THE TRAUTENFELS STUDY

A diagnosis of road safety using the Dutch conflict observation technique DOCTOR

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ABSTRACT

Under the auspices of the ICTCT (International Committee on Traffic Conflicts Techniques) an international calibration study was conducted at a signalized rural intersection at Trautenfels, Austria. Six teams recorded traffic conflicts simultaneously. On behalf of both the sponsors of this study (BASt, BRD and KfV, Austria) a traffic safety diagnosis was carried out on the basis of conflicts (scored by the Dutch team) and limited accident figures. Several recommendations were made for improving the intersection.

The Dutch version of this report is published by the Institute for Perception TNO (Van der Horst & Kraay, 1985).

CONTENTS

1. INTRODUCTION

A joint road safety study by the Bundesanstalt für Strassenwesen (BASt), Federal Republic of Germany, and the Kuratorium für Verkehrssicherheit (KfV), Austria, was conducted on some transit tourist routes. The study was organised as a result of earlier research which indicated that foreign road-users in particular were involved in accidents on these routes.

The ICTCT (International Committee on Traffic Conflicts Techniques) was consulted on the question of whether members could participate in the study. Finally three teams, each using its own technique, carried out complete 'before' and 'after' surveys at two of the twelve research locations (selected on the basis of accidents data), from Austria, Sweden and Finland respectively. The purpose of this was (a) to make a diagnosis on the basis of a 'before' survey, (b) to recommend countermeasures and (c) to evaluate the measures implemented. The measures were on a very modest scale. The 'after' survey offered the ICTCT an oppertunity to carry out a calibration study at an intersection in a rural area; in addition to the three countries mentioned above, conflict observation teams from France, the United States and the Netherlands took part in this. An Israelian team examined some behavioural aspects separately. Each of the six teams was asked, after the field surveys was completed, to make a diagnosis of the traffic situation at the intersection (for the 'after' situation only) and formulate recommendations for improvements on the basis of its own findings.

This report gives an assessment of the traffic situation itself; it does not consider the original research topic concerning foreign road users. This section is not connected with the calibration study proper, the results of which will be published separately.

2. DESIGN AND IMPLEMENTATION OF THE CALIBRATION STUDY

The ICTCT carried out an initial calibration study in 1983 at three intersections in Malmö, Sweden. A report of this study can be found in Grayson (ed.) (1984). It was considered worthwhile to recalibrate the various techniques for a totally different situation, e.g. a rural intersection. The purpose of this calibration study was twofold:

a. to compare the observation data of the six teams taking part in terms of similarities and differences in the scoring of conflicts and their seriousness;

b. to compare the observation data with objective data obtained from quantitative analysis using video.

Each team was additionally asked to make a diagnosis of the traffic situation at the Trautenfels intersection on the basis of its own conflict data and, if possible, to make recommendations for improvements. A brief description of the Trautenfels intersection is given in Appendix A.

Each team had at least two observers to carry out the observations, and was free to choose where to station them. It was not possible to conceal all the observers entirely; the local situation, with a car park next to a filling station in the immediate vicinity of the intersection and some adjoining buildings, gave no grounds for the assumption that the presence of the observers in any way influenced the traffic behaviour of passing road users.

All the teams observed simultaneously, at the same times. They used a standard observation form (Appendix B). The Dutch team transferred the relevant data from their own observation forms (Appendix C) to the standard form after each observation period.

For the purpose of comparison for the calibration study, the observation forms were collected at the end of each morning and evening and clearly labelled. Each situation scored was identified on video and given its own number. All the labelled situations will be collected on a single video tape for further analyses by each team. The results given here relate solely to the conflict observations carried out on the spot by the observers from the Dutch team.

3. THE DUTCH CONFLICT OBSERVATION TECHNIQUE "DOCTOR"

During the past year the Institute for Road Safety Research SWOV and the Institute for Perception TNO (IZF-TNO) have jointly developed a conflict observation technique, which have been given the name DOCTOR (Dutch Objective Conflict Technique for Operation and Research). It was developed making extensive use of knowledge obtained from the international calibration study at Malmö (Grayson (ed.), 1984) and extensive behavioural observations and video-aided analyses by IZF-TNO (Van der Horst et al., 1981, 1984). A conflict observation technique was previously developed in the Netherlands by the Dutch Institute for Preventive Health Care TNO (Güttinger, 1980), this mainly involved "shadow observations" (following and observing pedestrians).
DOCTOR was first used in practice in the Trautenfels study. A specimen DOCTOR observation form is shown in Appendix C.
This Dutch technique differs from most other techniques because in determining the seriousness of a conflict the danger of a collision as well as the risk of injury play a part. A brief description of DOCTOR is given here; more detailed information can be found in Kraay et al. (1986).
The seriousness of the conflict has a scale of 1 to 5 varying from a minor conflict to a very grave one. In case of an observed conflict the observer is requested to give an overall impression with a rating from 1 to 5. Taken into account is the risk of a collision as well as its potential seriousness if a collision had actually taken place. There is in fact a combination of factors, such as the differences in speed, the available and required space, the angle of approach and the types of road users involved.

The risk of an accident is estimated by using the minimum TTC and/or the PET scales. In the risk of injury the potential impact energy and the protection against harm play a role.
Besides the overall rating, ratings are also determined for the separate aspects. Along with the extra information this gives about critical behaviour, these data are also used to adjust the rating of the severity of the conflict afterwards if necessary.

Some special training was given as a preparation for the study. This was based on the material available from the first calibration study, and made use of video to instruct in the following skills:

- detecting conflict situations
- estimating speeds
- estimating the seriousness of a conflict
- estimating the minimum TTC (time to collision) values.

The next step was, again using video, to score the conflicts (scored by four or more teams in Malmö) using the DOCTOR technique. The DOCTOR scores were compared with the results of the Malmö survey (for these see Oppe, 1986). In addition to video training, some field training was given in the following skills:

- direct estimation of speeds by observers: to see how close the estimates were to the real speeds they were compared with radar speed measurements;
- conflict scoring using the DOCTOR observation form at two intersections for a total of six hours: the field observations were subsequently assessed and discussed on the basis of video recordings made at the same time.

Three Dutch observers were trained in this way. Two of them carried out most of the observations in Austria, the third stepped in on occasion.

4. RESULTS OF THE DUTCH CONFLICT STUDY

4.1. Conflicts

Observations took place at the Trautenfels intersection for a total of 26 hours over four days. The observation periods are shown in Table 1. The weekend was included because a large number for foreign road users were again expected. During the observations 78 conflicts were scored, an average of three per hour. On Friday the number of conflicts recorded was somewhat higher (3.8 per hour) and on Saturday somewhat lower (2.3 per hour) than the average. A list of the conflicts scored by the Dutch team is given in Appendix F.

It is not possible to assess the number of encounters in relation to particular periods because of the absence of detailed data on traffic volumes (see also Appendix D).

Day		Observation period	Length (hrs)	Number of conflicts
Thursday	12-09-1985	07.10 - 08.10	1	2
		08.30 - 09.30	1	1
		10.00 - 12.00	2	7
		13.30 - 15.00	1.5	4
		15.30 - 17.00	1.5	4
		17.30 - 18.30	1	5
Friday	13-09-1985	07.00 - 08.30	1.5	4
		09.00 - 10.30	1.5	2
		11.00 - 12.30	1.5	4
		14.00 - 15.30	1.5	6
		16.00 - 17.00	1	4
		17.30 - 18.30	1	10
Saturday	14-09-1985	07.00 - 08.30	1.5	1
		09.00 - 10.30	1.5	2
		13.30 - 15.00	1.5	5
		15.30 - 17.00	1.5	7
		17.30 - 18.30	1	1
Sunday	14-09-1985	09.00 - 10.30	1.5	3
		11.00 - 12.30	1.5	6
Total			26.0	78

Table 1. Observation periods and numbers of conflicts scored.

4.1.1. Classified by seriousness and type

The DOCTOR technique recognizes five classes which give an overall assessment of the seriousness of a conflict situation. Table 2 shows the conflicts at this intersection took place between fast vehicles, entirely in accordance with the general traffic pattern, with very few pedestrians and cyclists.

Figure 1 shows the distribution of all conflicts according to seriousness. The majority of them - 82% - were in the minor category. There was one case of a minor rear-end collision.

4.1.2. Classified by type of manoeuvre and location

From now on we shall not distinguish between the various types of fast vehicle: all the conflicts here were between cars. The main types of manoeuvre in this type of conflict are right-angle (↓←), left-turn (→↙—), rear-end (→ →) and weaving (↑↑—) situations.
Table 3 shows the conflicts by type of manoeuvre. The locations of the serious conflicts (category of seriousness 3-5) is shown in Figure 2.

Type	Seriousness 1	2	3	4	5	Total
Lorry - lorry	-	1	-	-	-	1
Car - lorry	7	1	2	-	-	10
Car - car	29	20	6	1		56
Car - tractor	2	1	1			4
Car - motorcycle	1	2		-	-	3
Subtotal	38	24	11	1	-	74
Car - cycle	-	-	1	-	-	1
Car - pedestrian	1	1	1	-	-	3
Total	39	25	13	1	-	78

Table 2. Numbers of conflicts by type and seriousness.

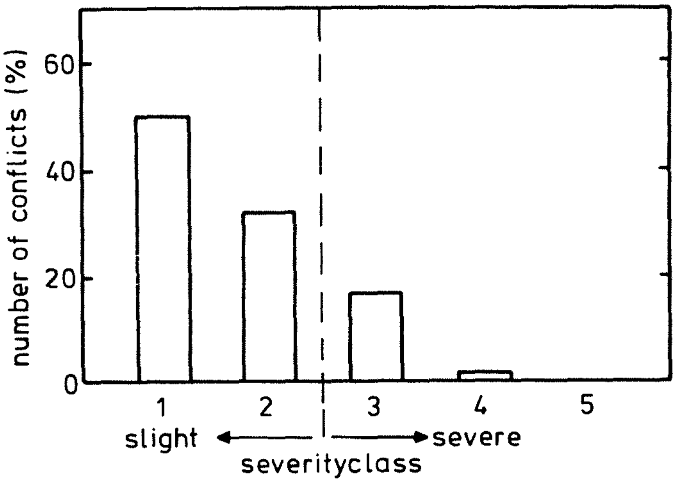


Figure 1. Relative distribution of conflicts by category of seriousness.

Type	Manoeuvre		Minor (1-2)	Serious (3-5)	Total
Car - car	right-angle	intersection area K	1	2	3
	left-turn		18	3	21
	rear-end		25	3	28
	weaving (area A, B and C)		13	3	16
	others		5	1	6
Car - cycle	left-turn		-	1	1
Car - pedestrian	right-angle		2	1	3
Total			64	14	78

Table 3. Conflicts by type of manoeuvre (see also Appendix A, Figure A2).

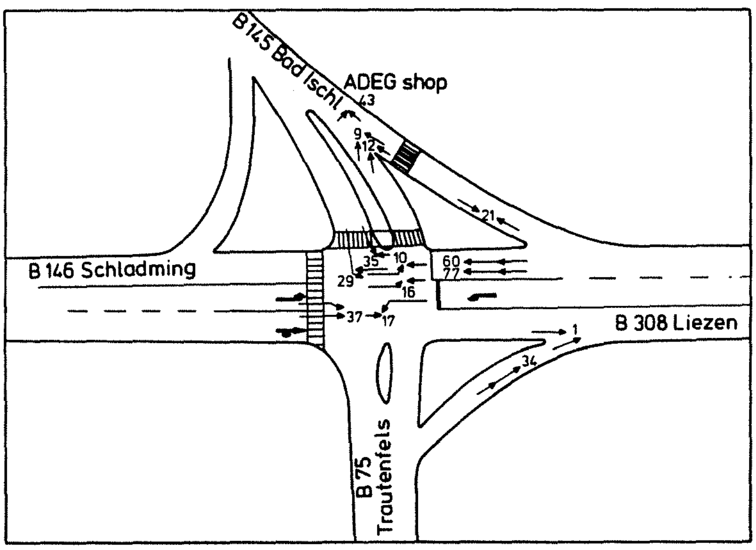


Figure 2. Locations of serious conflicts (category of seriousness 3-5).

To give a diagnosis of road safety at the intersection it is necessary to categorise the conflicts according to the combinations of manoeuvres which are possible there. Three types of locations were identified at the intersection: the intersection proper (area K; see Appendix A, Figure A2), the approach routes (1-4) and the special right-turn lanes (r1-r3 and areas A, B, C and D). On the intersection proper most conflicts take place between traffic turning left and oncoming traffic (Table 4). The traffic light system has no separate phase for traffic turning left. These conflicts are mainly PET situations. Vehicles are not usually found on a direct collision course; rather a vehicle turning just slips in between the oncoming traffic. In situations of this kind the risk of collision is calculated in terms of post encroachmenture time (PET): the time between the passing of the turning vehicle and the arrival of the oncoming vehicle.

Table 5 shows the locations of rear-end conflicts. Conflicts of this type are also common on the approach routes, as might be expected at a light-controlled intersection. Of the two serious conflicts on approach section 3, one was a minor collison between two cars. Rear-end conflicts in right-turn lanes take place mainly in lane r2, and are minor.

A third category of conflicts take place at (weaving) areas A, B and C, where traffic turning right tries to merge with the main stream again beyond the control of the traffic lights. Table 6 shows the figures. Traffic turning right at area B (traffic from Liezen for Bad Ischl) gives the most problems as regards both minor and serious conflicts: (a) there is no particular priority system at this point and so traffic in the right-turn lane has priority, and (b) the curve radius is fairly large with the result that this traffic travels at fairly high speeds. As already mentioned, most rear-end conflicts from the right-turn lanes take place here. A few conflicts in the 'other' category in Table 3 take place at the start of this right-turn lane (area D: three minor and one serious). The latter involved a tractor travelling in the wrong direction on lane r1 which caused a conflict with a vehicle turning right and then another one at area D with a vehicle on the main road.

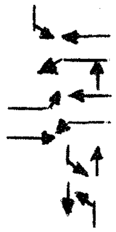
Type		Minor	Serious	Total
Car - car				
right-angle		-	2	2
		1	-	1
left-turn		12	2	14
		2	1	3
		4	-	4
		-	-	-
Total		19	5	24
Car - cycle				
left-turn		-	1	1
Total		19	6	25

Table 4. Conflicts on intersection area K by combination of manoeuvres

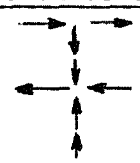
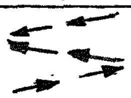
Location		Minor	Serious	Total
Approach section				
1		3	-	3
2		3	-	3
3		7	2	9
4		1	-	1
Right-turn lanes				
r1		-	-	-
r2		10	-	10
r3		1	1	2
Total		25	3	28

Table 5. Rear-end conflicts by location.

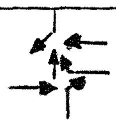
Weaving area		Minor	Serious	Total
A		3	-	3
B		9	2	11
C		1	1	2
Total		13	3	16

Table 6. Weaving conflicts by location (area A with priority system; area B no particular priority system; area C with Give Way sign).

4.2. Exposition

To interpret conflict data properly a comparison between the actual occurrence of conflicts and the exposition of the particular type of conflict (the total number of possible encounters) is indispensable, in addition to the absolute number of conflicts.
Various estimates of exposition based on the intensities of the relevant traffic flows all have their liminations as regards the assumptions on which they are based and permissible applications. There is as yet no agreement on this point in the literature (e.g. Van der Horst, 1981).
One method is, using a Poisson approximation, to calculate the risk of a vehicle in one traffic stream encountering a vehicle from the second stream within a certain period of time t (e.g. linked to crossing time plus a margin). Here it is assumed that the two streams are independent and neither of the two vehicles reacts to the other. The exposition value E for two intersecting streams of traffic during an observation period T can then be represented by the equation:

$$E = \frac{I_i \cdot I_j}{3600/t} \cdot T$$

where

I_i = intensity of stream i (per hour)
I_j = intensity of stream j (per hour)
t = interval during which an encounter takes place (s)
T = observation period (in hours)

It is difficult to give a suitable value for t without all sorts of additional information on speeds, design of intersection etc. A value of t = 5 s is not unreasonable, being comparable with a rule of thumb used for minimum preview time (the minimum time a driver must be able to see ahead to be able to react properly). For the time being, then, t is taken to be 5 s. At the Trautenfels intersection the exposition value E was applied to the left-turn manoeuvre, hereinafter referred to as E_L.*

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* At a light-controlled intersection the hypothesis that the two traffic streams are completely independent is disputable. This exposition value is used here as an example (for want of a better one). Further research is needed to produce a more precise yardstick.

A comparable exposition value for rear-end encounters in a single stream of traffic (with intensity I) can be calculated as follows:

$$E_{NT} = \frac{I^2}{3600/t} \cdot T$$

Here again an interval of t = 5 s would seem to be a reasonable figure giving plenty of time to react to each other.

There is a special situation in the case of intersecting traffic at an intersection with working traffic lights. The overwhelming majority of vehicles clear the intersection entirely without encounters, of course, consequently intensities in themselves would not seem to be very suitable as exposition values. Encounters between intersecting vehicles can only occur if one of the parties goes through a red light. Given that, because of the long cycle of 100 s at the Trautenfels intersection, there is almost always a vehicle waiting for green, an estimate of the number of vehicles going through red could be taken as the exposition value. There are no data on this directly relating to this intersection, however. Research conducted in the Netherlands (Van der Horst et al., 1985) indicates that at non-urban intersections with an yellow phase of 5 s about 0.25% of vehicles go through red. The equation for E_{Cr} for traffic streams crossing at right angles on the intersection proper is:

$$E_{Cr} = 0.0025 \cdot (I_1 + I_2 + I_3 + I_4) \cdot T$$

where

I_1-I_4 = intensity of traffic from approach directions 1-4 (per hour)

4.3. <u>Relationship to accidents</u>

The data available on traffic volumes are given in Appendix D. Exposition values for each type of conflict have been calculated using the formulae from para. 4.2. It should be emphasized that the results are unreliable since the count covered only a few hours. Accident figures are available for only one year: Appendix E shows the accidents which occurred in 1984. Of the total of 42 accidents, 32 are suitable for comparison with conflict data (Table E1 in Appendix E). Of these 11 resulted in physical injury to one or more persons. The remainder either occurred during the period from 7.00 pm to 6.00 am (when the traffic lights are switched off) or were single vehicle accidents.

On the basis of the data available on traffic volumes (the count covered only a few hours) and accidents (although reasonable in number, covering only one year) there is not much point in making a direct comparison between conflicts and accidents. In the DOCTOR technique it is particularly the serious conflicts (category of seriousness 3-5) which are used to make a safety diagnosis, whereas the minor conflicts are used primarily to support the diagnosis on operational aspects. A total of 14 serious conflicts were scored, of which 11 involved the main types of manoeuvre combinations identified in para. 4.1.2, viz. right-angle, left- turn, rear end and weaving situations. Table 7 gives relative indices based on conflicts and on accidents.
The order of dangerousness (descending) for C/E between right-angle, left-turn and rear-end situations is completely in line with the order obtained from the accidents involving injury. The right-angle situation (one of the road users involved must have offended the red light) is the most dangerous type. A more precise comparison can be carried out when more data are available on traffic volumes.
Weaving in the right-turn lanes also appears, from the conflict observations, to cause problems. It need not however result in accidents (not at least on the basis of one year's accident figures). These conflicts would seem to have more to do with operational problems; while they do give rise to friction, they are clearly not so much a cause of accidents.

Since four manoeuvre combinations occur in the left-turn manoeuvre and rear-end situation, to give an illustration these have been separated out. Figure 3 shows the results, taking account of all conflicts and all accidents. This indicates that the accident/conflict ratio is much higher for rear-end situations that for left-turn manoeuvres. The left-turn manoeuvre from Bad Ischl (↳↑) seems to be different from the other left-turn manoeuvres. It concerns an interaction with relatively many left-turners and relatively few through going cars.

Manoeuvre	Serious conflicts C	C/E_{26hrs}	All accidents A	A/E_{yr} ($x10^{-3}$)	Injury accidents AI	AI/E_{yr} ($x10^{-3}$)
Right-angle	2	0.0360	4	21.3	2	42.6
Left turn	3	0.0030	3	0.0175	3	0.0175
Rear end	2	0.0002	25	0.0165	6	0.0039
Weaving	3	0.0032	-	0	-	0
Rear end on Right turn lanes	1	0.0014	-	0	-	0

Table 7. Risk index C/E_{26hrs} (number of serious conflicts per exposition value for 26 hours), safety index 1 A/E_{yr} (all accidents per exposition value (for 1 year) and safety index 2 AI/E_{yr} (number of accidents involving injury per exposition value (for 1 year) by combination of manoeuvres.

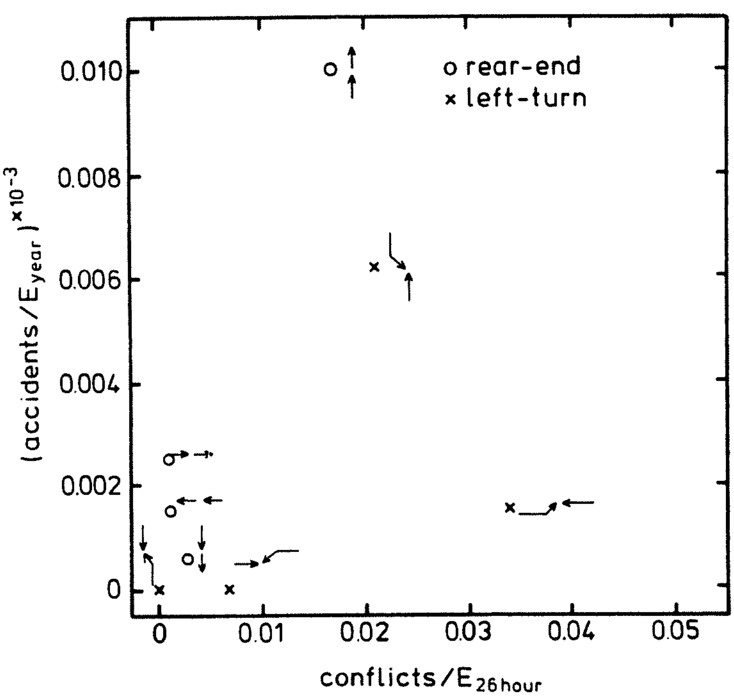


Figure 3. Relationship between safety index and risk index for left-turn and rear-end manoeuvre combinations.

5. GENERAL DIAGNOSIS

The following comments may be made on the basis of all the conflicts scored.

1. Most of the problems occur on the intersection proper, and in particular involve vehicles turning left coming into conflict with oncoming vehicles from the direction of Liezen. In the conflict situations observed these latter were travelling at relatively high speeds, which results in a high degree of seriousness for both conflicts and accidents.

2. The main road carries a fairly large proportion of heavy goods vehicles, and because of the traffic density it is often difficult for cars to overtake them. Several times it was noted that overtaking vehicles used both left-turn lanes, sometimes from a standstill and sometimes at high speed.

3. A number of the rear-end conflicts on the main road were influenced by the uncertainty caused by the flashing green light. The Israelian team has investigated this aspect in more detail.

4. Another problem concerns traffic coming from the direction of Liezen and turning right to Bad Ischl, which has to merge with traffic from the left without any specific priority system. The traffic from Liezen often travels at high speed along the turn-off, and the traffic merging to the left assumes that it is on the main road and has priority. The many conflicts scored here were generally minor.

5. Traffic from the direction of Trautenfels travelling towards Liezen meets a stop sign and a stop line. If a driver stops before the line, however, he has absolutely no view of the traffic approaching from Schladming, owing to the position of the control box, the traffic superintendant's box and the route indicator sign. Moreover, the layout of the entry lane is such that even if traffic brakes for traffic on the main road it is on a collision course with a relatively low TTC value.

6. It is notable that as soon as the lights for traffic from the direction of Bad Ischl turn to yellow, those for the main direction turn to red-yellow; thus it is certainly theoretically possible that a collision could take place with both parties thinking they were in the right. A few conflicts did indeed take place in this situation. In the case of the accident in this situation it was not clear what phase the lights for the motorcyclist had reached.

7. Next to the ADEG shop there is a parking place directly adjoining the road. Drivers leaving the car park have poor visibility to the left, from which direction cars are generally approaching at high speed. This caused a number of minor conflicts. It was noted in one case that a driver leaving the car park turned left and began driving against the traffic from Liezen. He realized his mistake and corrected it before it was too late. The layout here is not clear, however.

8. The route information for traffic from Liezen turning right to Bad Ischl is unclear. A few times drivers passed the right-turn lane, stopped, reversed and the turned right. It was also noted a few times that drivers reached the intersection proper and then turned right after the stop line.

6. PROPOSALS FOR IMPROVEMENTS

The present traffic light system has a fixed cycle of 100 s, which often causes unnecessarily long waiting times. Given the traffic intensities, a vehicle-actuated system would be more suitable: we would suggest green for the turn-offs on demand and a restricted extension of green for the main road, controlled with the aid of detector loops at a good distance; long loops should be installed in the area before the stop line. An exclusive phase for traffic turning left from the main road, on demand, is highly recommended: this could prevent the most serious accidents. We also recommend abolishing the flashing green, which clearly has an adverse effect on drivers' decision-making (see also Mahalel et al., 1985).

The three turn-offs at very least create operational problems in the traffic process due to weaving and rear-end situations.
The right turns to Liezen and Schladming could certainly be included in the traffic light system.
On the right turn from Liezen to Bad Ischl the traffic intensities are much higher. Given the present layout (large curve radius, resulting in high speeds), it would be advisable to include a separate right-turn lane in the traffic light system. If it is decided that traffic turning right should remain outside the system controlling the intersection, we would advise reducing the speed of traffic by reducing the curve radius. The priority for merging traffic should also be better regulated, with an entry lane and a Give Way sign for traffic merging from the right. An advance route sign for traffic from Liezen turning right, showing the layout of the intersection with the separate right-turn lane would make it clearer to drivers which lane to choose. We would also advise moving the right-turn sign to a position before the right-turn lane on the right-hand side of the road. The present position on the triangular island can cause confusion.

REFERENCES

Grayson, G.B. (ed.) (1984). The Malmö study; A calibration of traffic conflict techniques. A study organised by ICTCT - the International Committee on Traffic Conflict Techniques. R-84-12, SWOV, Leidschendam, 1984.

Güttinger, V.A. (1980). Met het oog op hun veiligheid; De ontwikkeling van een conflictobservatietechniek ter beoordeling van de verkeersveiligheid van woongebieden voor kinderen (With a view to their safety; The development of a conflict observation technique for the assessment of road safety for children in residential areas). Dissertatie, Universiteit van Amsterdam, 1980.

Kraay, J.H.; Van der Horst, A.R.A. & Oppe, S. (1986). Handleiding voor de conflictobservatietechniek DOCTOR (Manual for the conflict observation technique DOCTOR). SWOV/IZF-TNO, Leidschendam, 1986 (In preparation).

Mehalel, D.; Zaidel, D. & Klein, T. (1985). Driver's decision process on termination of the green light. Acc. Anal. & Prev. 17 (1985) 5 : 373-380.

Oppe, S. (1986). Building an objective conflict technique. SWOV, Leidschendam, 1986 (In preparation).

Van der Horst, A.R.A. & Riemersma, J.B.J. (1981). Registration of traffic conflicts: Methodology and practical implications. IZF 1981 C-22. Institute for Perception TNO, Soesterberg, 1981.

Van der Horst, A.R.A. (1984). The ICTCT calibration study at Malmö: A quantitative analysis of video recordings. IZF 1984-37. Institute for Perception TNO, Soesterberg, 1984.

Van der Horst, A.R.A.; Ten Broeke, W. & Bakker, P.J. (1985). De roodlichtdiscipline van bestuurders van motorvoertuigen onder invloed van een aanpassing van de geeltijd (Driver's obedience to the red traffic signal as influenced by an one second prologation to the yellow phase). IZF 1985 C-11. Instituut voor Zintuigfysiologie TNO, Soesterberg, 1985.

Van der Horst, A.R.A. & Kraay, J.H. (1985). Trautenfels-studie; Diagnose van de verkeersonveiligheid met behulp van de Nederlandse conflictobservatietechniek DOCTOR. IZF 1985-27. Instituut voor Zintuigfysiologie TNO, Soesterberg, 1985.

APPENDIX A

BRIEF DESCRIPTION OF TRAUTENFELS INTERSECTION

The Trautenfels intersection is situated along a major trunk route through Austria, running from the Salzburg border crossing in the north via Eben, Radstadt and Schladming through the Enntal to Liezen and then south to the Yugoslavian border (B146-B308). The intersection joins this road with one used more by tourists, through Salzgammergut from Salzburg via Bad Ischl (B145); see Figure A1. To the south the B75 connects up with the intersection.

In the summer months large numbers of mainly Yugoslavian and Turkish guest workers make use of the main road on the way from the Netherlands and West Germany to their home countries and back. There is also quite a lot of goods traffic.
The main road is joined by numerous access roads to nearby villages and hamlets; it has a number of curves and sections with various gradients.

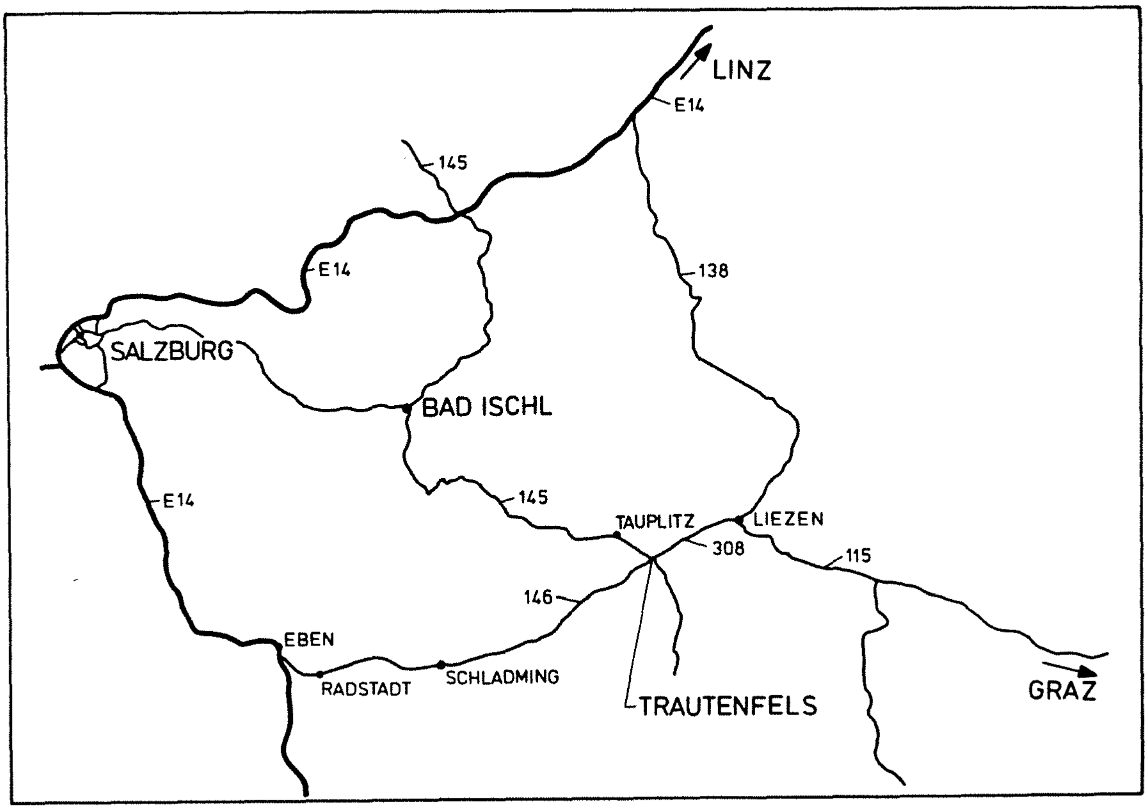


Figure A1. Location of Trautenfels intersection, Austria.

The intersection has a simple traffic light system, which is in operation from 6.00 am to 7.00 pm. The system has a fixed cycle 100 s long. Essentially there are two phases: either traffic on both sides of the main road has green or traffic on the two side roads. Only traffic from the north turning left for Liezen has a brief period of exclusive green at the end of the green phase for the side roads.
A special feature of the system is the flashing green (grünblinken) 3 s before yellow begins (yellow phase 5 s). In effect the yellow phase amounts to 8 s, rather long in comparison with the length elsewhere.

The intersection as a whole has a fairly typical layout (see Figure A2). Except for one branch, traffic turning right avoids the traffic light system, using separate right-turn lanes. Priority at the three junctions is variously regulated: at area A by Give Way signs, at area B with no special priority and at area C by stop signs.

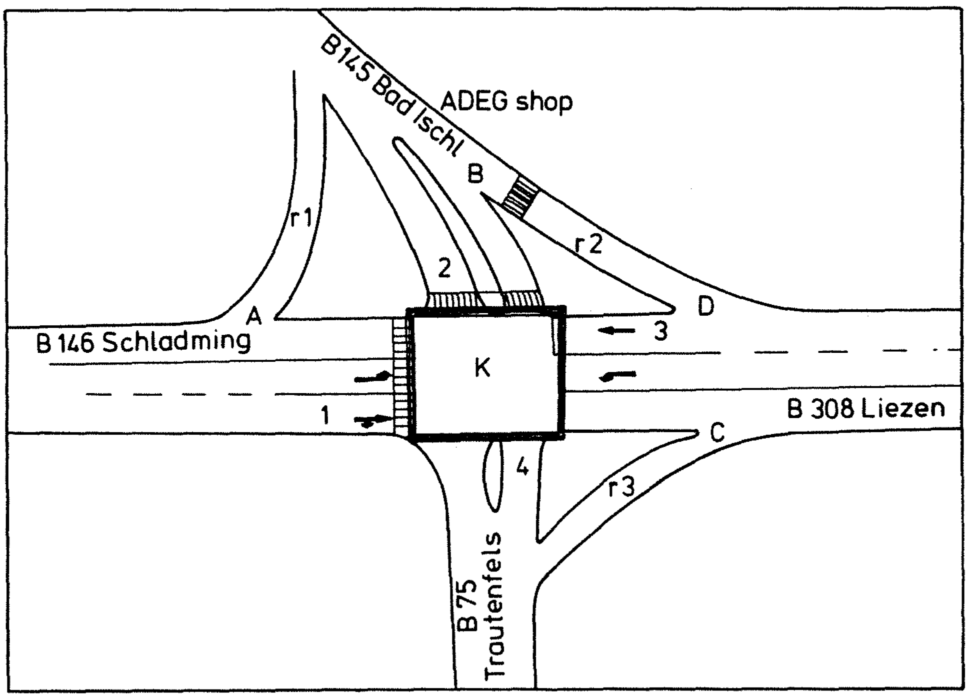


Figure A2. Sketch of Trautenfels intersection.

APPENDIX B

THE INTERNATIONAL SCORING FORM

ICTCT - CONFLICTDATASHEET - AUSTRIA 1985

ID-code: ....

Intersection: Trautenfels B 308/B 145 .... Date: ....

Team: A D F ISR NL S SF USA

Observer: ....

Precise time of conflict: .... hour - min - sec | N:o

Road-users involved:

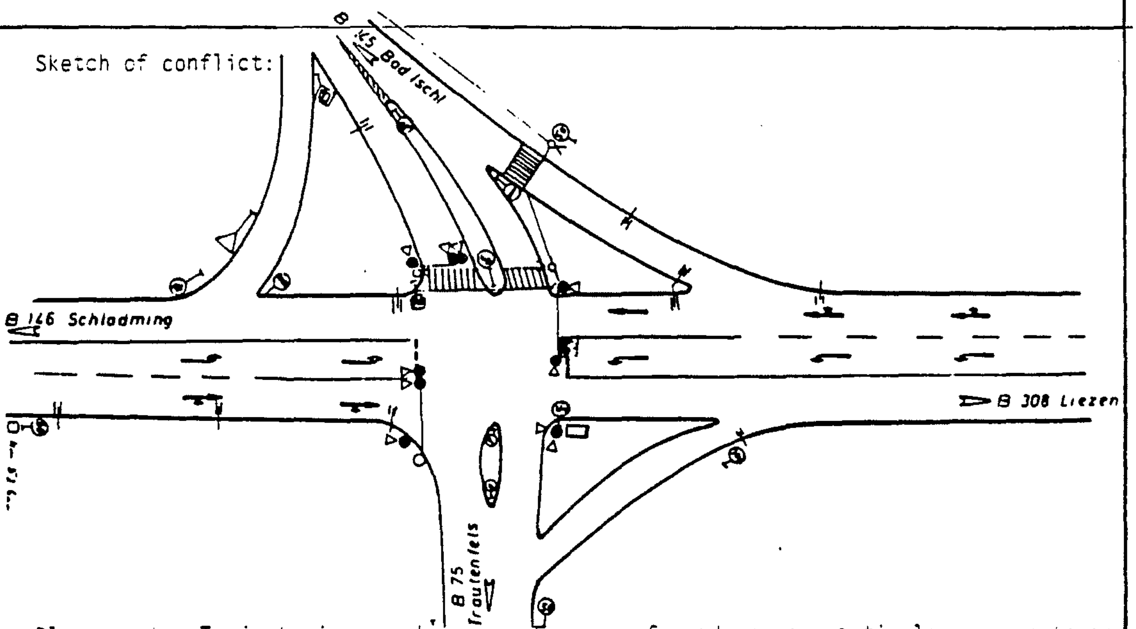
1) ___ ....
2) ___ ....
3) ___ ....
4) ___ ....

C = Car
T = Taxi
P = Pedestrian
B = Bicyclist
M = Moped
Mc = Motorbike
Bus= Public transport
L = Lorry
O = Others

Please note for,
Cars: colour,type
P/B/M/Mc: age,sex

Severity rating: ___ ___ ___ ....

Sketch of conflict:



Please note: Trajectories, number or reference of road-users, particular movements as breaking, stopping, skidding, falling etcetera.

Additional data/Comments (to be defined by each team)

APPENDIX C

THE DOCTOR OBSERVATION FORM

DOCTOR OBSERVATIEFORMULIER

volgnr.

OBSERVATOR:

WEER: ZONNIG ☐ BEWOLKT ☐ REGEN ☐

WEGDEK: DROOG ☐ NAT ☐

DATUM:

LOCATIE:

GEMEENTE:

OBSERVATIE-PERIODE:

ERNST CONFLICTSITUATIE

1	2	3	4	5
licht				zeer ernstig

TIJD CONFLICT

☐☐☐

MIN. TTC

☐☐☐☐☐

0 0,5s 1,0s 1,5s 2,0s >

PET

☐☐☐

0 0,5s 1,0s >

GESCHATTE LETSELERNST

zeer klein	klein	redelijk	groot
☐	☐	☐	☐

CONFLICTTYPE

weggebruikers:	Nr.1	Nr.2	Nr.3
personenauto	☐	☐	
vrachtauto, bus	☐	☐	
bromfiets	☐	☐	
fiets	☐	☐	
voetganger	☐	☐	
andere	☐	☐	

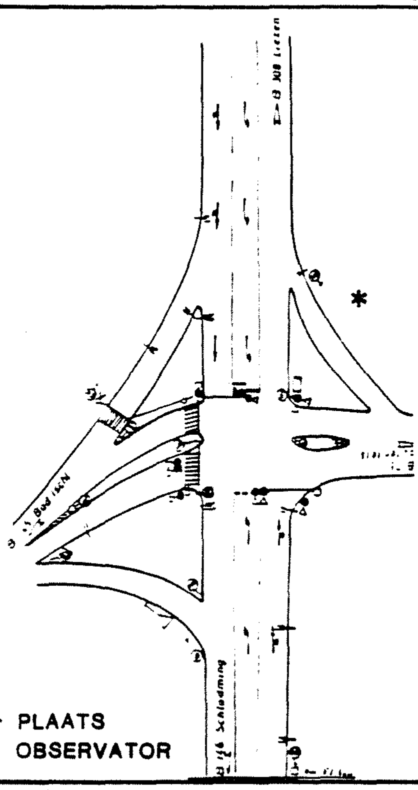
SNELHEID

0 - 15 km/uur	☐	☐
15 - 30 km/uur	☐	☐
30 - 50 km/uur	☐	☐
50 - 70 km/uur	☐	☐
70 - 100 km/uur	☐	☐
> 100 km/uur	☐	☐

VERMIJDINGSACTIES

geen reactie	☐	☐
gecontroleerd	☐	☐
ongecontroleerd	☐	☐
remmen	☐	☐
versnellen	☐	☐
uitwijken	☐	☐

MANOEUVRE EN DEELNEMERS



* PLAATS OBSERVATOR

OPMERKINGEN:

APPENDIX D

TRAFFIC VOLUMES

At the time of writing only sketchy data are available on traffic volumes. Austria carried out some counts during the observation periods: these are shown in Table D.

Date	Time	1			2			3			4		
12-09-1985	10-11	38	162	-	-	-	-	143	216	58	-	-	-
	11-12	50	171	-	-	-	-	124	224	39	-	-	-
	16-17	51	227	-	8	52	185	135	260	79	-	-	-
13-09-1985	10-11	36	140	-	-	-	-	99	298	51	-	-	-
	14-15	38	295	-	20	34	173	166	378	51	-	-	-
14-09-1985	9-10	-	-	-	29	36	125	128	328	51	-	-	-
	14-15	15	335	1	24	18	120	153	498	32	2	38	27
15-09-1985	10-11	41	228	3	22	26	80	109	524	57	-	-	-
Average total per hour		33	223	-	21	33	137	132	341	52	2	38	27

Table D. Traffic volumes of motorised traffic at Trautenfels intersection. Directions as in Appendix A, Figure A2 (south to north).

APPENDIX E

ACCIDENTS FIGURES

Austria has provided accident figures for a period of one year (1984). The locations of the accidents are shown in Figure E.

For the diagnosis of road safety at the intersection and the relationship with conflicts, the relevant accidents were selected from this total of 42 on the basis of the time of day (from 6.00 am to 7.00 pm) and the types of road user involved. Table E shows the accidents classified by type of manoeuvre. From 7.00 pm to 6.00 am the traffic lights are switched off.

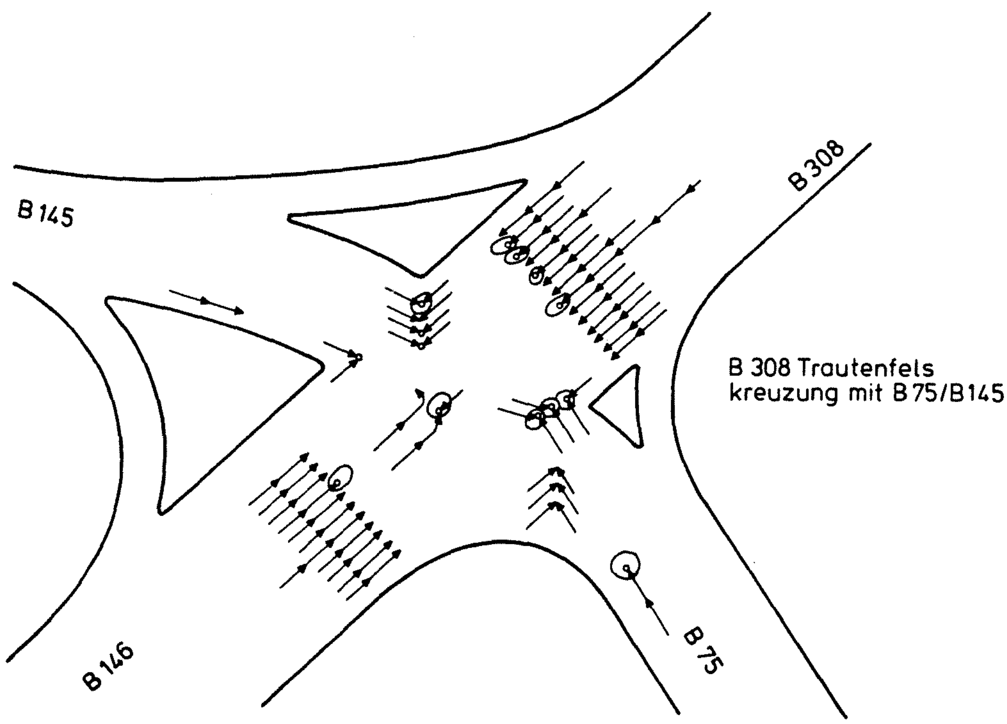


Figure E. Locations of accidents in 1984 at Trautenfels intersection; the 11 accidents involving injury between 6.00 am and 7.00 pm are ringed.

Type	Manoeuvre	Accidents MDO*	Injury	Total
06.00 - 19.00 hrs				
Car - car**	right-angle (area K)	2	5	7
	rear-end	19	6	25
Subtotal		21	11	32
19.00 - 06.00 hrs				
Car - car		4	3	7
Car (single vehicle)		2	-	2
Car - deer		-	1	1
Total		27	15	42

*MDO = material damage only
**Car = all fast traffic

Table E. Accidents by type of manoeuvre.

APPENDIX F

CONFLICTS SCORED BY THE DUTCH TEAM

by day, time, type of conflict, manoeuvre and location

(1) L = lorry/bus   M = motorcycle   B = bicycle
C = car   Tr = tractor   P = pedestrian

(2) See Appendix A, Figure A2.

Conflict number	Date	Time	Conflict type (1)	Manoeuvre	Location (2)	Seriousness of conflict	PET
1	12-9	07.28.56	M-C	weaving	C	3	
2	12-9	07.50.24	P-C	crossing	B	2	
3	12-9	09.25.15	C-L	rear-end	r2	2	
4	12-9	10.05.11	C-C	rear-end	r2	1	
5	12-9	10.23.53	C-C	turning	K	1	
6	12-9	10.30.48	C-L	weaving	B	1	
7	12-9	10.47.27	C-P	crossing	B	1	
8	12-9	11.03.54	C-C	weaving	A	1	
9	12-9	11.10.31	M-C	weaving	B	3	
10	12-9	11.56.46	C-C	turning	K	3	x
11	12-9	13.40.20	C-C	turning	K	2	x
12	12-9	14.00.42	C-L	weaving	B	3	
13	12-9	14.45.38	C-C	turning	K	2	x
14	12-9	14.45.42	C-C	rear-end	B	2	
15	12-9	15.46.50	C-C	rear-end	r2	2	
16	12-9	16.07.49	L-C	turning	K	3	x
17	12-9	16.19.00	C-B	turning	K	3	x
18	12-9	16.21.21	C-C	rear-end	r3	1	
19	12-9	17.35.19	C-C	rear-end	3	2	
20	12-9	18.16.09	C-C	weaving	B	1	
21	12-9	18.17.25	C-Tr	frontal	r2	3	
22	12-9	18.17.47	C-Tr	frontal	D	2	
23	12-9	18.25.50	C-C	change of lane	1	2	
24	13-9	18.26.44	C-C	weaving	C	1	
25	13-9	07.43.12	C-C	weaving	B	2	
26	13-9	08.28.13	C-C	rear-end	D	1	
27	13-9	08.28.23	C-C	rear-end	B	2	
28	13-9	09.40.45	C-C	rear-end	r2	1	
29	13-9	10.12.12	C-C	intersec-ting	K	3	x
30	13-9	11.14.44	C-C	weaving	B	1	
31	13-9	11.42.57	C-L	turning	K	1	x
32	13-9	12.14.27	C-L	turning	K	1	x
33	13-9	12.22.16	C-C	rear-end	r2	1	

Conflict number	Date	Time	Conflict type (1)	Manoeuvre	Location (2)	Seriousness of conflict	PET
34	13-9	14.03.10	C-C	rear-end	r3	3	
35	13-9	14.29.31	C-C	inter-secting	K	4	
36	13-9	14.55.54	C-C	rear-end	K	1	
37	13-9	15.10.13	C-C	change of lane	K	3	
38	13-9	15.27.19	C-L	turning	K	1	x
39	13-9	15.29.28	C-C	rear-end	r2	2	
40	13-9	16.07.07	C-Tr	rear-end	1	1	
41	13-9	16.28.13	C-L	overtaking	2	1	
42	13-9	16.48.17	C-Tr	overtaking	2	1	
43	13-9	16.59.13	C-P	crossing	r2	3	
44	13-9	17.34.47	C-C	rear-end	4	2	
45	13-9	17.43.48	C-C	rear-end	3	1	
46	13-9	17.44.51	C-M	turning	K	2	x
47	13-9	18.01.31	C-C	weaving	B	2	
48	13-9	18.04.20	C-C	turning	K	1	x
49	13-9	18.10.53	C-C	turning	K	2	x
50	13-9	18.19.35	C-C	overtaking	B	1	
51	13-9	18.19.50	C-C	inter-secting	K	1	x
52	13-9	18.20.28	C-C	turning	K	2	x
53	13-9	18.22.42	C-C	rear-end	1	2	
54	14-9	08.17.44	L-L	rear-end	3	2	
55	14-9	09.03.20	C-C	rear-end	3	1	
56	14-9	09.17.45	C-C	rear-end	r2	1	
57	14-9	14.08.01	C-C	turning	K	1	x
58	14-9	14.10.37	C-C	rear-end	r2	1	
59	14-9	14.32.03	C-C	rear-end	r2	1	
60	14-9	14-43-26	C-C	rear-end	3	3	
61	14-9	14.51.20	C-L	weaving	B	1	
62	14-9	15.35.24	L-C	turning	K	1	
63	14-9	15.53.35	C-C	rear-end	3	2	
64	14-9	15.57.46	C-C	turning	K	1	x
65	14-9	16.14.20	C-C	rear-end	D	1	
66	14-9	16.26.45	C-C	turning	K	2	x
67	14-9	16.28.23	C-C	rear-end	A	1	
68	14-9	16.36.29	C-C	turning	K	2	x
69	14-9	18.28.33	C-C	turning	K	1	
70	15-9	09.11.43	C-C	turning	K	2	x
71	15-9	09.37.31	C-C	weaving	B	1	
72	15-9	10.20.55	C-C	rear-end	1	1	
73	15-9	11.17.07	C-C	weaving	A	2	
74	15-9	11.35.30	C-C	weaving	B	2	
75	15-9	11.46.13	C-C	inter-secting	3	1	
76	15-9	11.55.38	C-C	turning	K	1	
77	15-9	12.22.23	C-C	rear-end	3	3	
78	15-9	12.29.25	C-C	rear-end	r2	1	