Incident Warning Systems: Accident Review

S. Oppe (SWOV), J.E. Lindeijer (SWOV) & P. Barjonet (INRETS)

R-94-50

HOPES

Horizontal Project for the Evaluation of Safety

DRIVE II Project V2002
Deliverable 17
Workpackage 31
Activity 31.2

Incident Warning Systems: Accident Review

Authors:

S. Oppe (SWOV)
J.E. Lindeijer (SWOV)
P. Barjonet (INRETS)

Deliverable type:	P
Contract date:	March 1994
Submission date:	November 1994

Commission of the European Communities — R&D programme Telematics Systems in the Area of Transport (DRIVE II)

R-94-50

SWOV Institute for Road Safety Research
P.O. Box 170
2260 AD Leidschendam
The Netherlands
Telephone 31703209323
Telefax 31703201261

The research reported herein was conducted under the European Community DRIVE Programme. The project is being carried out by a consortium comprising: Institute for Transport Studies, University of Leeds; Department of Traffic Planning and Engineering, University of Lund; Swedish National Road Administration; Fachgebiet Verkehrsplanung und Verkehrswesen, Technische Universität München; Traffic Research Centre, University of Groningen; Transport Research Laboratory; Centro Studi Sui Sistemi Trasporto; FACTUM; Department of Transport and Logistics, Chalmers University of Technology; Department of Civil and Environmental Engineering, University College Cork; Technical Research Centre of Finland; Institute for Road Safety Research SWOV; Institute for Traffic Safety, TÜV Rheinland; INRETS BRON; INRETS DERA; and Swedish Road and Traffic Research Institute. The opinions, findings and conclusions expressed in this report are those of the authors alone and do not necessarily reflect those of the EC or of any organization involved in the project.

EXECUTIVE SUMMARY

The purpose of traffic incident warning systems (IWS) is to make road users aware of the hazards along the road ahead. After receiving the warning, road users are expected to reduce their speed, increase the headway and to increase their alertness, or to divert to an alternative route, avoiding the location of hazard. When they reach the problem area, they are supposed to be better prepared to avoid possible accident situations, caused e.g. by shock waves. The changes in behaviour are expected to improve the efficiency of the network in the hazardous situations, partly by harmonizing the traffic flow and partly by moving the drivers to problem-free sections of the road network.

One major aim of the IWS is to increase safety. The effectiveness of such a system in improving safety can be measured intermediately by behavioural improvements, but should be measured finally by the reduction in the number and the severity of accidents. Because accidents are rare events, it is difficult, especially when evaluating small-scale systems, to detect statistically significant improvements. An evaluation of IWS on the basis of accidents is necessary, but cannot be done within the scope of the evaluation study carried out by HOPES within DRIVE II.

The aim of this accident review is to check what proportion of accidents recorded in the past could in principle have been prevented by using an IWS. An additional aim is to detect particular safety problems at the IWS test sites, that require attention in the other IWS evaluation activities, especially the behavioural studies and the conflict studies. An after study of accidents, using the outcomes of this before study is recommended.

It is not assumed that the IWS prevents all types of accidents, but only those that are related to the warning messages given. Therefore, accidents are categorized in such a way that relevant accident types can be distinguished from the accident types that are not supposed to be affected. Larger effects on particular subgroups are easier to detect than smaller effects on the total number of accidents. Another advantage of this categorizing is the possibility to check whether observed changes in traffic (conflict) behaviour actually correspond with accident reductions on related subgroups of accidents. Finally, from the classification of accidents it is possible to estimate the maximum accident reduction to be expected with an ideal system.

Traffic safety is not only expressed in the total number of accidents. More important is a presentation of safety measured in relation to exposure to risk. A general description of safety regarding the total amount of traffic is given for the experimental sections as well as for control sections.

The accident files differed considerably between the three projects (EUROTRIANGLE, PORTICO and MELYSSA), both in the amount of detail and in the categories used to score the accidents, but for all three locations the relevant accident types could be distinguished. It turned out that a large proportion of the accidents are of a type that is relevant for a warning system, but that the specific types were very different between the projects. In the EUROTRIANGLE

project change of lane is the main accident type related to the IWS. This is not surprising, given the complicated nature of the road system just before the Kennedy tunnel, where a large number of routes come together or divert. For PORTICO it is the single accident at high speed. For MELYSSA it is the rear-end and queuing accident that is most dominant. On the A1 in Portugal, congestion is much less, while the average speed and the speed variation is much larger than at the other locations. In Antwerp there is often congestion, so that drivers probably anticipate sooner and drive more slowly. Speed is hardly mentioned as a main cause. On the A6 near Lyon, congestion is less frequent than in Antwerp, but much more frequent than on the A1 near Lisbon. Given the relatively high speeds, one might expect more problems in the case of congestion on the A6 than in Antwerp.

There are also large differences in the accident causes scored by the police. These differences are more difficult to interpret than those in accident type, because they are less objective and ask for judgement. In France, the dominant cause mentioned was traffic violation; in Portugal it was high speed; and in Belgium wrong manoeuvres and special circumstances were mentioned most often.

In conclusion, it can be stated that for a large proportion of the accidents, the type and cause can be regarded as relevant for an IWS, but that special attention should be given to specific types of problems that are location dependent. Furthermore, it is to be recommended that for the coding of accident causes more objective categories and more systematic scoring procedures should be used in the European countries, to make international comparisons easier.

TABLE OF CONTENTS

1 INTRODUCTION

The major aim of the IWS is to increase safety. The effectiveness of such a system in improving safety can therefore be measured intermediately by behavioural improvements, but should be measured finally by the reduction obtained in the number and the severity of accidents. Because accidents are rare events, it is difficult, especially when evaluating small-scale systems, to detect statistically significant improvements. An evaluation of IWS on the basis of accidents is necessary, but cannot be done within the scope of the evaluation study carried out by HOPES in DRIVE II.

The aim of this accident review is to check what proportion of accidents recorded in the past could in principle have been prevented by using an IWS. An additional aim is to detect particular safety problems at the IWS test sites, that need attention in the other IWS evaluation activities, especially the behavioural and conflict studies. An after study of accidents, using the outcomes of this before study, is recommended.

This accident review is meant to detect specific types of problems that resulted in accidents, which could possibly have been prevented if the drivers had been warned in time by an incident warning system. This accident review was carried out for all three test sites with Incident Warning Systems that are part of the HOPES Evaluation study, namely the PORTICO system, the EUROTRIANGLE system and the MELYSSA system:

- In the EUROTRIANGLE project the experimental section is part of the Antwerp ring road just before entering the Kennedy tunnel, going in the direction of the centre of Antwerp.

- The PORTICO system is or will be implemented on a two-lane mountain road IP5 and on the motorway A1. The experimental site on the A1 is located near a toll-station just outside Lisbon. Only the A1 is part of this accident review.

- The MELYSSA location is situated on the north-south motorway A6 in the neighbourhood of Lyon. Two parallel roads, the RN6 and the D933, are relevant as re-routing alternatives.

A description of the warning systems, their aims and details about the location and situational characteristics is given in HOPES Deliverable 15: Design of Incident Warning Systems Evaluation Studies.

We are grateful for the cooperation of the authorities of all three projects, who provided us with the necessary accident data and the relevant background information, making it possible for us to read and understand the automated files or data on paper. Greater effort than expected was necessary on both sides to explain the structure and to read the files. Sometimes clarifications required more time from the reviewers as well as from the helpful representatives of the projects.

The accident review focuses on those accidents that could have been prevented if correct information about the situation at hand had been given in time and if the drivers were to behave as expected after receiving the information. The review was also supposed to identify scenarios that could be used to focus attention in the behavioural studies on particular problems. It is also intended to compare relative frequencies of accident types with corresponding types of critical behaviour and conflicts. In addition, exposure data were collected to give information on the accident risk at the three locations selected for the installation of the warning systems. However, it turned out that it is difficult to obtain detailed information on exposure. Information about motorway safety in general has been used as reference data, but the recording of accidents, especially property damage only accidents or accidents with minor injuries, is not always carried out in a consistent way. Therefore only a limited comparison of risk between the three IWS has been possible.

2 THE EUROTRIANGLE PROJECT

2.1 GENERAL INFORMATION

At the beginning of 1994, the "Rijkswacht" supplied automated accident files for the experimental section of the E17 motorway as well as additional automated accident data from 1993 for the surrounding motorways on the Antwerp ring road and for motorways that give access to that ring road. Annex 1 gives a picture of the experimental site, together with the surrounding motorways in the province of Antwerp.

Only a small number of categories were fixed. Some extra information was provided in a short description added to each record. This information was used for the selection by hand of the relevant accidents. However, the amount of information about the cause or chain of events leading to the accident differed between the cases. Classifications of types of accidents as well as categories of causes are therefore rather subjective and not very systematic.

It had been hoped to use an analysis of the detailed descriptions of the accidents to obtain extra information beyond the general information already available from the manoeuvre coding, but this was not possible because of the inconsistency of the descriptions. There is no common format and no schematic drawing of the accident situation. A representative sample taken from the descriptions in the original DBASE file is given in Annex 2. Also included is an example of the descriptions (MEMO _VONG) for another sample together with an English translation. For privacy reasons, the files do not contain any information that identifies the drivers.

A few examples of descriptions that were relevant for our categorization are given below:

- head/tail accident with no further information:
  - "Car no. 1 hit the rear end of car no. 2. Therefore, car no. 2 hit the rear end of car no. 3." or "head/tail accident".
- head/tail accident, caused by late notice of congestion:
  - "Because of congestion car no. 2 and 3 stood still in the middle lane. Driver of car no. 1 did not notice the queue in time. Result: head/tail accident, involving cars no. 1, 2 and 3."
- entering/exiting accident:
  - "Car no. 1 entered the R1. At that moment car no. 2 changed lane. Car no. 1 hits car no. 2."
- freight/obstacle accident:
  - "Car no. 1 hits an obstacle (beam, lost by a truck). Next, the beam damaged car no. 2."
- other reasons/unknown:
  - "Loss of control" or no description at all.

Most of the informative descriptions (of relevant accidents) give some information about the chain of events, allowing selection of causes, such as:

- head/tail accident; caused by high speed:
  - "Driver of car no. 1 drove too fast. Did not notice his speed difference relative to the car in front in time. A head/tail accident was the result."
- head/tail accident; caused by incident:
  - "After a crash with the guardrail car no. 1 stood still in the left lane. Car no. 2 crashed into car no. 1."
- head/tail accident; caused by an obstacle on the road:
  - "Car no. 1 stopped in front of an obstacle on the road (freight lost by a van). Driver of car no. 2 could not manage to avoid car no. 1 and hit the car."
- lane change accident; caused by an overtaking manoeuvre:
  - "Driver of truck overtook a car in front of him. Next, swerves to the right and grazed the car."
- lane change accident; caused by diffuse behaviour in front:
  - "According to Mr. X a white van in front of him first started an overtaking manoeuvre but did not finish it and returned to its lane. At the time Mr. X wanted to overtake the white van, the white van swerves to his lane. Mr. X had to make an abrupt brake, skids and hits a guardrail on the left side."

2.2 RESULTS

2.2.1 Accidents

The total annual number of accidents on the experimental road section, including injury accidents and accidents with property damage only, was about 200, and more than 2000 accidents were reported on the surrounding motorways within the province of Antwerp. All accidents were analyzed manually, because only a small part of the information was coded. The accidents used were reported in 1993.

Firstly, the accidents that did not take place on the motorway itself were excluded. The selection criterion was the place of the accident. Accidents on junctions nearby the motorway, at fuel stations, etc. were considered not relevant. This selection resulted in 138 accidents on the E17, and 807 accidents on the surrounding motorways. Of these, 71 accidents on the E17, and 383 accidents on the surrounding motorways were regarded as relevant to the Incident Warning System. Secondly, the 138 and 807 accidents were categorized according to type of accident. Thirdly, the 71 and 383 accidents were categorized according to the relevant causes. Table 1 gives an overview of the types of accidents, both on the E17, the experimental section and on the surrounding motorways. Table 2 gives an overview of the categories of relevant causes.

Table 1 shows that the majority of the accidents (head/tail; lane change; entering/exiting; obstacles) are of a type that in principle can be prevented by an effective warning system. The percentages of the accidents of a particular type do not differ substantially between the E17 and the surrounding motorways. This means that if the system proves to be effective, it could be extended to other parts of the ring road system.

In Table 2 we notice that there are differences between the E17 and the surrounding motorways. Late notice of the queue is mentioned relatively less frequently as a cause for accidents on the E17. This is probably the case because queuing takes place each morning during the peak hours and therefore will be less surprising on the E17. Furthermore, this section is already supported by an existing warning system.

Overtaking or changing lanes is the major cause on the E17. Additional to the speed, incident and congestion messages, consideration should be given to providing keep-your-lane warnings in high occupancy periods.

Table 1: Classification of accident types

	E17 (experimental)		Surrounding motorways	
accident types:	number	percent	number	percent
head/tail	37	26.8	222	27.5
lane change	28	20.3	285	35.3
flat tyre/fire	14	10.1	22	2.7
rain/aquaplaning	14	10.1	54	6.7
obstacles	11	8.0	60	7.4
entering/exiting	11	8.0	43	5.3
other/unknown	23	16.7	121	15.0
Total	138	100	807	100

Table 2: Selected relevant categories for the accident review

	E17 (experimental)		Surrounding motorways	
categories:	number	percent	number	percent
late notice of queue	10	14.1	102	26.6
speed/ attention/ incident	22	31.0	120	31.3
overtaking; others involved	28	39.4	118	30.8
entering/ exiting	11	15.5	43	11.2
Total	71	100	383	100

2.2.2 Accident risk

Table 3 shows the overall risk on the experimental road section, and on the surrounding motorways within the province of Antwerp. The accident rate at the experimental site is slightly higher than on the surrounding motorways.

From Annex 1 it can be seen that this entire road network consists in the main of entering, exiting and weaving sections, and is not representative of a regular motorway in Belgium. Therefore, if the system is a success, then the surrounding motorway system and comparable networks around other cities will be potential areas for application as well.

Table 3: Accident risk (accidents per 10^8 Vkm) for the experimental road section at the E17 and the surrounding motorways

	V-Km's (x 10^8)	Road length	Number of accidents	accident rate
Experimental section E17	7.19	16.6	138	19.19
Surrounding motorways	45.52	215.6	807	17.73

3 THE PORTICO PROJECT

3.1 GENERAL INFORMATION

Accident data for the experimental section in Portugal (A1) was received on paper, including a codebook. The accidents are taken from an automated datafile, with coded accident characteristics and accident causes. Annex 3 gives an example of the form used to code the accidents, together with an example of the coded accident records. A translation of the categories into English is added. When recording an accident, the Portuguese police selects one accident type out of seven main categories. After that a sub-category is selected for the two most common main accident types. The following categories are used:

1. Collision between vehicles, with sub-categories:
   - rear-end
   - lateral, sideways
   - frontal
   - chain accident

2. Collision with objects outside lane, with sub-categories:
   - guardrail
   - road sign
   - vehicle on shoulder
   - other objects

3. Roll-over

4. Fire

5. Collision with pedestrian

6. Skidding and running off the road

7. Other accident type

For each accident type, the police select one cause out of four main causes, each having a number of sub-causes. The categories are:

1. Driver related causes, with sub-categories:
   - fell asleep
   - driver under the influence of alcohol
   - sickness
   - driver distracted
   - not responding to signs or regulations
   - excessive speed

- driving in wrong direction

2. Vehicle related causes, with sub-categories:
   - mechanical problem
   - problem with brakes

3. Infrastructure related causes, with sub-categories:
   - obstacle
   - pavement damage
   - snow/ice on the road
   - gravel/sand on the road
   - oil on the road

4. Other cause

At first sight this classification and categorizing seems clear. However, if more than one category applies, it is not always clear what kind of criteria has been used by the police to select the type of accident and cause. For example, fifty percent of all the selected causes concern excessive speed (see Table 4), but it is not clear what category was selected when a driver under the influence of alcohol was driving too fast. Differences between the accident types "chain" and "rear-end" accidents are not clear either.

To compare relevant accident types and causes between the three projects EUROTRIANGLE, PORTICO and MELYSSA, more information is needed than is given in the automated PORTICO police reports. A detailed study of the original reports of these accidents would be required. This has not been done, because the data was not available.

3.2 RESULTS

3.2.1 Accidents

The data that we received from the automated datafile are given in Appendix 3. The data include 121 accidents, 57 of which are property damage only accidents. The remaining 64 accidents are injury accidents, ranging from serious injury (14 accidents) to accidents with only slight injuries (50 accidents). No fatal accidents were reported. Table 4 gives an overview of the accidents on the A1 from April 1, 1993 to April 1, 1994.

Table 4: Types of accidents and causes on the A1 in Portugal

Accident type:	No. of Accid.	Accident cause:	No. of Accid.	Wet road
roll over	3	excessive speed	1	
		distracted/unattended	1	
		mechanical problem	1	1
skidding	60	excessive speed	31	21
		distracted/unattended	5	1
		sleep	1	
		wrong direction	2	1
		problem with brakes	9	2
		alcohol	1	
		other causes	11	4
rear-end	28	excessive speed	15	6
		distracted/unattended	5	3
		sleep	2	1
		wrong direction	2	1
		gravel/sand	1	
		other causes	3	1
sideways	5	excessive speed	1	1
		wrong direction	2	1
		mechanical problems	1	1
		other causes	1	1
frontal	1	driver distracted	1	1
chain accid.	7	excessive speed	4	2
		wrong direction	1	
		obstacle on lane	1	
		other causes	1	
guardrail/obj	17	excessive speed	10	4
		driver distracted	4	1
		problems with brakes	3	
Total	121		121	54

3.2.2 Accident risk

Table 5 shows a comparison of the overall risk on the experimental road section with the risk on the A1 from Lisbon to Porto and with the risk on all motorways in Portugal.

Table 5: Accident risk (accidents per 10^8 Vkm) for the experimental road section, the A1 and all motorways

	V-Km's (x 10^8)	Number of accidents	Accident rate	Injury accidents	Inj acc rate
Sacavem/Alverca	3.299	121	36.68	57	17.28
A1 Lisbon/Porto	29.585	2524	85.31	693	23.42
All Motorways	46.073	4097	88.92	1082	23.48

This table shows that the A1 has an accident rate that is comparable to the accident rate of the total motorway system. The experimental part at Sacavem/Alverca has a considerably lower accident rate for all accidents, but the rate of the injury accidents is relatively high, although still lower than the average motorway in Portugal. Although the experimental site is relatively safe in general, special types of accidents, related to the IWS system such as high speed accidents, could be disproportionately high. No information is available at this level of disaggregation.

Because the level of reporting differs considerably from country to country for property damage only accidents and accidents with minor injuries, a comparison with the results of the other experimental sites is difficult to make. Such a comparison is in principle possible for fatal accidents or accidents with hospitalized victims. However, in this case there are no fatal accidents and the degree of severity of the injuries is not known. A preliminary comparison can be found in Section 5.1.

4 THE MELYSSA PROJECT

4.1 GENERAL INFORMATION

The Incident Warning System on the A6 that will be evaluated in the HOPES project is only a small part of the total MELYSSA system. There are two alternative routes that can be used by drivers on the A6. These are the RN 6, a major road, not being a motorway, and the D933, a lower type of road than the RN6. Evaluation of the MELYSSA project should include these routes, because messages advising drivers to reroute are planned. This rerouting could cause accident increases on the alternative routes. Therefore all three routes are included in the review. Annex 4 shows the routes on a map.

The accident data for MELYSSA were already available at the beginning of 1994. However, the review of this data was delayed because of formal problems concerning the permission required from the authorities for the use of detailed accident data. Annex 5 shows the categories that are used for the coding of the accidents. As in the case of PORTICO, this information is rather detailed and can be used directly to select and categorize the relevant accidents.

4.2 RESULTS

4.2.1 Accidents

The accident data, including injury accidents and property damage only accidents, have been collected over the period from 1988 through 1992. In this period 228 accidents were reported on the A6 motorway itself, 348 on the parallel road RN6 and 278 on the parallel road D933. Tables 6 through 8 give an overview of the main accident categories, their supposed causes and relevant manoeuvres.

Table 6 shows that there are large differences between the three types of road. This is mainly due to a difference in road type. On the A6 and to a lesser extent on the RN6, a main cause as reported by the police is the disobedience of rules or the state of the driver. It is not clear what kind of rules are violated. Although speeding is not mentioned frequently as a cause on the A6, it is probable that it is often scored as a traffic violation. In any case, the warning system could be used to restrict traffic violations or to increase alertness in dangerous situations. Drunk driving is more often a cause on the RN6 and the D933. This may be an effect of police control on the A6, but also a result of the less optimal driving conditions on non-motorways. Speed is also less of a problem on the A6 than on the other routes. This could be expected from the type of road as well. In general however, the percentages of causes linked to driver error are not very different for the three route types.

Table 6: Accidents on the motorway A6, the N6 and D933, between Lyon and Mâcon, disaggregated by supposed accident causes

	A6		RN6		D933	
supposed causes:	No.	%	No.	%	No.	%
traffic violation	102	44.7	63	18.1		
weariness, indisposition, drug	27	11.8	8	2.2	6	2.1
disability	1	0.4			1	0.3
drunk driving	5	2.2	40	11.4	35	12.5
parking			3	0.8		
speed	16	7.0	49	14.0	68	24.4
other cause driver	24	10.5	87	25.0	133	47.8
engine problems	3	1.3	4	1.1	2	0.7
flat tyre	7	3.0				
bad weather	2	0.8	6	1.7	3	1.0
animal	2	0.8				
other cause road	3	1.3	4	1.1		
unknown cause	36	15.7	84	24.0	30	10.0
Total	228	100	348	100	278	100

Table 7: Accidents on the motorway A6, the N6 and D933, between Lyon and Mâcon, disaggregated by type of collision

	A6		RN6		D933	
type of collision:	No.	%	No.	%	No.	%
frontal	10	4.3	36	10.3	63	22.6
rear-end	78	34.0	45	12.9	28	10.0
queuing	47	20.6	35	10.0	13	4.6
sideways	15	6.5	113	32.4	91	32.7
lane change	18	7.8	32	9.1	35	12.5
stayed in lane	43	18.8	13	3.7	3	1.0
no collision	5	2.2	1	0.2	12	4.3
other	12	5.2	73	20.9	33	11.8
Total	228	100	348	100	278	100

Table 7 shows the distribution of accidents with regard to type of collision. Here too we see large differences between the three routes. As expected, the percentage of frontal accidents at the A6 is less than on the other routes. More interesting is the large percentage of rear-end and queuing accidents on the A6. These accidents are relevant for a warning system.

Table 8 shows the data disaggregated by manoeuvre. Given the differences between types of collision and supposed causes, it is surprising that the percentages of accidents without a change of direction are almost the same. It must be noted that this category means different things for different road types. The high percentages of right and left turn accidents and of crossing accidents on the RN6 and D933 are offset by the high percentages of queuing and overtaking accidents on the A6. Accidents associated with these latter types of manoeuvres are also relevant for incident warning systems.

Table 8: Accidents on the motorway A6, the N6 and D933, between Lyon and Mâcon, disaggregated by type of manoeuvre

	A6		RN6		D933	
manoeuvre before accident:	No.	%	No.	%	No.	%
no changing direction	148	65.0	223	64.0	183	65.8
same direction, same lane	33	14.4	7	2.0	7	2.5
parking			3	0.8		
driving backwards	2	0.8	1	0.2	2	0.7
stopping	9	3.9	1	0.2	1	0.3
entering	2	0.8	9	2.5	7	2.5
overtaking to the right	19	8.3	17	4.8		
changing lane			3	0.8		
turning right			4	1.1	2	0.7
turning left			31	8.9	31	11.1
crossing the road			15	4.3	25	8.9
half turn			11	3.1	3	1.0
cutting in on the right	5	2.2	3	0.8	6	2.1
other	10	4.3	20	5.7	11	3.9
Total	228	100	348	100	278	100

4.2.2 Accident risk

The accident rates for injury accidents on the A6, RN6 and D933 are 3.5, 23 and 37.6 accidents per 10^8 km respectively. For the A6, this rate is relatively low. On an average motorway in France this risk is between 5.0 and 6.0. The severity rate, however, is exceptionally high: 18.5% of the injuries are fatal. This is twice as high as the average. This rate is probably due to the high percentage of night-time accidents, which are 49% of the total. The accident rate on the RN6 is comparable to the average rate for this type of road. The fatality rate is 11%, which is just slightly higher than average. The fatality rate on the D933 is 5.3%.

Given these figures, it can be stated that the potential safety improvement from a warning system on the A6 is high, but also that rerouting to the other routes may cause an increase in risk and consequently in the number of accidents.

5 COMPARISON AND CONCLUSIONS

5.1 COMPARISON OF THE THREE SYSTEMS

It is not easy to make a comparison between the accident data of the three incident detection systems, because in all three countries different accident categories are used. But on a more general level it can be noticed that there are significant differences between the accidents at the three systems. Table 9 gives the results at an aggregated level for the accident types.

Table 9: Comparison of the percentages of accidents by accident type for the three projects

	E-T (E17)	E-T (other)	PORT. (A1)	MEL. (A6)
rear-end/queuing	27	27	23	54
sideways/entering/exiting	28	40	4	14
single/obstacle	28	16	66	21
other	17	17	7	11
Total	100	100	100	100

From this table it can be concluded that rear-end or queuing accidents are the dominant type for MELYSSA. Half of all the accidents are of this type. The percentage on the other motorways is around half this value. Sideways, entering or exiting accidents are the dominant accident types for EUROTRIANGLE, especially on the surrounding motorways. The predominant problem for PORTICO is the number of single car accidents. Situational differences will account for most of the differences. From the behavioural and loop-detector studies, to be presented in other HOPES deliverables, we know that there is much less congestion on the A1 in PORTICO than on the other test sites, while the average speed as well as the speed differences are high. Single car accidents may be the result, because of a loss of vehicle control (see also Table 10). The road structure at the EUROTRIANGLE test site is complicated, with many entering, exiting and weaving sections. This will explain the relatively high percentage of this type of accidents. For MELYSSA, the main problem could be linked to the fact that the average speed is higher than in Antwerp, congestion is less but probably more than in PORTICO, and if taking place is probably less expected by the drivers, causing more rear-end and queuing accidents.

Table 10 gives a comparison of the main relevant factors or causes. Speed has been mentioned by the police as the most important accident cause in PORTICO. In the EUROTRIANGLE project speed is almost never explicitly mentioned, except sometimes in combination with loss

of control. Often this speed was not above the legal limit. Loss of control is scored more often and seems to imply a high speed (at least given the circumstances), but this is not made explicit. Inattentiveness is more often scored in EUROTRIANGLE, sometimes combined with loss of control. Other causes that are often scored in EUROTRIANGLE refer to additional circumstances (obstacles, sand on the road, slippery road etc.). For MELYSSA, traffic violation is the main category, but speed violations are probably the main reason for scoring. Because this is not clear, traffic violations are scored here as wrong manoeuvres. Finally, it can be noticed that driving under the influence of alcohol is seldom scored for the accidents for all three test sites, although it is generally recognized as an important accident cause. It should be stressed again that this comparison is preliminary, because the effects of differences in registration procedures and the use of scoring categories are not quite clear.

Table 10: Accidents categorized according to the main causes or most relevant factors in the three projects

<table>
<tr><th></th><th>E-T (E17)</th><th>E-T (other)</th><th>PORT. (A1)</th><th>MEL. (A6)</th></tr>
<tr><td>speed</td><td rowspan="2">23</td><td rowspan="2">28</td><td>51</td><td>7</td></tr>
<tr><td>attention</td><td>16</td><td>12</td></tr>
<tr><td>wrong manoeuvre</td><td>28</td><td>20</td><td>6</td><td>45</td></tr>
<tr><td>alcohol</td><td>1</td><td rowspan="3">53</td><td>1</td><td>2</td></tr>
<tr><td>other driver failure</td><td rowspan="2">49</td><td rowspan="2">26</td><td>11</td></tr>
<tr><td>other/unknown</td><td>23</td></tr>
<tr><td>Total</td><td>100</td><td>100</td><td>100</td><td>100</td></tr>
</table>

A comparison of the accident risk between the systems should be made with even more caution. The level of reporting can vary considerably, especially in the case of property damage only accidents or accidents with minor injuries. A comparison between Tables 3 and 5 shows that the accident rate in PORTICO is much higher than in EUROTRIANGLE. The injury rate at the Portuguese location is comparable to the accident rate at the Belgian location, although also non-injury accidents are registered in Belgium. Therefore, the accident rate seems indeed to be higher in PORTICO than in EUROTRIANGLE, as could be expected from the national figures on accident rates. The fatality rates for Portugal, Belgium and France per 100,000 inhabitants are 32.2, 18.8 and 18.5 respectively, according to the data published by BASt in Germany, from the IRTAD database for 1991. The accident rate for injury accidents on the MELYSSA section is 3.5, which is much lower than in PORTICO. No conclusions will be drawn from this comparison.

5.2 CONCLUSIONS

An evaluation of IWS on the basis of a before and after accident study is outside the scope of the HOPES evaluation work in DRIVE II. At least one year, and preferably more then one year, of accident data is necessary after the installation of the system. However, it is recommended that such a before and after study be carried out by the projects themselves, using the before data as reported in this study.

A comparison of the main accident types showed that there are large differences in accident types between the three test sites. The dominant accident types are all relevant for an IWS, but the special problems indicate different warning strategies. For EUROTRIANGLE, the main problem is entering, exiting and weaving. For PORTICO, the main problem concerns speeding. For MELYSSA, rear-end and queuing accidents are the main problem, but speeding could be a problem too. To ascertain the effectiveness of the warning systems in improving safety, studies should focus on a reduction of these types of accidents. In the conflict and behavioural studies carried out by HOPES on PORTICO and EUROTRIANGLE, extra attention will be given to the main types of problems.

There are also large differences in accident causes, but these reflect to a large extent differences in attitudes or interpretations made by the police and are therefore more difficult to compare. It is clear that the accidents are not scored for scientific reasons. For example, for the MELYSSA study it would have been informative to know the type of traffic violation that was scored.

To improve the value of such an evaluation and comparison, it would be better to define more objective categories for the causes of accidents and to define systematic scoring procedures to be carried out in the various European countries.

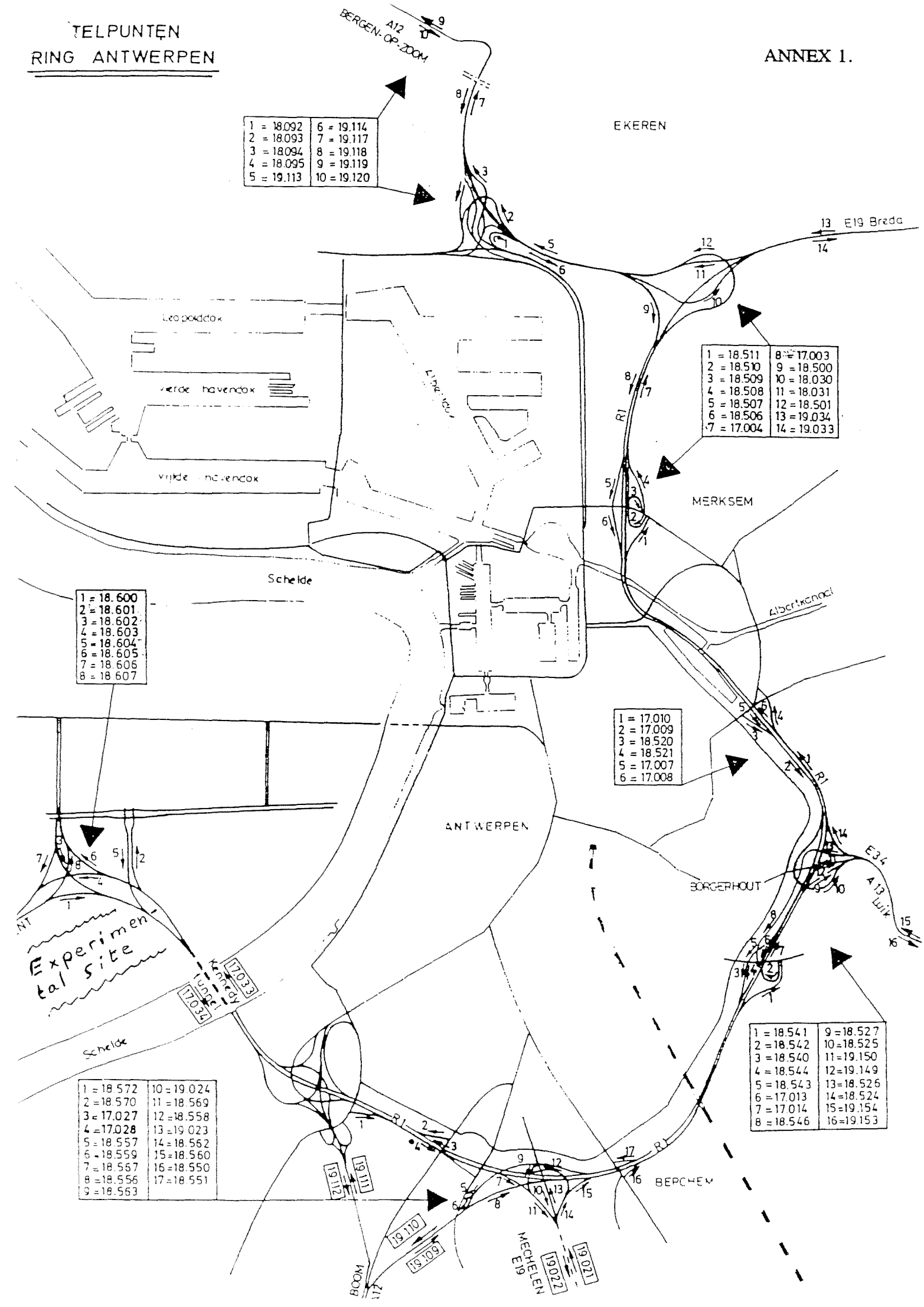
GLOSSARY

accident analysis	traffic safety analysis, based on recorded accidents, to detect the combination of factors that caused the accident
accident review	description of the recorded accidents by type and or cause
accident risk	the expected total loss resulting from expected numbers and types of accidents, for a nation, person, vehicle, route or location. In its simplest form it is measured by using the accident rate
accident rate	(fatality rate, injury rate): the number of accidents (fatalities, injuries) divided by a measure of exposure to risk, such as the number of vehicle kilometres
ATT	Advanced Transport Telematics
behavioural analysis	analysis of road user behaviour, in particular of potentially dangerous behaviour (risky overtaking, close following, cutting in, fast approaches, unexpected or late manoeuvres, swerving etc.).
conflict	the standard international definition is: "a traffic conflict is an observable situation in which two or more road users approach each other in space and time to such an extent that there is a risk of collision if their movements remain unchanged"
design stage	when the architecture of the system is being specified
feasibility stage	when tests can be conducted on usability
implementation stage	when an overall assessment of the safety impact of the system in actual operation can be done
intermediate measure of risk	a measure of potential danger, derived from road user behaviour, in relation to the state of the traffic system and the road user environment
IWS	incident warning system; to warn road users for accidents ahead, congestion or slow driving vehicles, obstacles on the road etc.
man machine interaction	the individual road user's response and adaptation to changes in the man-machine system

prospective analysis	covers all phases of developmental work before actual implementation (on-road trials); thus concerned with the feasibility, design and pre-implementation stages (laboratory and test track)
retrospective evaluation	covers the implementation phase; thus concerned with the more traditional before and after studies of safety impact
'safety philosophy'	the comprehensive knowledge and understanding of all safety related issues that are important for the understanding of what constitute safe and non-safe outcomes
system safety	the reliability of hardware and software
traffic safety	the total safety effects on the man-machine environment system.

TELPUNTEN
RING ANTWERPEN

ANNEX 1.



1 = 18.092	6 = 19.114
2 = 18.093	7 = 19.117
3 = 18.094	8 = 19.118
4 = 18.095	9 = 19.119
5 = 19.113	10 = 19.120

1 = 18.511	8 = 17.003
2 = 18.510	9 = 18.500
3 = 18.509	10 = 18.030
4 = 18.508	11 = 18.031
5 = 18.507	12 = 18.501
6 = 18.506	13 = 19.034
7 = 17.004	14 = 19.033

1 = 18.600	
2 = 18.601	
3 = 18.602	
4 = 18.603	
5 = 18.604	
6 = 18.605	
7 = 18.606	
8 = 18.607	

1 = 17.010	
2 = 17.009	
3 = 18.520	
4 = 18.521	
5 = 17.007	
6 = 17.008	

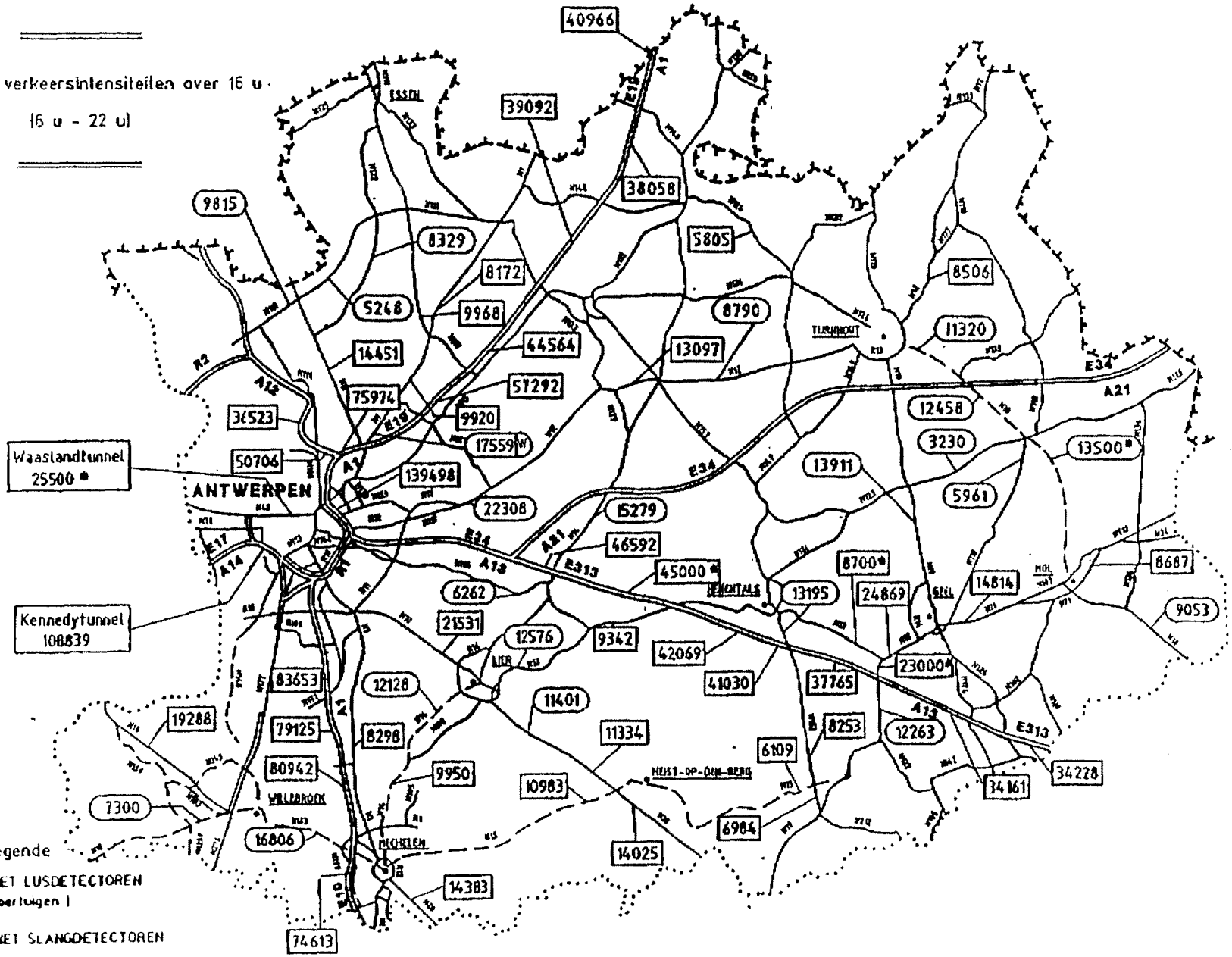
1 = 18.572	10 = 19.024
2 = 18.570	11 = 18.569
3 = 17.027	12 = 18.558
4 = 17.028	13 = 19.023
5 = 18.557	14 = 18.562
6 = 18.559	15 = 18.560
7 = 18.567	16 = 18.550
8 = 18.556	17 = 18.551
9 = 18.563	

1 = 18.541	9 = 18.527
2 = 18.542	10 = 18.525
3 = 18.540	11 = 19.150
4 = 18.544	12 = 19.149
5 = 18.543	13 = 18.526
6 = 17.013	14 = 18.524
7 = 17.014	15 = 19.154
8 = 18.546	16 = 19.153

1993

Gemiddelde verkeersintensiteiten over 16 u

(6 u - 22 u)



Legende

0000 : TELPOST MET LUSDETECTOREN (aantal voertuigen)

000 : TELPOST MET SLANGDETECTOREN (voertuigeenheden)

0000* : GERAAMDE INTENSITEIT

0000 W : BEINVLOED DOOR WERKEN

Example of the accident file for nine accidents, from EURO-TRIANGLE.

GEMEENTE: BRE ST JOB VONGDAT: 13/03/93 VONGUUR: 0610
AANT_DO : 0 AANT_LG: 0 AANT_ZW: 1 ATL_GEK: 0 ATL_PART: 1 GEVOLG: LL
WEG1_NAAM: A1 WEG1_RI : 1 WEG1_PLEK: 46.7 WEER: 1
WEG2_NAAM: WEGDEK: 1 WEG2_PLEK: 0.0 ZICHT: 4
MEMO_VONG: IN SLAAP

GEMEENTE: ZWI BURCHT VONGDAT: 14/03/93 VONGUUR: 0200
AANT_DO : 0 AANT_LG: 0 AANT_ZW: 0 ATL_GEK: 0 ATL_PART: 2 GEVOLG: SS
WEG1_NAAM: A14 WEG1_RI : 1 WEG1_PLEK: 98.1 WEER: 1
WEG2_NAAM: WEGDEK: 1 WEG2_PLEK: 0.0 ZICHT: 4
MEMO_VONG: 2 RIJDT RI GENT EN VERLIEST EEN WIEL WELKE TEGEN 1
BOLT

GEMEENTE: ANTWERPEN VONGDAT: 12/03/93 VONGUUR: 1905
AANT_DO : 0 AANT_LG: 0 AANT_ZW: 0 ATL_GEK: 0 ATL_PART: 1 GEVOLG: SS
WEG1_NAAM: A12 WEG1_RI : 1 WEG1_PLEK: 33.5 WEER: 1
WEG2_NAAM: WEGDEK: 1 WEG2_PLEK: 0.0 ZICHT: 4
MEMO_VONG: OP SPLITSING GEREDEN-GEINTOXICEERD

GEMEENTE: WOMMELGEM VONGDAT: 12/03/93 VONGUUR: 0900
AANT_DO : 0 AANT_LG: 0 AANT_ZW: 0 ATL_GEK: 0 ATL_PART: 1 GEVOLG: SS
WEG1_NAAM: A13 WEG1_RI : 1 WEG1_PLEK: 5.9 WEER: 1
WEG2_NAAM: WEGDEK: 1 WEG2_PLEK: 0.0 ZICHT: 1
MEMO_VONG: AANHANGWAGEN BEGINT TE SLINGEREN EN IN GRACHT

GEMEENTE: ANT DEURNE VONGDAT: 10/03/93 VONGUUR: 0815
AANT_DO : 0 AANT_LG: 0 AANT_ZW: 0 ATL_GEK: 0 ATL_PART: 2 GEVOLG: SS
WEG1_NAAM: A13 WEG1_RI : 2 WEG1_PLEK: 0.8 WEER: 1
WEG2_NAAM: WEGDEK: 1 WEG2_PLEK: 0.0 ZICHT: 1
MEMO_VONG: 2 REMT VOOR FILE 1 OP2

GEMEENTE: AARTSELAAR VONGDAT: 09/03/93 VONGUUR: 1650
AANT_DO : 0 AANT_LG: 0 AANT_ZW: 0 ATL_GEK: 0 ATL_PART: 2 GEVOLG: SS
WEG1_NAAM: A12 WEG1_RI : 1 WEG1_PLEK: 29.4 WEER: 1
WEG2_NAAM: CLEIDAALLAAN WEGDEK: 1 WEG2_PLEK: 0.0 ZICHT: 1
MEMO_VONG: BEIDEN KOMEN UIT DEZELFDE RICHTING EN STAAN NAAST
ELKAAR OPKRUISPUNT WAAR ZIJ SAMEN DEZELFDE
RICHTING AFSLAAN -ZIJDELINGSE AANRIJDING

GEMEENTE: ANT WILRIJK VONGDAT: 09/03/93 VONGUUR: 0650
AANT_DO : 0 AANT_LG: 0 AANT_ZW: 0 ATL_GEK: 0 ATL_PART: 1 GEVOLG: SS
WEG1_NAAM: A12 WEG1_RI : 1 WEG1_PLEK: 33.8 WEER: 1
WEG2_NAAM: WEGDEK: 1 WEG2_PLEK: 0.0 ZICHT: 4
MEMO_VONG: VERMOEDELIJK TE SNEL IN BOCHT IN TUNNEK

GEMEENTE: ANT DEURNE VONGDAT: 06/03/93 VONGUUR: 2012
AANT_DO : 0 AANT_LG: 0 AANT_ZW: 0 ATL_GEK: 0 ATL_PART: 1 GEVOLG: SS
WEG1_NAAM: A13 WEG1_RI : 2 WEG1_PLEK: 2.0 WEER: 1
WEG2_NAAM: WEGDEK: 1 WEG2_PLEK: 0.0 ZICHT: 4
MEMO_VONG: KONTROLEVERLIES IN BOCHT

GEMEENTE: WOMMELGEM VONGDAT: 06/03/93 VONGUUR: 0155
AANT_DO : 1 AANT_LG: 0 AANT_ZW: 0 ATL_GEK: 0 ATL_PART: 1 GEVOLG: LL
WEG1_NAAM: A13 WEG1_RI : 1 WEG1_PLEK: 5.4 WEER: 2
WEG2_NAAM: WEGDEK: 3 WEG2_PLEK: 0.0 ZICHT: 4
MEMO_VONG: HAALT VTG RECHTS IN DAN VOLGENDE VTG LINKS EN
SLIPT TOLT ROND EN KOMT TEGEN BOOM TERECHT

BETONPAAL.

47 - Vrachtauto 1 verliest deel van de lading (kiezelstenen). Enkele hiervan komen terecht op voertuigen 2 en 3.

48 - VW VERANDERT VAN RIJSTROOK TEGEN PW

49 - BESTUURDER AUTO DUB GEBR WORDT VERRAST DOOR EEN TAK OP DE RIJBAAN .BIJ HET REMMEN SLIPT EN BOTST HET VOERTUIG TEGEN EEN TRACTOR OPLEGGER

50 - VOLGENS BESTUURDER TWEE WIJKT EERSTE BESTUURDER UIT VAN DE MIDDENSTE NAAR DE LINKERRIJSTROOK MOET HIERVOOR HEVIG AFREMMEN EEN BEETJE VERDER DIENT EERSTE BESTUURDER TERUG HEVIG AF TE REMMEN LUKT ER NIET MEER IN OM TE STOPPEN RIJDT ACHTEROP VOORGANGER.

51 - Lek aan carburator veroorzakt brand van vtg.

52 - BESTUURDER 1 VERKLAART DAT BESTUURDER 2 ZOU AFGEWEKEN ZIJN VAN ZIJN RIJSTROOK,HIJ DIENDE HIERDOOR UIT TE WIJKEN SLIPTE DRAAIDE ROND EN BOTSTE TEGEN DE VANGRAILS.BESTUURDER 2 VERKLAART DAT HIJ NIET IS AFGEWEKEN DOCH BESTUURDER 1 GESLIPT IS?????

53 - geslipt op mazout dewelke op rijbaan lag

54 - porsche reed te snel(140 km) voorligger vrachtauto aanhangwagen reed in de uitertst linkse rijstrook t.g.v. voorgaand ongeval.porsche reed achter op de aanhangwagen.

55 - partij 1 vertrekt vanuit stilstand van de pechstrook op de onverlichte E17, partij 2 rijdt 1 achteraan aan, vtg van 1 totaal verhakkeld; geleed vtg van 2 belandt in middenberm en richt aanzienlijke schade aan O.D. aan; partij 3 welke aan komt gereden schrikt hiervan, remt vrij hevig én wordt vrijwel onmiddellijk door z'n achterligger, partij 4, achteraan aangereden.

56 - PW RIJDT IN OP VRACHTWAGEN

57 - KONTROLEVERLIES BIJ UITWIJKEN BIJ INHAALBEWEGING

58 - BESTUURDER WIL DE E17 OPRIJDEN RICHTING ANTWERPEN EN WORDT NAAR ZIJN ZEGGEN GEHINDERD DOOR EEN VRACHTAUTO DIE DE UITRIT ST NIKLAAS WIL NEMEN. HIERDOOR MOET HIJ UIWIJKEN NAAR RECHTS EN KOMT IN AANRIJDING MET DE BETONNEN PAAL NAAST DE RIJBAAN.

59 - OP RECHTERRIJSTROOK RIJDT EEN TREKKER MET OPLEGGER AAN 80 KM PER UUR. ERNAAST OP DE MIDDENRIJSTROOK RIJDT EEN MINIBUS .EVENEENS OP DEZE RIJSTROOK NADERT EEN PW SAAB. DE BEST.V.D. SAAB MERKT TELAAT DE MINIBUS EN RAAKT DEZE NOG TIJDENS HET UITWIJKEN LIN?KS ACHTER. DE BESTUURDER VAN DE SAAB VERLIEST DAN DE KONTROLE OVER HET STUUR EN KOMT IN AANRIJDING MET DE VANGRAILS LINKS VAN DE BAAN. DE MINIBUS KOMT DAN IN AANRIJDING MET DE RECHTS RIJDENDE TRAKTOT MET OPLEGGER.

Detailed information available in the EURO-TRIANGLE project for a representative sample of accidents, with an english translation.

47. Truck 1 looses part of the load (small stones). Some of these fell on car 2 and 3.

48. VW (truck) changes lanes and (collapses) against PW (car).

49. Driver car "DUB GEBR" is surprised by a branch on the road. While braking, the car is skidding and hits a truck with trailer.

50. According to driver two, driver one changed to the left lane; he has to break violently; a bit further driver one has to break fiercly, it is not possible (for driver one or two?) to stop and he hits the car in front.

51. Leaking carburator causes a fire.

52. Driver 1 declares that driver 2 changed lanes, he had to swerve, was skidding and hit a gardrail. Driver 2 declares that he did not change lanes, but driver 1 just was skidding???

53. Skidding of "mazout"on the lane.

54. Porche drove too fast (140 km); truck with trailer in front drove on most left lane because of accident that thad taken place in front. Porche hit trailer from behind.

55. Party 1 starts after he stood still on the emergency lane at the not-illuminated E17, party 2 hits 1 from behind; car 1 "totaal verhakkeld" (total loss); combination 2 damages the O.D. (mid-rail?) seriously; party 3 is frighted, brakes severely and is immediately hit from behind by car 4.

56. Car drives into truck.

57. Loss of control, while changing lanes at overtaking manoeuvre.

58. Driver wants to enter the E17in the direction of Antwerp and is, according to him, hindered by a truck that want to take tke exit to St. Niklaas. Therefore, he has to move to the right and hits a concrete pole besides the road.

59. A truck with trailer drives at the right lane with 80 KM. Besides him drives a minibus and behind him a Saab. The driver of the saab notices the minibus too late and hits him, while moving to the left. The Saab-driver looses control and hits the gardrail at the left. The minibus hits the truch with trailer to the right of him.

CAM Nº REG ANO

BRISA, AUTO-ESTRADAS DE PORTUGAL, SA

BOLETIM ESTATÍSTICO DE ACIDENTES

Nº DE BOLETINS UTILIZADOS NESTE ACIDENTE

A

A.1 - PARTICIPANTES

.1 ☐ VIA S.O.S.
.2 ☐ VIA VIATURA BRISA
.3 ☐ VIA GNR/BT
.4 ☐ VIA PORTAGEM
.5 ☐ OUTROS (QUAL?) .....

A.2 - DATA E HORA DO ACIDENTE

ANO MES DIA

HORA MIN.

A.3 - LOCALIZAÇÃO

.1 AUTO-ESTRADA A ☐
.2 Km
.3 SENTIDO
1 ☐ N/S OU E/O
2 ☐ S/N OU O/E
.4 VIA
1 ☐ ESQUERDA
2 ☐ CENTRAL
3 ☐ DIREITA
4 ☐ LENTOS
.5 ZONA
1 ☐ SECÇÃO CORRENTE
2 ☐ NÓ (ACESSOS)
3 ☐ PORTAGEM
4 ☐ ÁREA SERVIÇO/ REPOUSO

CÓDIGO DEU

B - VEÍCULOS INTERVENIENTES

B.1 - NÚMERO TOTAL DE VEÍCULOS INTERVENIENTES NO ACIDENTE

B.2 - IDENTIFICAÇÃO

CATEGORIA (*)	MARCA	MODELO	MATRÍCULA	PAÍS
A ☐				
B ☐				
C ☐				
D ☐				

(*) M - MOTO; L - LIGEIRO; P - PESADO; A - ARTICULADO

C - CONSEQUÊNCIAS

COD DEU

C.1 - ☐ ACIDENTE COM VÍTIMAS

	A	B	C	D	TOT
1 MORTOS	☐	☐	☐	☐	☐
2 FERIDOS GRAVES	☐	☐	☐	☐	☐
3 FERIDOS LEVES	☐	☐	☐	☐	☐

C.2 - ☐ ACIDENTES SÓ COM DANOS MATERIAIS

D - CAUSAS DO ACIDENTE

D.1 - CONDUTOR
- QUEBRA DE ATENÇÃO

1 ☐ SONOLÊNCIA
2 ☐ ALCOLÉMIA
3 ☐ DOENÇA
4 ☐ DISTRAÇÃO

- DESRESPEITO DA SINALIZAÇÃO

5 ☐ INCUMPRIMENTO DA SINALIZAÇÃO
6 ☐ EXCESSO DE VELOCIDADE
7 ☐ REGRA DE CIRCULAÇÃO

D.2 - VEÍCULO

1 ☐ AVARIA MECÂNICA
2 ☐ REBENTAMENTO DE PNEU

D.3 - INFRAESTRUTURAS

1 ☐ OBSTÁCULO NA VIA
2 ☐ DEFICIÊNCIA DO PISO
3 ☐ GELO, GEADA OU NEVE
4 ☐ GRAVILHA OU AREIA
5 ☐ ÓLEO

D.4 - OUTRAS (QUAL?) .....

CÓDIGO DEU

E - NATUREZA DO ACIDENTE

E.1 - COLISÃO ENTRE VEÍCULOS

1 ☐ TRASEIRA
2 ☐ LATERAL
3 ☐ FRONTAL
4 ☐ CHOQUE EM CADEIA

E.2 - COLISÃO COM OBSTÁCULOS FORA DA FAIXA DE RODAGEM

1 ☐ GUARDAS DE SEGURANÇA
2 ☐ SINALIZAÇÃO
3 ☐ VEÍCULO PARADO NA BERMA
4 ☐ OUTROS (QUAL?) .....

E.3 - ☐ CAPOTAMENTO

E.4 - ☐ INCÊNDIO

E.5 - ☐ ATROPELAMENTO

E.6 - ☐ DESPISTE

E.7 - ☐ OUTRA (QUAL?) .....

CÓDIGO DEU

F - CIRCUNSTÂNCIAS EXTERNAS

COD DEU

F.1 - ESTADO DO PISO

1 ☐ SECO E LIMPO
2 ☐ MOLHADO
3 ☐ COM GELO, GEADA OU NEVE
4 ☐ COM GRAVILHA OU AREIA
5 ☐ COM ÓLEO
6 ☐ OUTRAS (QUAIS?) .....

F.2 - LUMINOSIDADE

1 ☐ PLENO DIA
2 ☐ CREPÚSCULO OU AURORA
3 ☐ SOL ENCANDEANTE
4 ☐ ZONA COM ILUMINAÇÃO
5 ☐ NOITE ESCURA
6 ☐ NOITE COM LUAR

F.3 - FACTORES ATMOSFÉRICOS

1 ☐ BOM TEMPO
.2 ☐ CHUVA
3 ☐ VENTO FORTE
4 ☐ NEVOEIRO
5 ☐ GRANIZO
6 ☐ NEVANDO

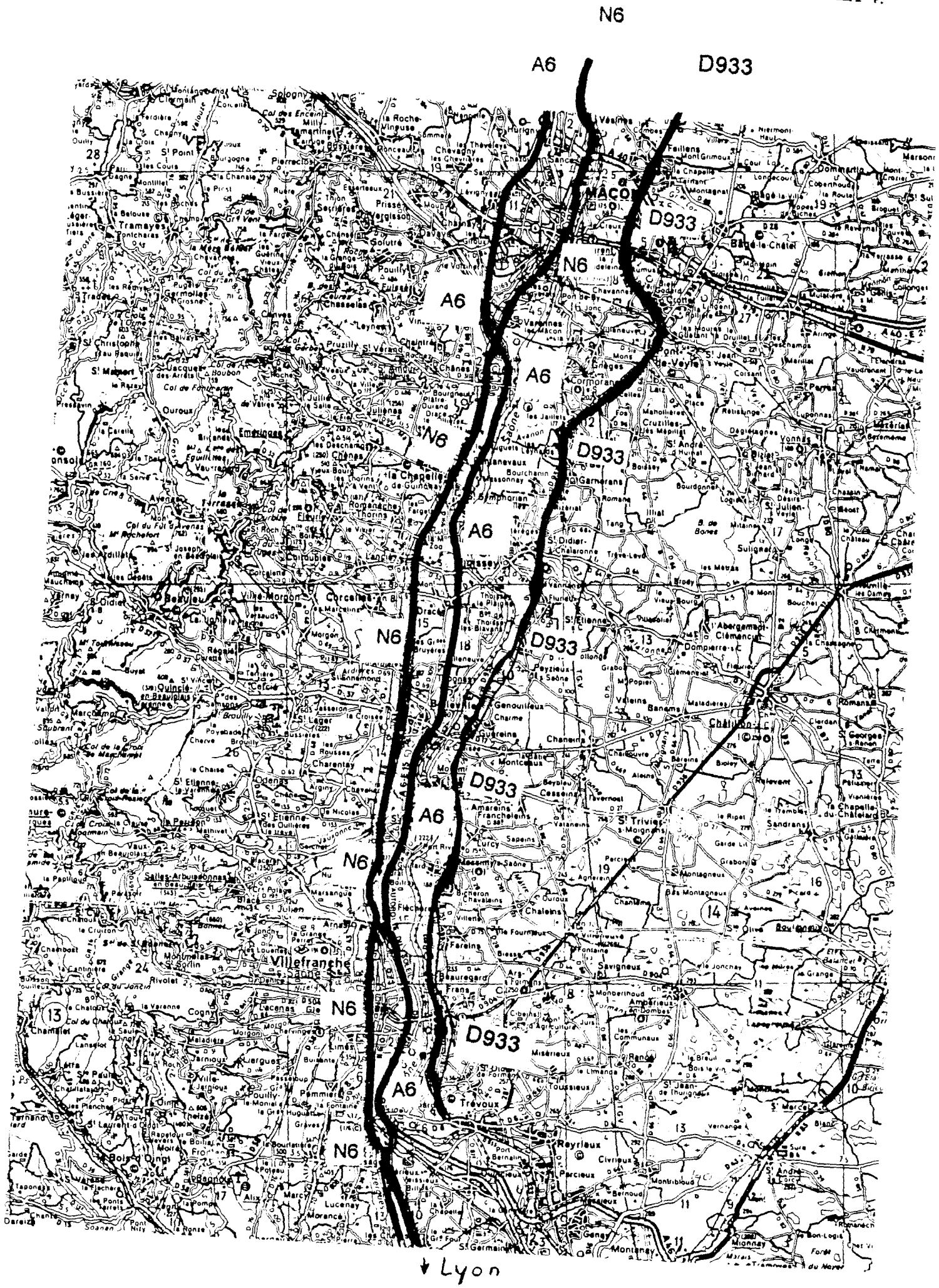
ANNEX 3.

BRISA - MOD. 50

AE 1	KM	SENTIDO 2	DATA 3	Meteorologia 4	Visibilidade 5	Estado do piso 6	Tipo 7	Causas 8	Mortos 9	Nº Feridos 10 graves 11	ligeiros 12
1	9.30	S	02/04/93	F31	F21	F11	E6	D4	0	0	0
1	14.00	S	11/04/93	F32	F21	F12	E6	D4	0	0	0
1	3.20	S	24/04/93	F32	F22	F12	E6	D16	0	0	1
1	3.00	S	25/04/93	F33	F21	F12	E12	D17	0	0	3
1	3.10	S	28/04/93	F32	F21	F12	E6	D16	0	0	0
1	10.50	S	07/05/93	F31	F21	F11	E6	D22	0	3	0
1	11.40	S	17/05/93	F31	F21	F11	E6	D12	0	0	1
1	3.00	S	23/05/93	F32	F21	F12	E6	D4	0	1	0
1	6.30	S	24/05/93	F32	F21	F12	E6	D16	0	0	0
1	3.00	S	24/05/93	F32	F21	F12	E6	D4	0	2	0
1	3.00	S	25/05/93	F32	F21	F12	E6	D16	0	0	0
1	3.00	S	26/05/93	F32	F21	F12	E12	D4	0	0	1
1	12.30	S	20/06/93	F31	F25	F11	E6	D4	0	0	0
1	8.50	S	25/07/93	F31	F21	F11	E6	D22	0	0	0
1	11.05	S	06/08/93	F31	F21	F11	E21	D22	0	0	0
1	4.30	S	19/08/93	F31	F21	F11	E6	D16	0	0	0
1	2.60	S	05/09/93	F31	F21	F11	E6	D4	0	0	1
1	3.00	S	16/09/93	F32	F21	F12	E6	D16	0	0	0
1	2.98	S	24/09/93	F31	F21	F11	E24	D14	0	1	0
1	10.80	S	28/09/93	F31	F21	F11	E3	D16	0	0	1
1	10.60	S	10/10/93	F32	F21	F12	E6	D16	0	0	0
1	10.50	S	11/10/93	F32	F21	F12	E6	D16	0	1	0
1	11.40	S	15/10/93	F32	F22	F12	E6	D16	0	0	0
									0	8	8

1. Highway
2. Direction
3. Date
4. Meteorology
5. Visibility
6. Condition of the pavement
7. Type
8. Reason
9. Dead
10. Number of injured people
11. Serious
12. Lights

ANNEX 4.



Description of accident causes and relevant categories for scoring for the PORTICO data.

D - CAUSES OF THE ACCIDENT

D1. Conductor
D14. Inattention
D16. Immoderation velocity
D17. Circulation rule

D2. Vehicle
D21. Mechanic average
D22. Tyre blowing

D3. Structures
D31. Obstacle on the way
D34. Sand

D4. Others

E - NATURE OF THE ACCIDENT

E1. Crash among vehicles
E11. Rear
E12. Lateral
E13. Frontal
E14. Succession

E2. Crash with obstacles outside of the road
E21. Rails protection
E24. Others

E3. Overturned

E6 - Without translation

F - EXTERIOR CIRCUMSTANCES

F1. Condition of the pavement
F11. Dry and clear
F12. Wet

F2. Luminosity
F21. Plenary day
F22. Crepuscle or aurora
F25. Dark night
F26. Night with moonlight

F3. Atmospherics agents
F31. Good weather
F32. Rain
F33. Buster

FICHIER ACCIDENTS

CARACTERISTIQUES

LUMIERE
1 PLEIN JOUR
3 CREPUSCULE OU AUBE
3 NUIT SANS ECLAIRAGE PUBLIC
NUIT AVEC ECLAIRAGE PUBLIC
4 - NON ALLUME
5 ALLUME

ORGANISME
1 GENDARMERIE NATIONALE
2 POLICE NATIONALE
3 C R S
4 PREFECTURE DE POLICE
5 P A F

JOUR
1 LUNDI
2 MARDI
3 MERCREDI
4 JEUDI
5 VENDREDI
6 SAMEDI
7 DIMANCHE
8 VEILLE DE FETE
9 FETE

CAUSE PRESUMEE

USAGER

01 INFRACTION PN
02 MALAISE - FATIGUE
03 INFIRMITE CORRIGEE
04 INFIRMITE NON CORRIGEE
INFIRMITE SENSORIELLE
06 - CORRIGEE GN
06 - NON CORRIGEE GN
07 AUTRE INFIRMITE GN
08 IVRESSE
09 MEDICAMENT - DROGUE GN
10 MAN USA NON IDENTIFIEE PN
11 VITESSE GN
12 STATIONNEMENT GN
18 AUTRE CAUSE GN

VEHICULE

20 FREINS PN
21 PNEUS PN
22 MECANIQUE

88 CAUSE FORTUITE PN
99 CAUSE INDETERMINEE

23 ECLAIRAGE - SIGNALISATION
24 CHARGEMENT GN
26 DEPLACEMENT GN
28 CARAVANE EN LACETS GN
29 PNEU USE GN
30 ECLATEMENT PNEU GN
38 AUTRE CAUSE GN

VOIRIE ET AUTRE

40 CHAUSSEE GLISSANTE
41 ROUTE DEFORMEE MAUVAIS ETAT DU REVET
42 ROUTE ENCOMBREE GN
43 SIGNALISAT INADAPTEE
44 MANQUE DE VISIBILITE
46 STAT GENANT LA VISIBILITE PN
48 MAUVAISE COND ATMOSPH
47 ANIMAL ERRANT GN
88 AUTRE CAUSE VOIRIE GN

TYPE DE COLLISION
1 FRONTALE
2 PAR L ARRIERE
3 EN CHAINE
4 PAR LE COTE
OBSTACLE FIXE
5 - AVEC SORTIE DE CHAUSSEE
6 - SANS SORTIE DE CHAUSSEE
7 SANS COLLISION PN
8 AUTRE

CONDITION ATMOSPHERIQUE
1 NORMALE
2 PLUIE LEGERE
3 PLUIE FORTE
4 NEIGE - GRELE
5 BROUILLARD
6 VENT FORT
7 TEMPETE
8 TEMPS EBLOUISS.
9 TEMPS COUVERT

INTERSECTION
1 HORS INTERSECTION
2 A PROXIMITE IMMEDIATE PN
3 EN X
4 EN T
5 EN Y
6 A + DE 4 BRANCHES
7 PASSAGE A NIVEAU GN
8 AUTRE

AGGLOMERATION
1 HORS AGGLOMERATION
2 1 A 2 000 HAB
3 2 001 A 5 000 HAB
4 5 001 A 20 000 HAB
5 20 001 A 50 000 HAB
6 50 001 A 100 000 HAB
7 100 001 A 200 000 HAB
8 + DE 200 000 HAB

1	N° DEPART 2	ORGANISME 5	N° DE PROCES VERBAL CODE UNITE 6 — N° P.V 11	DATE AN 18 — MOIS 20 — JOUR 22	HEURE HEURE 24 — MIN 26	28	29	CAUSE PRESUMEE 30	TYPE DE COLLISION 32	33	INTERSECTION 34	N° COMM INSEE 35	38	39

LIEUX

CATEGORIE ADMIN
1 AUTOROUTE
2 BRETELLE D AUT
3 ROUTE EXPRESS
4 R N
5 C D
6 C C
7 HORS RESEAU PUBL ZONE RESERV P A F PARKING OUVERT A
8 LA CIRC PUBLIQUE OU ZONE PUBL P A F
9 AUTRE

LOCALISAT
0 N° ROUTE
1 FINATO
2 CODE SPEC.

CLASSE DE LARGEUR DE LA ROUTE

Nbre VOIES	LARG	SEPARES	Nbre VOIES	LARG	2 SENS	PN SENS UNIQ	PN SENS VAR
2=2	< 14m	01	≤ 02	≤ 6m	10	11	12
2=2	≥ 14m	02	≤ 02	6 < et < 7m	20	21	22
2=3	< 21m	03	≤ 02	≥ 7m	30	31	32
2=3	≥ 21m	04	= 03	< 10m60	40	41	42
2=4	< 28m	05	= 03	≥ 10m60	50	51	52
2=4	≥ 28m	06	= 04	< 14m	60	61	62
> 2=4	INDIFF	07	= 04	≥ 14m	70	71	72
			> 04	INDIFF	80	81	82

TRACE EN PLAN - GN
1 PARTIE RECTILIGNE
ENTREE DE COURBE
2 - A DROITE
3 - A GAUCHE
4 EN COURBE A DROITE
5 EN COURBE A GAUCHE
SORTIE DE COURBE
6 - A DROITE
7 - A GAUCHE
8 DANS UN S
9 ETRANGLEMENT

ETAT DE LA SURFACE
1 NORMALE
2 MOUILLEE
3 ENNEIGEE
4 BOUE
5 VERGLAS
6 CORPS GRAS - HUILE
7 GRAVILLONS EPARS
8 DEFORMEE
9 AUTRE

SIGNALISATION
01 SIGNAUX A BRAS DE POLICE
02 FEUX TRICOLORES EN FONCT.
03 STOP
04 CEDEZ LE PASSAGE
06 PRIORITE A DROITE
06 FEUX JAUNES CLIGN EN FONCT OU FEUX TRICOLORES EN PANNE
07 CHANTIER
08 PASSAGE A NIVEAU
09 ARRET DE BUS
10 SORTIE D ECOLE
11 LIMITATION DE VITESSE
12 BALISAGE ACCIDENT PN
13 AUTRE BALISAGE PN
14 SENS INTERDIT GN
INTERDICTION :
15 - DE DEPASSER POUR V.L. GN
16 - DE DEPASSER POUR P.L. GN
17 - DE TOURNER A DROITE GN
18 - DE TOURNER A GAUCHE GN
19 - DE FAIRE DEMI-TOUR GN
20 CARREFOUR PRIORITAIRE GN
21 ROUTE PRIORITAIRE GN
23 PANNEAU VIRAGE GN
24 PASSAGE PIETON GN

OUVRAGE D'ART - PN -
1 SOUTERRAIN - TUNNEL
2 PONT - AUTOPONT
3 PASSAGE A NIVEAU
4 ECHANGEUR-DIFFUSEUR
5 VOIE TRAMWAY
6 PARC DE STATIONNEMENT PUBLIC DE SURFACE

CODE ROUTE 40 — CAT FONCT 1 G C 2 AUTRE 41 — 42

CODE BLANC SI PAS D IND LETTRE INDICE A B C ETC
0 PAS D INDICE 2 BIS 3 TER ETC
N° DE ROUTE 43 44 — 49 50

REPERAGE
0 P R
1 ADRESSE
2 CODE SPECIAL
POINT - REPERE km 51 52 — m 55 56

60

PROF. EN LONG - GN
1 PLAT
2 MONTEE
3 DESCENTE
4 SOM DE COTE
5 BAS DE DESC.

62 — 63

64

LARG. DU T.P.C.
1 0,1 ≤ TPC < 1,6m
2 1,6 ≤ TPC < 2m
3 2 ≤ TPC < 3m
4 3 ≤ TPC < 6m
5 6 ≤ TPC < 7m
6 7 ≤ TPC < 12m
7 TPC > 12m

65

PISTE CYCLABLE
1 NON
2 OUI : UNIDIRECTIONN. PN
3 OUI : BIDIRECTIONN PN
4 OUI : BANDE CYCLABLE

66 — 67

ACCIDENT SUR AUTOROUTE OU SUR ROUTE A CHAUSSÉES SÉPARÉES - PN
1 ACC. SUR CHAUSSEE
2 ACC. SUR B.A.U.
SENS DU P R
1 - CROISSANT
2 - DECROISSANT

69 — 70 — 71 — 72

74 — 75 — 76 — 77 — 78 — 83 84 — 85 — 86 — 94 — 96 — 97 — 98 — 99 — 100 — 101 — 103 — 104 — 105 — 108

VEHICULES

CATEGORIE
11 BICYCLETTE
12 CYCLOMOTEUR
13 VELOMOTEUR
14 MOTOCYCLETTE
16 MOT 1 / 17 MOT 2 / 18 MOT 3 APRES 1 03 80
20 V.L
30 V.L.+CARAV OU REM
31 CAMIONNETTE < 3,5T
40 V.U PTC > 3,5T
41 TRACTEUR ROUTIER
42 V.U. + REMORQUE
43 T.R. + SEMI REM
50 TRANSP EN COM
60 ENGIN SPECIAL
61 TRACT AGRICOLE
63 AUTRE

VEH SPEC - PN
1 TAXI
2 AMBULANCE A P
3 AMBULANCE PRIVEE
4 POMPIERS
5 POLICE
6 TRANSP EXCEPT
7 MATIERES DANG
8 MILITAIRES

PARTIE HEURTEE
1 AVANT
2 AVANT DROIT
3 AVANT GAUCHE
4 ARRIERE
5 ARRIERE DROIT
6 ARRIERE GAUCHE
7 COTE DROIT
8 COTE GAUCHE
9 ETAT D EPAVE DESSUS DESSOUS

MANŒUVRE AVANT L'ACCIDENT
CIRCULANT
01 - SANS CHANGER DE DIREC.
02 - MEME SENS MEME FILE
03 - EN MARCHE ARRIERE
04 SUR PISTE CYCLABLE PN
05 SUR BANDE CYCLABLE PN
DANS UN COULOIR BUS
06 - A CONTRE SENS PN
07 - MEME SENS PN
08 EN ZONE PIETONNE PN
09 ARRETE (AUT QUE STAT)
10 EN STATIONNEMENT
11 FRANCHISSEMENT T P C
12 ENTRANT SUR CHAUSSEE APRES STAT-HORS CHAUS DEPASSANT
13 - A GAUCHE
14 - A DROITE
16 CHANG DE FILE EN 3+POS GN
CHANG DE FILE PN
SE RABATTANT
16 - A GAUCHE
17 - A DROITE
DOUBLANT EN CONT OBST
18 - A GAUCHE
19 - A DROITE
TOUR EN DOUBL PAR COTE OPPOSE
20 - A GAUCHE
21 - A DROITE
TOURNANT NORMALEMENT
22 - A GAUCHE
23 - A DROITE
24 DEMI-TOUR SUR CHAUSS
25 TRAVERSANT LA CHAUSS
26 MANŒUVRE DE STAT PN
27 OUVERTURE DE PORTE PN
28 SANS CONDUCTEUR PN
29 AUTRE

PRINCIPAL OBSTACLE FIXE HEURTE
01 BATIMENT MUR OU PILE DE PONT GLISSIERE
02 - SECTION COURANTE GN
03 - EXTREMITE GN
GLISSIERE METALLIQUE
04 - SECTION COURANTE PN
05 - EXTREMITE PN
GLISSIERE BETON
06 - SECTION COURANTE PN
07 - EXTREMITE PN
PROTECTION BORDURE
08 - CHAUSSEE
09 - PONT
10 BORDURE TROTTOIR PN
11 ILOT OU REFUGE PIETON
12 ARBRE
13 PANNEAU DE SIGNALIS
14 PIED DE PORTIQUE
15 CANDELABRE
16 BORNE DE SIGNALISAT
17 BORNE D'APPEL D URG.
18 POTEAU EDF-PTT
19 POTEAU PARCMETRE PN
20 AUTRE POTEAU PN
21 VEHICULE GN
22 2 ROUES PN
23 V.L PN
24 P.L PN
AUTRE OBSTACLE :
25 - SUR CHAUSSEE
26 - SUR TROTTOIR PN
27 PASSAGE A NIVEAU PN
28 SORTIE DE CHAUSSEE SANS OBSTACLE GN
29 AUTRE

OBSTACLE MOBILE
1 PIETON
2 2 ROUES PN
3 V.L PN
V.EH GN
4 P.L PN
5 ANIMAL PN
6 T.C. PN
7 TRAIN
8 AUT VEH S RAIL PN
9 AUTRE

IMMATRICULAT
1 LOCAL
2 NON LOCAL
3 ETRANGER
4 AUTRE

ECLAIRAGE - PN
1 IGNORE
2 FEUX ETEINTS FEUX ALLUM. :
3 - POSITION
4 - CROISEM
5 - ROUTE
6 - DETRESSE
7 - SPECIAUX
9 - AUTRE

INFRACTION - PN

LETTRE VEHIC 108 — 109 — SENS DE CIRCUL SENS P R 1 - CROISS 2 - DECR 113 — 114 — CODE ROUTE 112 — 133 — 134 — 136 — 137 — 138 — 139 — 158 — 159 — 161 — 162 — 163 — 164 — 116 — 140 — 166 — 117 — 142 — 167 — 119 — 144 — 169 — 120 — 146 — 170 — 121 — 146 — 171 — 122 — 147 — 172 — 126 — 160 — 175 — 127 — 162 — 177

ANNEX 5.