' as either single- or dual-carriageways. The two together account for approximately 10% of all accidents so care should be taken to account for them in analyses that consider single- and dual-carriageways separately.[8]

- There is no specific definition of a bend or the severity of a bend. This is because in terms of safety many factors are important, including the type of approach, camber, superelevation, radius, transition, road surface, aspect, verge width, gradient etc. Therefore, it is up to the discretion of the reporting officer as to how the accident is classified. In addition, as a bend feature is only specified as a category in the 'vehicle manoeuvre' variable, the vehicles in an accident that occurs *at a junction on a bend* may be recorded according to a junction or a bend-related manoeuvre.

- Horses are now included as a vehicle type on the STATS19 form[9].

- A complex devolved casualty reporting system such as that operated in Britain will never produce perfect results and while very few, if any, fatalities do not become known to the police, there is evidence that an appreciable proportion of non-fatal injuries are not reported to the police.

- There is some evidence that the precise location given for an accident is often inaccurate. It may be hard to ascertain precisely where the accident occurred, with respect to where the vehicles came to a halt, particularly in the case of a high speed accident. In addition, the Police will not always attend the accident scene immediately after the accident.

[7] Government policy is now that speed limits in all villages should be 30mile/h (DETR, 2000b)

[8] The convention adopted in the casualty analyses in this manual is to combine these data with dual-carriageway data for motorway and A-road accidents and to combine them with single-carriageway data for accidents on lower class roads.

[9] In 1999, 181 horse rider casualties were reported, 2 of whom were fatally injured. 40% of casualties occurred on urban roads; 60% on rural roads (DETR, 2000a). It is not known how many horses were injured or involved in road accidents where the rider was uninjured.

APPENDIX F: RURAL ACCIDENTS INVOLVING VULNERABLE ROAD USERS

Vulnerable Road Users (VRUs) are defined as pedestrians, pedal cyclists, Two Wheeled Motor Vehicle (TWMV) riders, or child casualties (age <16years).

Table F1 below gives some overall percentages for the VRU groups derived from STATS19 accident data. These are the investigatory levels to be used to identify over-represented groups, which should be studied in greater depth using tables F2 - 5ab. Note the advice and words of caution about the use of investigatory levels given in chapters 1 and 4 of this guide.

Table F1: Investigatory levels relating to Vulnerable Road User accidents on rural roads

Rural roads (speed limit ≥ 50miles/h)		Road class and carriageway type							
		Dual-carriageway			Single-carriageway				All
		M/way	A	All dual	A	B	C/Uncl	All single	All rural
% of all rural accidents that involved at least one:	Pedestrian injury	1.4	2.9	2.4	3.2	3.4	4.3	3.6	3.2
	Injury of a child (age <16 yrs)	7.5	7.4	7.4	9.1	9.0	10.6	9.6	9.0
% of all rural accident-involved vehicles that were:	TWMVs	2.2	5.1	3.9	5.5	6.8	6.1	5.9	5.2
	Pedal cycles	0.1	2.3	1.4	1.7	2.7	3.6	2.4	2.1
% of all rural casualties that were:	Children (age<16 yrs)	7.0	7.0	7.0	7.8	8.0	9.6	8.3	7.9

	rural single c/w			rural dual c/w	
Table F2a	**A roads**	**B roads**	**C+Uncl**	**Motorway**	**A roads**
pedestrians			**roads**		
all accidents that involved a pedestrian as a percentage of all accidents on this road class	3%	3%	4%	1%	3%
all vehicles involved in an accident with a pedestrian as a percentage of all vehicles involved in accidents on this road	2%	2%	3%	1%	2%
all pedestrian casualties as a percentage of all casualties on this road class	2%	2%	3%	1%	2%
all pedestrian fatalities as a percentage of all pedestrian casualties on this road class	13%	7%	4%	23%	18%
casualty severity ratio *	0.50	0.41	0.35	0.60	0.55
number of pedestrian casualties **	737	284	531	112	371

Table F2b		**A roads**	**B roads**	**C+Uncl**	**Motorway**	**A roads**
pedestrians				**roads**		
all pedestrian accidents and that were:	at night -not lit	28%	28%	24%	28%	15%
as a percentage of all pedestrian accidents on this road class	wet road	31%	30%	29%	26%	31%
	not at junctions	73%	74%	80%	77%	61%
	T/Y junctions	17%	16%	13%	2%	9%
	slip road junctions	1%	1%		15%	10%
	roundabouts	1%	2%	0%	4%	11%
all vehicles involved in a pedestrian accident that were:	on a bend	8%	11%	12%		3%
as a percentage of all vehicles involved in pedestrian accidents on this road class	parked	7%	8%	8%	24%	10%
	on/entering/leaving hard shoulder				19%	
	HGVs	6%	4%	3%	27%	10%
all pedestrians involved in an accident that were:	crossing road (not on crossing)	46%	38%	32%	27%	47%
as a percentage of all pedestrian accidents on this road class	in road (not crossing)	28%	36%	43%	43%	23%

* casualty severity ratio= number of casualties KSI/ total number of casualties

** average of 1994 and 1995

Table F3a		rural single c/w			rural dual c/w	
		A roads	B roads	C+Uncl roads	Motorwa	A roads
children (<16)						
all accidents that involved a child as a percentage of all accidents on this road class		9%	9%	11%	8%	8%
all vehicles involved in an accident with a child as a percentage of all vehicles involved in accidents on this road c		5%	5%	6%	4%	4%
all child casualties as a percentage of all casualties on this road class		8%	8%	10%	7%	7%
all child fatalities as a percentage of all child casualties on this road class		2%	1%	1%	1%	2%
casualty severity ratio *		0.17	0.17	0.16	0.10	0.13

Table F3b		A roads	B roads	C+Uncl roads	Motorwa	A roads
children (<16)						
all casualties who were children and pedal cyclists as a percentage of all child casualties on this road class		5%	9%	13%	0%	4%
casualty severity ratio		0.28	0.29	0.29		0.32
all casualties who were children and pedestrians as a percentage of all child casualties on this road class		6%	7%	9%	1%	6%
casualty severity ratio		0.49	0.45	0.34	0.89	0.55
number of child casualties**		2773	981	1676	823	1239
all accidents that involved a child and that were:	not at junctions	55%	58%	71%	83%	49%
as a percentage of all child accidents on this road class	T/Y junctions	24%	21%	16%	0%	11%
	roundabouts	1%	3%	0%	7%	22%
	slip road junctions	1%	0%	0%	9%	8%
all vehicles involved in a child accident that were:	on a bend	13%	25%	28%		4%
as a percentage of all vehicles involved in child accidents on this road class	turning right /waiting to turn right	17%	12%	9%	0%	7%
	waiting to go ahead /stopping	12%	6%	4%	28%	22%

* casualty severity ratio= number of casualties KSI/ total number of casualties

** average of 1994 and 1995

	rural single c/w			rural dual c/w	
Table F4a	**A roads**	**B roads**	**C+Uncl**	**Motorwa**	**A roads**
pedal cyclists			**roads**		
all accidents that involved a pedal cyclist as a percentage of all accidents on this road class	3%	5%	6%	0.2%	5%
all vehicles involved in an accident with a pedal cyclist as a percentage of all vehicles involved in accidents on this road c	3%	5%	6%	0.2%	5%
all pedal cyclists involved in an accident as a percentage of all vehicles involved in accidents on this road class	2%	3%	4%	0.1%	2%
all casualties on pedal cycles involved in an accident as a percentage of all casualties on this road class	2%	3%	4%	0.1%	3%
all fatalities on pedal cycles involved in an accident as a percentage of all pedal cycle casualties on this road class	5%	2%	2%	5%	6%
casualty severity ratio *	0.32	0.30	0.34	0.14	0.32
number of pedal cycle casualties**	694	373	677	11	542

Table F4b		**A roads**	**B roads**	**C+Uncl**	**Motorwa**	**A roads**
pedal cyclists				**roads**		
all accidents that involved a pedal cyclist and that were:	at night -not lit	11%	11%	9%		6%
as a percentage of all pedal cyclist accidents on this road class	wet road	24%	25%	19%		26%
	not at junctions	56%	52%	64%		30%
	T/Y junctions	26%	21%	21%		8%
	slip roads junctions					11%
	private drive junctions	7%	8%	9%		2%
	roundabouts	1%	10%	0%		44%
all pedal cyclists involved in an accident that were:	on a bend	6%	11%	19%		5%
as a percentage of all pedal cyclists involved in accidents on this road class	changing lane	3%	2%	2%		5%
	right turn/wait turn right	14%	13%	11%		7%
all other vehicles involved in a pedal cycle accident that were:	right turn/wait turn right	12%	11%	8%		6%
as a percentage of all other vehicles involved in accidents on this road class	overtaking	23%	24%	16%		11%
	on a bend	5%	7%	20%		3%
	changing lane					7%
	HGV	9%	5%	3%		8%
	LGV	6%	7%	7%		7%

* casualty severity ratio= number of casualties KSI/ total number of casualties

** average of 1994 and 1995

Table F5a	rural single c/w			rural dual c/w	
	A roads	B roads	C+Uncl roads	Motorwa	A roads
Two Wheeled Motor Vehicles (TWMV)					
all accidents that involved a TWMV as a percentage of all accidents on this road class	11%	12%	10%	5%	10%
all vehicles involved in an accident with a TWMV as a percentage of all vehicles involved in accidents on this road c	10%	12%	10%	4%	7%
all TWMVs involved in an accident as a percentage of all vehicles involved in accidents on this road class	5%	7%	6%	2%	5%
all casualties on TWMVs involved in an accident as a percentage of all casualties on this road class	7%	8%	7%	3%	7%
all fatalities on TWMVs involved in an accident as a percentage of all TWMV casualties on this road class	5%	4%	4%	3%	3%
casualty severity ratio *	0.45	0.44	0.41	0.31	0.31
number of TWMV casualties**	2472	989	1230	371	1241

Table F5b		A roads	B roads	C+Uncl roads	Motorwa	A roads
Two Wheeled Motor Vehicles (TWMV)						
all accidents that involved a TWMV and that were :	at night -not lit	10%	13%	14%	6%	5%
as a percentage of all TWMV accidents on this road class	wet road	20%	21%	22%	25%	23%
	not at junctions	52%	54%	67%	75%	34%
	T/Y juncs	26%	23%	19%	2%	8%
	private drive junctions	11%	9%	9%	0%	1%
	slip road junctions	1%			11%	7%
	roundabouts	1%	5%		11%	45%
all TWMVs involved in an accident that were:	overtaking	19%	10%	6%	8%	8%
as a percentage of all TWMVs vehicles involved in accidents on this road class	on a bend	29%	39%	43%	8%	11%
all single vehicle TWMV accidents as a percentage of all TWMV accidents on this road class		27%	36%	34%	39%	32%

* casualty severity ratio= number of casualties KSI/ total number of casualties

** average of 1994 and 1995

APPENDIX G: ARRIL USERGUIDE

ARRIL User Guide

Program Operation

Contents

INTRODUCTION

ARRIL stands for 'Analysis of Rural Road Investigation Levels'. It is a companion to 'Accident Analysis on Rural Roads – A Technical Guide'. Before using *ARRIL* you should be familiar with the principles described in the Technical Guide.

ARRIL is designed to automate much of the process presented in Appendix B of the Technical Guide.

ARRIL processes road accident data files and produces summaries of accident and casualty rates on the rural roads covered by the accident data. These summaries can then be imported into specially designed Excel spreadsheets (provided with the package) which automatically indicate how accident rates on those rural roads differ from the national norm. This enables you to quickly identify roads or areas where more detailed investigation of accident levels may be required.
ARRIL works with road accident data files where each record is presented in a standard format. This is the format used to export local road accident data to the national database at the Department for Transport. A definition of this format is presented in "Road Accident Data – GB: Variables and Values and Export Record Layouts" (DETR, 2001). You can extract records in this format from accident recording packages such as the Microcomputer Accident Analysis programme (MAAP for Windows, 2000) developed by TRL and analyse them quickly with *ARRIL*.

ARRIL can perform two different types of analysis. It can produce summaries of accident and casualty rates for individual rural roads within and area. Alternatively it can compare rural road accidents in one data file with those in another. These files may contain data from the same area obtained over two different time periods (perhaps 'before' and 'after' an area wide treatment

has been implemented), or may contain data from two separate areas (with one area acting as a control for the other).

In all of the above cases the summaries can be imported into specially written Excel spreadsheets (See “Using ARRIL Part Two”). These contain tables that flag those categories of accident or casualty where the local value exceeds the national investigatory level.

It is important to remember that this accident analysis only provides an indication of where problems may lie. Further investigation will be necessary to identify specific problems.

ARRIL: Overview of Program

ARRIL is designed so that the user needs no knowledge of computer programming to run the program.

ARRIL has two main sections:

Part 1 - guides you through five steps to generating an accident data summary file of accident statistics. These include specifying the accident data to be analysed and selecting the type of analysis to be performed.

Part 2 - guides you through taking the contents of the accident summary data and importing it into spreadsheets where they are compared to pre-defined national data. The spreadsheet flags those areas where the local data significantly exceeds the national data and where further investigation may be necessary.

GETTING STARTED

Installing ARRIL

If *ARRIL* is supplied on a CD, the procedure for installing the package, on a computer running WindowsXP is as follows:-

(i) Insert the *ARRIL* CD into your computer's compact disc drive.

(ii) Browse to your CD drive through the "My Computer" icon. Double click the file "Setup.exe" This will start the *ARRIL* installation program.

(iii) Follow the instructions on the screen.

During the installation procedure, you have the opportunity to change the directory, in which the main executable files will be installed. The default directory in which *ARRIL* will be installed is 'C:\PROGRAM FILES\ARRIL\'. The installation also copies an example data file for the program, called 'Rural.txt'.

ARRIL can be installed on older generations of Windows such as Windows 3.1 and Windows 95. At step (ii) you should run the file "Setup.exe" from the CD.

ARRIL can also be installed on Windows98 and WindowsNT. Please note it is important that you select an appropriate default printer for your computer, so that the results can be printed in the correct format.

If *ARRIL* is obtained from a web page, simply copy the files to a suitable directory on your hard drive for example, 'C:\PROGRAM FILES\ARRIL\'

*Windows is a trademark of the Microsoft Corporation.

Running ARRIL

If installed with Windows XP, Windows95, 98 or NT, the set-up procedure will have created a shortcut, so that *ARRIL* can be started by simply clicking the Start button, selecting 'Programs', '*ARRIL*' then '*ARRIL*' again. Alternatively, use Windows Explorer or the 'My Computer' window, to find the executable file 'ARRIL1.exe' in the directory in which *ARRIL* was installed and then double click on it.

If installed with an older generation of Windows then *ARRIL* can be started by using the 'Program Manager' to select the file 'ARRIL.exe' in the relevant directory and running it.

Help File

ARRIL is not supplied with a help file. All information pertaining to the program is included in this document.

Program limitations

ARRIL uses accident data files as input. It follows that information in these files should be as accurate as possible. The program assumes a certain level of quality for the data and may not work correctly if some information is missing.

ARRIL contains various error checking routines. It will not proceed with its calculations if any record is missing date (Year, Month, Day) information.

Users should also note the following:

The first line of the file must be an attendant circumstance record. These begin "000011" or "000015". (ARRIL will accept four blanks rather than zeros.)

ARRIL can only process one file at a time which contains all the attendant circumstance, vehicle and casualty records. If a user has this information in three separate files, these must be merged into one. (Note: the merged file can have the attendant circumstance, vehicle and casualty records in any order as long as the first record is an attendant circumstance record.)

In carrying out its calculations, *ARRIL* effectively ignores accidents where the carriageway type is entered as "unknown".

ARRIL will only produce statistics on files which contain at least 2 years of data.

ARRIL only analyses accidents where the speed limit is greater than 40 mph.

Definitions

Accident data file – A file containing STATS19 road accident data conforming to the STATS21 data format.

Specification file – A file which contains information which is entered by the user. This file also defines which rural roads you want to include in your analysis.

Summary file – A file generated by *ARRIL* which can be subsequently imported into an excel spreadsheet for subsequent analysis.

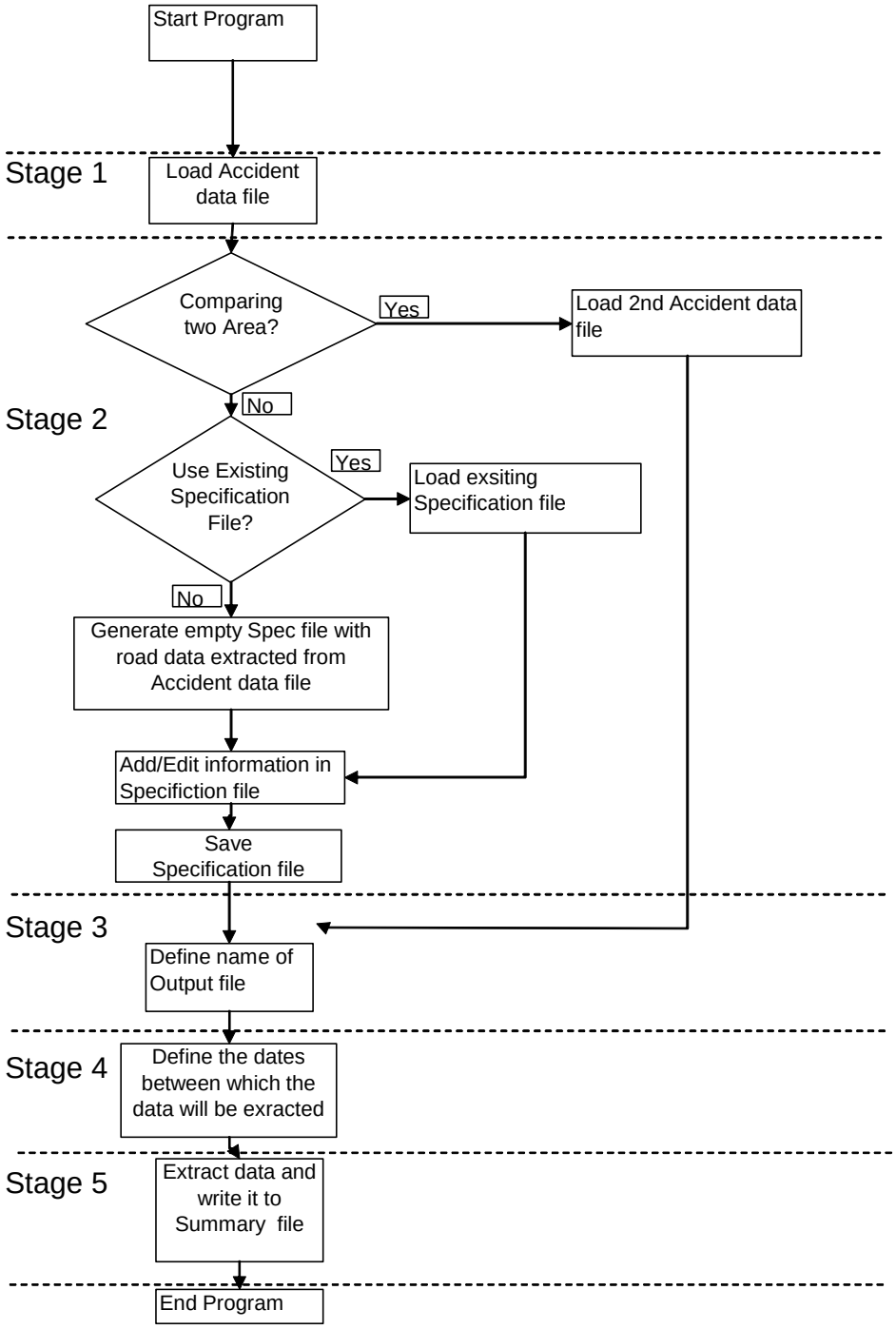
Example file

An example **Accident data file** "Rural.txt" has been supplied with the package. This file can be used to demonstrate most of the features of *ARRIL*.

USING *ARRIL* - PART ONE

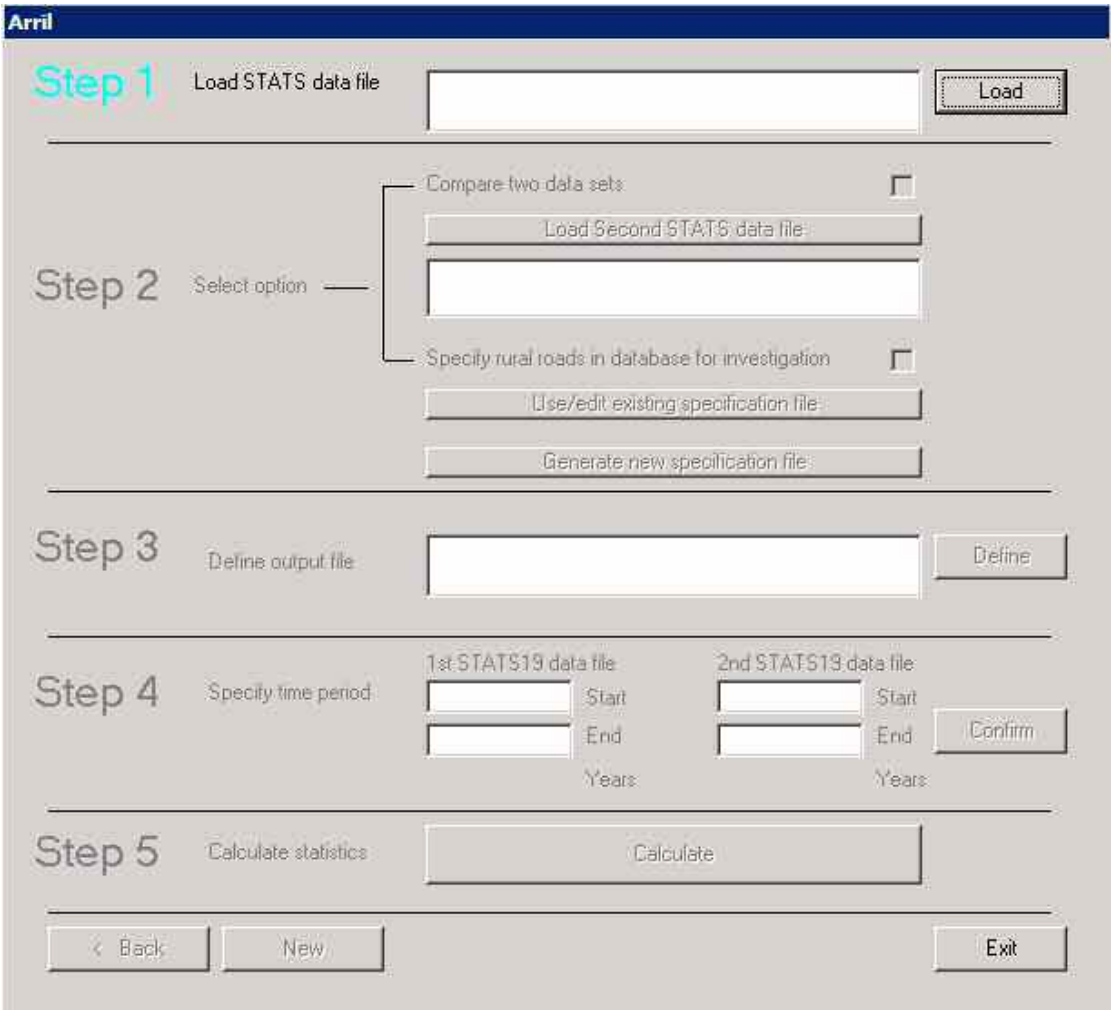
Producing accident summaries

A flow-chart showing the operation of *ARRIL* is shown below:



Start the *ARRIL* program.

Following the brief appearance of a title screen, the program will display the main input screen.



This guides you through the five steps which lead to the generation of a **Summary file**.

Step 1 - Load STATS 19 data file

Click on 'Load' and then browse to the **Accident data file** you want to analyse.

(Note: If you want to compare two areas (Option 1 below) choose either of the two files – it does not matter which one is chosen first at this stage. The data associated with this **Accident data file** will be designated 'AREA A')

Select the file and click on 'Open'. *ARRIL* automatically checks that the file contains STATS 19 data formatted in accordance with STATS 21. If it is not in the correct format you will be asked to choose another file or exit the program.

When you have chosen a valid **Accident data file** *ARRIL* will move automatically to Step 2.

Step 2 - Option selection

At Step 2 you must choose what sort of analysis you want to perform. You can either compare two sets of data or you can specify which roads you want to include in an analysis of individual roads from within an area.

Option 1- Compare two data sets

The first option allows you to compare data from two separate areas or two different time periods. The data for the two areas (or time periods) will need to be in two separate **Accident data files**.

Click on the box next to 'Compare two data sets' and then click on 'Load second STATS 19 data file'. Browse to the **Accident data file** containing the second set of data to be compared, select it and click on Open. *ARRIL* will warn you if the file is not in the correct format or if you try to compare an **Accident data file** with itself. Data from this file will be designated as coming from 'AREA B'.

Once this is done *ARRIL* moves to Step 3.

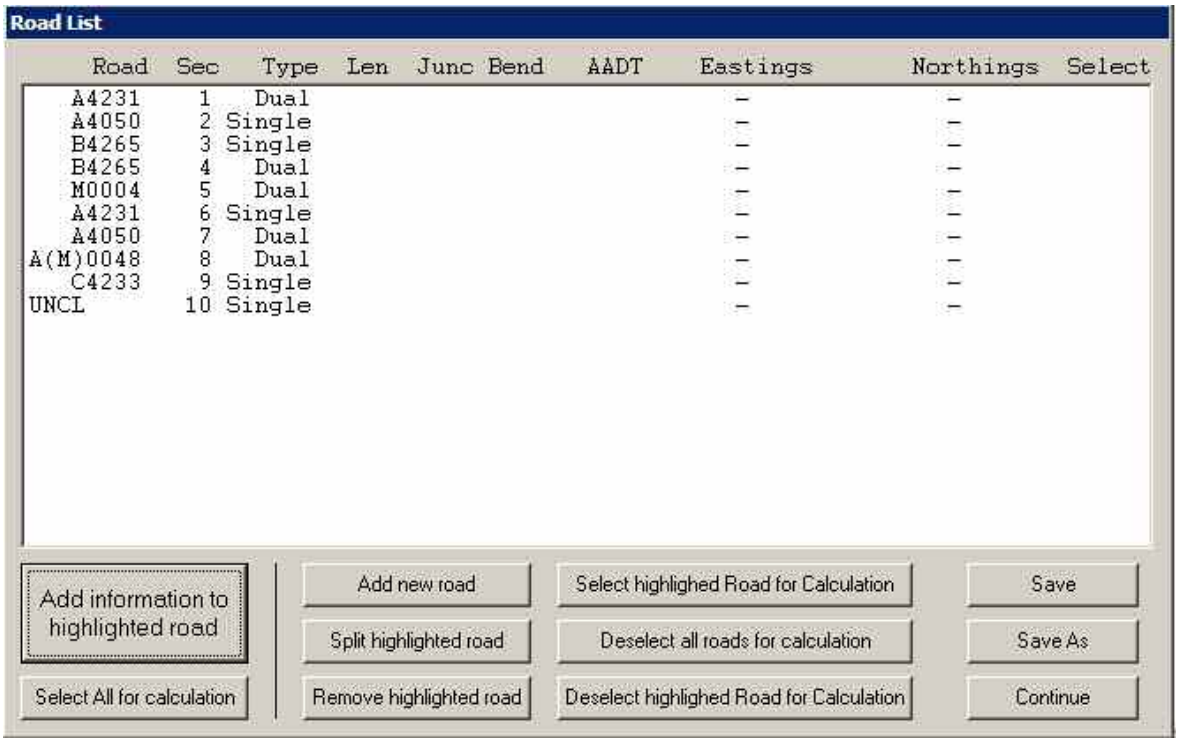
Option 2 - Specify rural roads in database for investigation

In order to allow the analysis of rural road accidents within an area it is necessary to utilise a **Specification file.**

The **Specification file** serves two purposes. Firstly, it allows you to specify which roads in the database are to be analysed. Secondly, it allows you enter additional information which cannot be extracted from the **Accident data file,** but is required by the analysis.

The first time an **Accident data file** is analysed you will need to generate a new specification file. On subsequent occasions you can choose to use/edit an existing **Specification file** or generate a completely new one.

Select the 'Generate New Specification file' button to generate a new **Specification file.** At this point *ARRIL* analyses the **Accident data file** and identifies roads within the file where rural accidents have occurred. This information is then displayed on a form called "Road List":

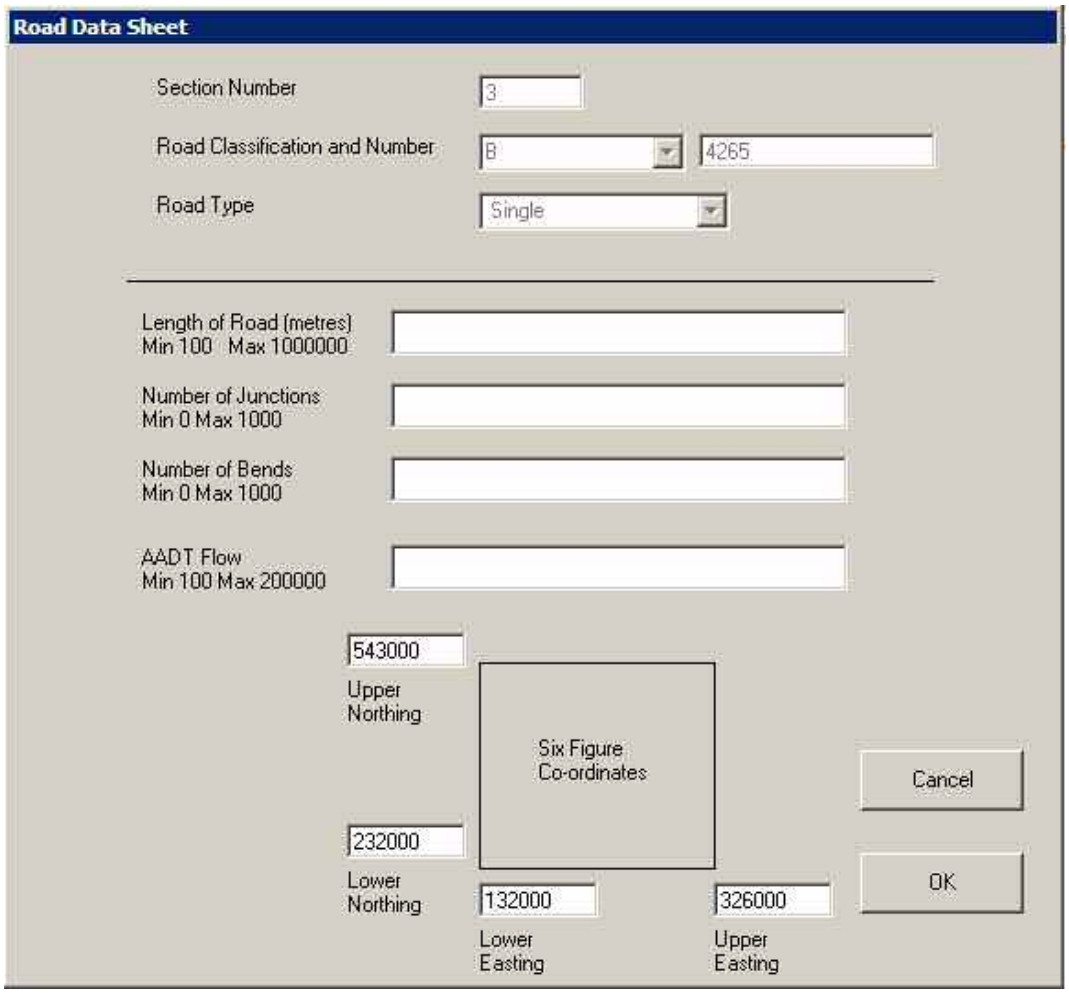


Each road is divided into single or dual-carriageway sections. If a road has both single and dual-carriageway sections (with rural

accidents) it appears twice in the list. Otherwise it will only appear once. Note: Unclassified roads (UNCL) are grouped together.

In order to calculate accident rates further, information about the characteristics of a road section must be added to the **Specification file**. These are the length of the section, the numbers of junctions and bends and the Annual Average Daily Traffic. (Note: For a dual carriageway or motorway, you are not required to enter the number of bends.)

Highlight the appropriate road then click on 'Add information to highlighted road' or double-click on a road. A new form "Road Data" is displayed as shown below:



You can then type in the relevant values for link length etc.

A road can be truncated by adding grid references. This is useful when you are only interested in part of a road. Enter the 6-figure

grid references into the boxes as shown above. Use the Cancel button to leave this form without saving any changes. Use the OK button to leave the form and save the changes.

If you are interested in looking at separate sections of a road it can be split into two or more parts. To split a road, highlight it in the "Road list" form. Then click on 'Split highlighted road' button. This will create a new entry in the road list identical to the one you chose to split. You can then add or change road information separately for each entry.

TIP!

Make sure that the entire road section you are interested in is within the box defined by the grid references, not just the end points.

Roads can be added to or deleted from the specification file using the appropriate buttons. New roads are added at the bottom of the road list. Once you have created the road add the details by choosing 'Add information to highlighted road'.

Roads can also be selected or de-selected for calculation. By de-selecting a road rather than deleting it you can quickly re-introduce it into the analysis later on.

When you have finished making changes to the **Specification file** click on 'Continue'. You will be asked whether you wish to save the changes. At this point, you can either overwrite an existing file or create a new one.

Step 3 - Define Summary file

The Summary file contains the accident data summaries that will be imported into the specially designed Excel spreadsheets. Click on 'Define' and then browse to the folder where you want to store the output. Enter a file name and click on 'Save'.

Step 4 - Specify time period

You will need to specify the time period covered by the **Accident data file(s)** in order to calculate accident rates.

ARRIL automatically identifies the earliest and latest rural accident record with the database(s). These dates are displayed on the form under Step 4 along with the time period between these dates.

You are allowed to alter the dates. For example, if the earliest accident occurred on January 3rd but you know that the file contains data for a calendar year, you are permitted to change the date to January 1st. Care must be exercised when using this feature to ensure the correct time period is entered.

Once the time periods are correct click the 'Confirm' button.

Note: *ARRIL* will only accept time periods of at least two years duration.

Step 5 - Calculate

To generate the **Summary file** click on the ‘Calculate’ button. *ARRIL* will let you know when the calculations have been completed and the summary file has been generated.

USING *ARRIL* - PART TWO

Importing the summary file into the relevant spreadsheet

In order to generate the investigatory level statistics it is necessary to import the **summary file** (generated under Part One) into a specially designed Excel workbook.

ARRIL is supplied with four Excel workbooks, one for each type of analysis:

DualArril.xls is used to compare the data for individual motorways and dual-carriageway roads within an area with the national investigatory levels.

SingleArril.xls compares the data for individual single-carriageway roads within an area with the national intervention levels.

Compare2AreasDual.xls compares the data for motorways and dual-carriageway roads for two areas against each other and with the national investigatory levels.

Compare2AreasSingle.xls compares the data for single-carriageway roads for two areas against each other and the national intervention levels.

Comparing individual roads to the national investigatory levels

The two workbooks DualArril.xls and SingleArril.xls allow you to compare individual roads within an area with the national investigatory levels. Each workbook contains three sets of sheets: one set deals with accident frequencies, another with accident involved vehicles and the last with casualties. (These are in substance the same as those presented in Appendix C of the main guide).

There are separate sheets for each class of carriageway. The dual-carriageway workbook contains sheets dealing with motorways and dual-carriageway A-roads. The single-carriageway workbook contains sheets for single-carriageway A-roads, B-roads, and C- and Unclassified Roads.

If the **Summary file** contains information on dual-carriageway and single-carriageway accidents, you will need to use both spreadsheets. The following instructions apply to both the DualArril.xls and SingleArril.xls workbooks.

Open the relevant workbook. The workbook should open on the **'Data'** worksheet. If it does not, you will need to click on the 'Data' tab at the bottom of the work book.

The 'data' worksheet contains two buttons. The 'Clear data from worksheet' button clears the results of any previous analysis. (Therefore, it is important that you save the worksheet to a different file name if you do not want to overwrite existing results.)

The "Import data from summary file" button is used to import the data from the **Summary file**. When this button is clicked the user is invited to enter the name of a **Summary file**. By default you will only be able to see files with the .out extension. When you open the file the data is automatically imported into the workbook and entered into the relevant worksheets.

You can then view the worksheets to identify where the accident level on an individual road exceeds the national investigation level.

Comparing two areas with each other and to the national investigatory levels

The two workbooks Compare2AreasDual.xls and Compare2AreasSingle.xls allow you to compare two areas with each other and with the national investigatory levels. Each workbook contains three sets of sheets: one set deals with accident frequencies, another with accident involved vehicles and the last with casualties.

There are separate sheets for each class of road. The dual-carriageway workbook contains sheets dealing with motorways and A-roads. The single-carriageway workbook contains sheets for A-roads, B-roads, and C- and Unclassified Roads.

Choose whether you are interested in dual-carriageway or single-carriageway roads and then open the relevant workbook. The workbook should open on the data worksheet. Click the button to import data from an output file. Browse to the file that was previously created by *ARRIL*. By default you will only be able to see files with the .out extension. When you click on open the file is automatically imported into the workbook and entered into the relevant worksheets.

You can then view the worksheets to identify areas where detailed accident investigation may be required. Where the accident level on an individual road exceeds the national intervention level, a value for the excess is shown. If the difference is statistically significant the figure is marked with either one or two stars.

* denotes a result that is significant at the 5% level

** denotes a result that is significant at the 1% level

8. REFERENCES

Department of the Environment, Transport and the Regions. DETR (2001) "Road Accident Data – GB. Variables and Values and Export Record Layouts"

MAAP for WINDOWS. MAAP (2000) User Guide. Application Guide 38. TRL Limited, Crowthorne.