RESULTS OF WESTEUROPEAN ACCIDENT INVESTIGATION PROGRAMS - A REVIEW

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Since several years numerous Westeuropean institutions investigate traffic accidents to gain data for further development of safety devices. By order of the "Forschungsvereinigung Automobiltechnik" (FAT), a suborganisation of the "Verband der Automobilindustrie e.V." (VDA), a study has been carried out by questioning investigation teams and evaluating their published papers to find answers to the following questions:

- institutions involved in accident data acquisition,
- investigation methods and main effort,
- review of their results.

One result of this inquiry was that 18 institutions have their own data acquisition team (see Fig. 1). The statements concerning the investigation methods are too spacious to be described here, they are published in the study of the FAT [1].

This paper presents

- methods of data acquisition,
- a classification of the results,
- comparability of results,
- state of results.

Institutions with data acquisition

- Adam Opel AG, Germany
- Alfa Romeo SpA, Italy
- Association Peugeot-Renault, France
- Chirurgische Universitätsklinik Heidelberg, Germany
- Daimler-Benz AG, Germany
- Fiat SpA, Italy
- Ford Werke AG, Germany
- Verband der Haftpflicht-, Unfall- und Kraftverkehrs-versicherer eV (HUK), Germany
- Medizinische Hochschule Hannover, Germany
- Odense University Hospital, Denmark
- L'Organisme National de Securité Routière (ONSER), France
- Saab-Scania, Sweden
- Stichting Wetenschappelijk Onderzoek Verkeersveiligheid (SWOV), Netherlands
- Technische Universität Berlin, Germany
- Transport and Road Research Laboratory (TRRL), Great Britain
- University of Birmingham, Great Britain
- Volkswagenwerk AG, Germany
- AB Volvo, Sweden

Fig. 1

METHODS OF DATA ACQUISITION

The required data from traffic accidents can be gathered by

1. immediate data acquisition
2. immediate and retrospective data acquisition
3. retrospective data acquisition

The immediate data acquisition by an own team has the advantage that the statements and the trustworthiness of the data can be estimated because of the known quality of the team.

Doing retrospective data acquisition it has to be considered that the acquisition method as well as kind and volume of the data is defined by the primary acquisition aim (police data - who is guilty, insurance data - regulation of damage, hospital data - medical treatment). Trustworthiness and representativeness of those data have to be checked. In addition, some data sources are not directly available to accident investigators, like judical or hospital records.

Fig. 2 shows the dimension of the characteristics of the three methods:

- data/case car
- cases/year
- manhours/case
- costs/case

The efficiency can only be ascertained in comparison with the results to the same subject. Because of lack of comparable results a calculation of the efficiency of the three methods has to be done later.

CLASSIFICATION OF RESULTS

A first step was to classify traffic participants into four groups: trucks, two-wheelers, passenger cars, pedestrians

Then the results have been co-ordinated with the respective group, and the third step was to make up a matrix for each group with 54 key-words used for accident investigation (Fig. 3-7). In these matrixes the number of results found out for each key-word combination was filled in. So the matrixes give an overlook to which problems (key-word combinations) results are excisting and to which not.

194 papers with 1298 results have been classified, because of the length of the list of the used literature it must be referred to the study of FAT [1]. We found that cars have been involved with 60%, followed by pedestrians with 18%, two-wheelers with 13% and trucks with 9% (Fig. 8). This distribution illustrates too the main effort in data acquisition according to groups of traffic participants.

COMPARABILITY OF RESULTS

We found out very soon that a comparison was impossible because aims and methods as well as team specific conditions of the different investigation teams are too divers. Therefore the results could only be juxtaposed. Two examples shall point out the difficulties to compare results (Fig. 9):

1 From different acquisitions data are present to the key-word combination "injury severity of car passengers" and "collision speed". However, the results shown in Fig. 9 are not comparable, because the speeds are estimated with the methods ETS, Δv, relative collision speed (RCS), and estimated mean relative impact speed and a unification is not possible.
To describe the injury severity, AIS and ISL (indice de sévérité des lesions) have been used, a unification is only possible with limitations.

2 To demonstrate the injury diminuishing effects of safety belts, the injury distribution among body parts with and without belts has been investigated. The values of the example in Fig. 9 are not comparable because the base of the values is
- the number of occupants by Saab,
- the number of injuries by Volvo.

With the declaration of some more basisdata a conversion would be possible and the use of the data would be extended without great expense.

With an acceptable expense to convert or to transfer units of measure and kind of description only 78 (6%) results could be juxtaposed. The following table shows the juxtaposed results in proportion to the groups of traffic participants.

	results		to be juxtaposed	
	N	%	N	%
cars	776	100	51	7
pedestrians	236	100	12	5
two-wheelers	163	100	8	5
trucks	123	100	7	6
	1298	100	78	6

To make use of accident investigation data more easy, the following points have to be considered:

- source of data
- selection criteria and restrictions
- number of cases
- distinct reference of percentage to basis values
- declaration of basisdata if comprehensive values have been used

STATE OF DATA ACQUISITION RESULTS

The specific conditions of 18 investigation teams and the experience in trying to compare results make evident that data acquisition is as complex as traffic accidents and does not allow a simple review. Therefore single results will not be discussed but a review of the state of results will be given by interpretation of the matrixes. Therefor the distribution of the results among the key-words and the correlation of accident parameters among themselves will be examined.

The distribution of the results among the traffic participants in Fig. 10 shows again the high part of passenger cars. In all groups the key-word group A - general indications - predominates, the distribution of the groups B - G varies considerably and in five groups the number of results is less than 10. Because there

are up to 11 key-words in one group, such a distribution is not satisfying.
This is also pointed out by the combination of key-word groups in Fig. 11, because for a lot of combinations no results are excisting or the values are lower than 1% of the results, so Fig. 11 shows the fields which should be investigated with more effort in the future.

To develop safety devices it is not only important to know the parameters influencing traffic accidents but also the correlation of these parameters. That is why the correlation of accident parameters has been examined to valuate the results of data acquisition. Therefor the parts of "single-parametric" and "multi-parametric" results will be confrontated.
An accident parameter has been defined as a dimension or a value influencing or describing the accident or his effects, like

- collision configuration	- speed	- OAIS, AIS
- position of occupants	- VDI, VIDI	etc.

These parameters are specified in the key-word groups B - G.

Dimensions used to mathematical compilation or statistical classification of the examined accident parameters are summarised in key-word group A (number, frequency, country, year).

Single-parametric result:
- frequency of car collision types
- frequency of injured parts of passenger bodies

Multi-parametric result :
- injury severity of pedestrians depending on collision speed (2 parameters)
- injury severity of pedestrians depending on their age, car body style and collision speed (4 parameters)

According to the above parameter definition the results have been classified depending on the number of parametrs being found. Results which have been published several times have been counted accordingly if they were not accurately identical.

The table and the curves in Fig. 12 show, that single- and two-parametric results predominate and that the number of results decreases rapidly from three to eight parameters. The course of the curve of pedestrian results compared with the others shows a more uniform distribution of the results among the first three parameters. One reason can be, that the former car accident investigation has shown the greater effectivness of a data acquisition which makes it possible to correlate several accident parameters.

Comparing the proportions of multi- to single-parametric results, one can see to which extent the correlation of accident parameters has been realized in the past.

	multi -parametric / single-parametric results
cars	~ 4
pedestrians	~ 3
two-wheelers	~ 2
trucks	1.5
all particip.	~ 3

The comparison of the factors shows, that the cars present the advantageous proportion with 4 : 1 of multi- to single-parametric results, and trucks the disadvantageous with 1.5 : 1 . These values shall not lead future activities mainly to the group trucks, but to a more intensive investigation of the correlation between the accident parameters.

In connection with the distribution of the results among the key-word groups and key-word group combinations (Fig. 10-11) one can state, that more effort in data acquisition shall be shifted to those subjects where only few results are found until now.

CONCLUSIONS

This study shows that

- the traffic participant group cars has received main efforts in data acquisition, pedestrians and two-wheelers get more and more attention and trucks usually are investigated as a collision partner of the other groups;
- the results of different data acquisition programs are not comparable, only for a few exceptions with the juxtaposition of results it is possible to check tendencies;
- the efficiency of investigation programs can only be ascertained when comparable results to one aim do excist;
- the distribution of results among the subjects (key-word groups) of accident investigation gets less favourable in the order cars, pedestrians, two-wheelers and trucks;
- the proportions of multi- to single-parametric results also get less favourable in the order cars, pedestrians, two-wheelers and trucks.

The formation of the OECD ad hoc group "Multidisciplinary Accident Investigation Surveys" (MAS) shows, that the problems, mentioned in this study, have been recognized and are partly in work. Besides this institutionalized planning and co-ordination, accident investigation teams are requested to diminuish the problems by direct contacts and agreements.

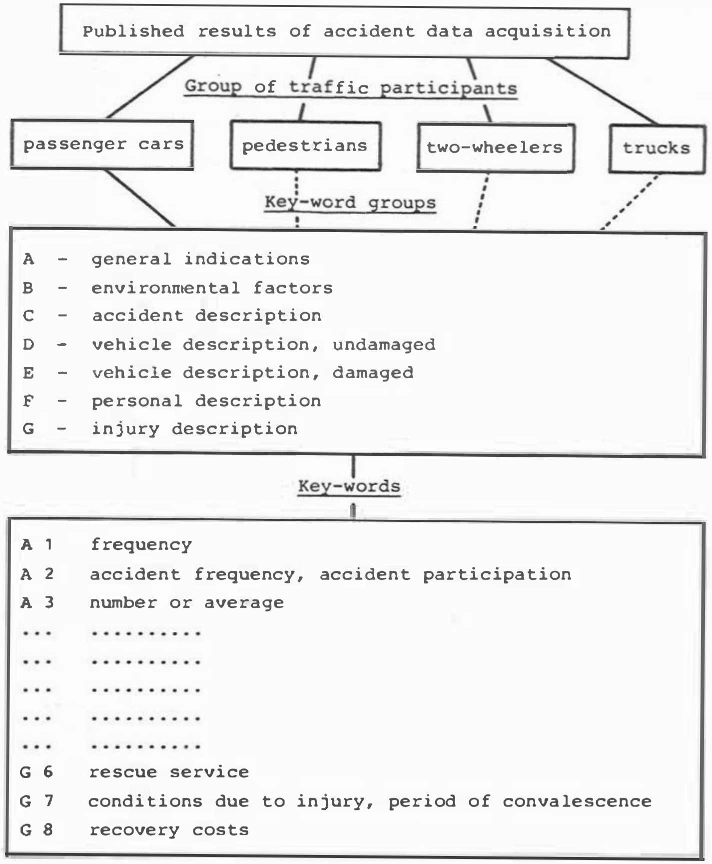
REFERENCES

[1] Wanderer, U., Blödorn, J.: Unfallforschung, westeuropäische Forschungsprogramme und ihre Ergebnisse. FAT Schriftenreihe Nr. 4, Frankfurt/Main 1977

	data acquisition		
	immediately after the accident	immediately and retrospective	retrospective
source of data	own acquisition	. own acquisition of a part of the data plus data from existing reports (police, hospital)	existing records from police, hospital, insurance companies, judical records etc.
number of data per case car	very high ($2-4 \cdot 10^3$)	middle - high (500-1000)	low - middle (250 - 500)
cases/year	low (100 - 1000)	low - middle ($10^3 - 10^4$)	middle - very high ($10^4 - 10^6$)
man hours/ case	high (50)	middle (20 - 30)	low (5 - 10)
costs/case	high (DM 1.000)	middle (DM 400-600)	low (DM 100-200)
example	Heidelberg Hannover Berlin Birmingham DB, Ford, VW ~~Peugeot-Renault~~ TRRL, Odense	Opel, SAAB Volvo, TRRL SWOV Birmingham	HUK-Verband SWOV, Volvo Alfa-Romeo Ford, Odense

Characteristics of different starts of data acquisition

Fig. 2



Model for classifying the results of accident data acquisition

Fig. 3

P	A 1	A 2	A 3	A 4	A 5	A 6	A 7	B 1	B 2	B 3	B 4	B 5	B 6	B 7	B 8	C 1	C 2	C 3	C 4	C 5	C 6	C 7	D 1	D 2	D 3	D 4	D 5	D 6	D 7	D 8	D 9	D10	D11	E 1	E 2	E 3	E 4	E 5	F 1	F 2	F 3	F 4	F 5	F 6	F 7	F 8	G 1	G 2	G 3	G 4	G 5	G 6	G 7	G 8	
A 1 frequency																18	10	13	10	9	15			1	3	3		4		18		3		5	10	3	6	5				4							8	6	6		1		A 1
A 2 acc. frequency, acc. participation				10	3	11	1	5	6	2	1	4	5		7						1		1	4	3							1							10			1													A 2
A 3 number or average								5							1	2	1	3																1	1				1								2	5	2	1					A 3
A 4 kind of traffic participation																		5																					1										1	1	6		1		A 4
A 5 year of data acquisition								2					2													1						2			2														1	2	1	1			A 5
A 6 country, area, place, invest. team							2	2							1	10		3	1		3		2							1					1	2		1									4	2	5						A 6
A 7 method of data acquisition																					4				1																								3						A 7
B 1 accident location (urban, rural)		O	O						1							6	3	4	1	3	1				2					3					1	1	2		1								2	1	3						B 1
B 2 type of road																1		1		1										3																	1								B 2
B 3 road construction characteristics																																																	1						B 3
B 4 environmental road conditions																	1																																						B 4
B 5 traffic control, traffic signs																																															1		1						B 5
B 6 traffic conditions, driving output		O																	1						2																										2				B 6
B 7 weather and visibility conditions																1	1																																						B 7
B 8 time of collisions, periods		O														3																													1		1				1	1			B 8
C 1 type of collision	O																	3	1		12				2			3							3		2	4	1								2	3	14	2					C 1
C 2 cause of accident																							2			3													2				1	2	2		1								C 2
C 3 coll. configuration, objects contacted	⊗																			1					1										3												5	1	4		2				C 3
C 4 damage configuration, type of damage	O																			4	1				1										1												1		4	1					C 4
C 5 direction of collision	O																		O		3				1										3												4	3	7		1				C 5
C 6 speed	O															O									3					1		1			1			1					3				5	2	11	5	1				C 6
C 7 length of throw																																																							C 7
D 1 make, model																	O																																						D 1
D 2 year, age																																		1			1	1										1	1	1					D 2
D 3 technical description of vehicle		X																			X											1			1			1											2	3	1				D 3
D 4 vehicle condition before accident																																			1																				D 4
D 5 vehicle equipment, accessory																												2	5									1									1			1					D 5
D 6 passive safety devices																																1					3	5										3	6	4	1		1		D 6
D 7 active safety devices																																																							D 7
D 8 use of seat belts																											O					4					4	2	2								5	11	13	8	1				D 8
D 9 influence of passenger compartment cond.																																																							D 9
D 10 position and number of passengers	⊗																																				7		4			2					6	13	11	10	2				D10
D 11 body style																																																							D11
E 1 location of damage	X																																		1																				E 1
E 2 classification of vehicle damage	O															⊗				O																											2	2	9	1	1				E 2
E 3 material damage, repair costs																																																							E 3
E 4 injury causing vehicle parts	X																											O																			1	6	4	4	3				E 4
E 5 effectiveness of safety devices	X																											X																			1		4	4	2				E 5
F 1 date of birth, age		O																																								3			1		9		4	3	2				F 1
F 2 stature, size																																																							F 2
F 3 weight																																																							F 3
F 4 sex																																													1		1		1						F 4
F 5 abilities, physically handicapped																																																							F 5
F 6 physiological state																																																							F 6
F 7 alcohol, drugs																																																							F 7
F 8 social aspects																																																							F 8
G 1 injury frequency of the whole body																													O								X													1					G 1
G 2 injury frequency of body parts			O	O												X											X		O		O					O													4			1			G 2
G 3 injury severity of the whole body	O															X		⊗		O			X	X			X		X		O			O			X															2			G 3
G 4 injury severity of body parts																							X														X														2				G 4
G 5 causes for fatal injuries	⊗																																																						G 5
G 6 rescue service																																																					1		G 6
G 7 cond. due to injury, period of convales.																																															O								G 7
G 8 recovery costs																																																							G 8

Key-word matrix for passenger cars (P) Fig. 4

F	A 1	A 2	A 3	A 4	A 5	A 6	A 7	B 1	B 2	B 3	B 4	B 5	B 6	B 7	B 8	C 1	C 2	C 3	C 4	C 5	C 6	C 7	D 1	D 2	D 3	D 4	D 5	D 6	D 7	D 8	D 9	D10	D11	E 1	E 2	E 3	E 4	E 5	F 1	F 2	F 3	F 4	F 5	F 6	F 7	F 8	G 1	G 2	G 3	G 4	G 5	G 6	G 7	G 8	
A 1 frequency																1	3	4	7	1	6													1			6			1		1	2							2	5				A 1
A 2 acc. frequency, acc. participation				10	3	11	1	2							2										1														10	5		2				1			1						A 2
A 3 number or average																	1	3			1																											5							A 3
A 4 kind of traffic participation																		4																			1		1									2	1	2	6		1		A 4
A 5 year of data acquisition																																																			1				A 5
A 6 country, area, place, invest. team							2											3																														2							A 6
A 7 method of data acquisition																					21																												1						A 7
B 1 accident location (urban, rural)																																															1								B 1
B 2 type of road																																																							B 2
B 3 road construction characteristics																																																							B 3
B 4 environmental road conditions																																																							B 4
B 5 traffic control, traffic signs																																																	1						B 5
B 6 traffic conditions, driving output																		1																																					B 6
B 7 weather and visibility conditions																																																							B 7
B 8 time of collisions, periods																																																			1	1			B 8
C 1 type of collision																																																							C 1
C 2 cause of accident																																												1	1										C 2
C 3 coll. configuration, objects contacted																																																							C 3
C 4 damage configuration, type of damage	X																			1	3	1											2						3	1							1	1	2	1					C 4
C 5 direction of collision																																													1										C 5
C 6 speed	O																					4												1					1				3					1	9	3					C 6
C 7 length of throw																					X												2						2																C 7
D 1 make, model																																																							D 1
D 2 year, age																																																							D 2
D 3 technical description of vehicle																																					1										1		1						D 3
D 4 vehicle condition before accident																																																							D 4
D 5 vehicle equipment, accessory																																																							D 5
D 6 passive safety devices																																																							D 6
D 7 active safety devices																																																							D 7
D 8 use of seat belts																																																							D 8
D 9 influence of passenger compartment cond.																																																							D 9
D 10 position and number of passengers																																																							D10
D 11 body style																			X			X																									1	3	3	3					D11
E 1 location of damage	X																				X																											1							E 1
E 2 classification of vehicle damage																																																							E 2
E 3 material damage, repair costs																																																							E 3
E 4 injury causing vehicle parts	X																																						1	1							2	3	8	1	1				E 4
E 5 effectiveness of safety devices																																																							E 5
F 1 date of birth, age		⊗																																						1							2	4	7	5	2				F 1
F 2 stature, size		⊗																	X																																				F 2
F 3 weight																																																							F 3
F 4 sex																																													1										F 4
F 5 abilities, physically handicapped																																																							F 5
F 6 physiological state																																																							F 6
F 7 alcohol, drugs																																																							F 7
F 8 social aspects																																																							F 8
G 1 injury frequency of the whole body																			X													X																	1						G 1
G 2 injury frequency of body parts																																X					O													2	1		1		G 2
G 3 injury severity of the whole body																			X		⊗										O	X					O	X																	G 3
G 4 injury severity of body parts				O																												X																							G 4
G 5 causes for fatal injuries	X																																																						G 5
G 6 rescue service																																																							G 6
G 7 cond. due to injury, period of convales.																																																							G 7
G 8 recovery costs																																																							G 8

Key-word matrix for pedestrians (F)

Fig. 5

Z	A 1	A 2	A 3	A 4	A 5	A 6	A 7	B 1	B 2	B 3	B 4	B 5	B 6	B 7	B 8	C 1	C 2	C 3	C 4	C 5	C 6	C 7	D 1	D 2	D 3	D 4	D 5	D 6	D 7	D 8	D 9	D10	D11	E 1	E 2	E 3	E 4	E 5	F 1	F 2	F 3	F 4	F 5	F 6	F 7	F 8	G 1	G 2	G 3	G 4	G 5	G 6	G 7	G 8	
A 1 frequency																1	4	5	1																		1					1	2						2		5				A 1
A 2 acc. frequency, acc. participation				10	3	11	1	2	2		1	3	4		2								2																5																A 2
A 3 number or average																	1	3																														5							A 3
A 4 kind of traffic participation																		4																			1		1				2					4	1		6		1		A 4
A 5 year of data acquisition								2					2																						2														2		1				A 5
A 6 country, area, place, invest. team							2	2										3					2													2											2	1	2						A 6
A 7 method of data acquisition																					2																																		A 7
B 1 accident location (urban, rural)																1	2																			1			1										1						B 1
B 2 type of road																																																							B 2
B 3 road construction characteristics																																																							B 3
B 4 environmental road conditions																																																							B 4
B 5 traffic control, traffic signs																																																							B 5
B 6 traffic conditions, driving output																		1																																					B 6
B 7 weather and visibility conditions																																																							B 7
B 8 time of collisions, periods																																																			1	1			B 8
C 1 type of collision																																																							C 1
C 2 cause of accident																																															1								C 2
C 3 coll. configuration, objects contacted																																																		1					C 3
C 4 damage configuration, type of damage																					1												1															1		1					C 4
C 5 direction of collision																																																							C 5
C 6 speed																			X									1															3							1					C 6
C 7 length of throw																																																							C 7
D 1 make, model																																																							D 1
D 2 year, age																																																							D 2
D 3 technical description of vehicle																																																							D 3
D 4 vehicle condition before accident																																																							D 4
D 5 vehicle equipment, accessory																																																							D 5
D 6 passive safety devices																																																							D 6
D 7 active safety devices																																																							D 7
D 8 use of seat belts																																																							D 8
D 9 influence of passenger compartment cond.																																																							D 9
D 10 position and number of passengers																																																							D10
D 11 body style																			X																													1	1	1					D11
E 1 location of damage																																																							E 1
E 2 classification of vehicle damage																																																							E 2
E 3 material damage, repair costs																																																							E 3
E 4 injury causing vehicle parts																																																1	2		1				E 4
E 5 effectiveness of safety devices																																																		2					E 5
F 1 date of birth, age																																															1	1	3	2	2				F 1
F 2 stature, size		X																																																					F 2
F 3 weight																																																							F 3
F 4 sex																																																							F 4
F 5 abilities, physically handicapped																																																							F 5
F 6 physiological state																																																							F 6
F 7 alcohol, drugs																																																							F 7
F 8 social aspects																																																							F 8
G 1 injury frequency of the whole body																																							X																G 1
G 2 injury frequency of body parts			O																X														X				O													1					G 2
G 3 injury severity of the whole body																																																							G 3
G 4 injury severity of body parts																																						X	X																G 4
G 5 causes for fatal injuries					X																																																		G 5
G 6 rescue service																																																							G 6
G 7 cond. due to injury, period of convales.																																																							G 7
G 8 recovery costs																																																							G 8

Key-word matrix for two-wheelers (Z) Fig. 6

L	A 1	A 2	A 3	A 4	A 5	A 6	A 7	B 1	B 2	B 3	B 4	B 5	B 6	B 7	B 8	C 1	C 2	C 3	C 4	C 5	C 6	C 7
A 1 frequency																2	4	5	1		1	
A 2 acc. frequency, acc. participation				8	3	11		1	2			3	5				1	3				
A 3 number or average																						
A 4 kind of traffic participation																		4				
A 5 year of data acquisition								2					3									
A 6 country, area, place, invest. team							2	2								1		3				
A 7 method of data acquisition																						
B 1 accident location (urban, rural)																1	2					
B 2 type of road																						
B 3 road construction characteristics																						
B 4 environmental road conditions																						
B 5 traffic control, traffic signs																						
B 6 traffic conditions, driving output		O																				
B 7 weather and visibility conditions																						
B 8 time of collisions, periods																						
C 1 type of collision																						
C 2 cause of accident																						
C 3 coll. configuration, objects contacted																						
C 4 damage configuration, type of damage																						
C 5 direction of collision																						
C 6 speed																						
C 7 length of throw																						
D 1 make, model																	O					
D 2 year, age																						
D 3 technical description of vehicle																						
D 4 vehicle condition before accident																						
D 5 vehicle equipment, accessory																						
D 6 passive safety devices																						
D 7 active safety devices																						
D 8 use of seat belts																						
D 9 influence of passenger compartment cond.																						
D 10 position and number of passengers																						
D 11 body style																						
E 1 location of damage																						
E 2 classification of vehicle damage																						
E 3 material damage, repair costs																						
E 4 injury causing vehicle parts																						
E 5 effectiveness of safety devices																						
F 1 date of birth, age																						
F 2 stature, size																						
F 3 weight																						
F 4 sex																						
F 5 abilities, physically handicapped																						
F 6 physiological state																						
F 7 alcohol, drugs																						
F 8 social aspects																						
G 1 injury frequency of the whole body																						
G 2 injury frequency of body parts																						
G 3 injury severity of the whole body																		O				
G 4 injury severity of body parts																						
G 5 causes for fatal injuries																						
G 6 rescue service																						
G 7 cond. due to injury, period of convales.																						
G 8 recovery costs																						

L	D 1	D 2	D 3	D 4	D 5	D 6	D 7	D 8	D 9	D10	D11	E 1	E 2	E 3	E 4	E 5	F 1	F 2	F 3	F 4	F 5	F 6	F 7	F 8	G 1	G 2	G 3	G 4	G 5	G 6	G 7	G 8
A 1 frequency																											2		3			
A 2 acc. frequency, acc. participation	1																3															
A 3 number or average																																
A 4 kind of traffic participation																													6			
A 5 year of data acquisition													2														2		1			
A 6 country, area, place, invest. team	2													2											2		2					
A 7 method of data acquisition																																
B 1 accident location (urban, rural)													1	1			1								1		2					
B 2 type of road																																
B 3 road construction characteristics																											1					
B 4 environmental road conditions																																
B 5 traffic control, traffic signs																																
B 6 traffic conditions, driving output																													1			
B 7 weather and visibility conditions																																
B 8 time of collisions, periods																													1	1		
C 1 type of collision																									1		1					
C 2 cause of accident	2																								1							
C 3 coll. configuration, objects contacted			1																								3					
C 4 damage configuration, type of damage																																
C 5 direction of collision																																
C 6 speed																																
C 7 length of throw																																
D 1 make, model																																
D 2 year, age																																
D 3 technical description of vehicle																									1		1					
D 4 vehicle condition before accident																																
D 5 vehicle equipment, accessory																																
D 6 passive safety devices																																
D 7 active safety devices																																
D 8 use of seat belts																																
D 9 influence of passenger compartment cond.																																
D 10 position and number of passengers																																
D 11 body style																																
E 1 location of damage																																
E 2 classification of vehicle damage																																
E 3 material damage, repair costs																																
E 4 injury causing vehicle parts																																
E 5 effectiveness of safety devices																																
F 1 date of birth, age																											2		2			
F 2 stature, size																																
F 3 weight																																
F 4 sex																																
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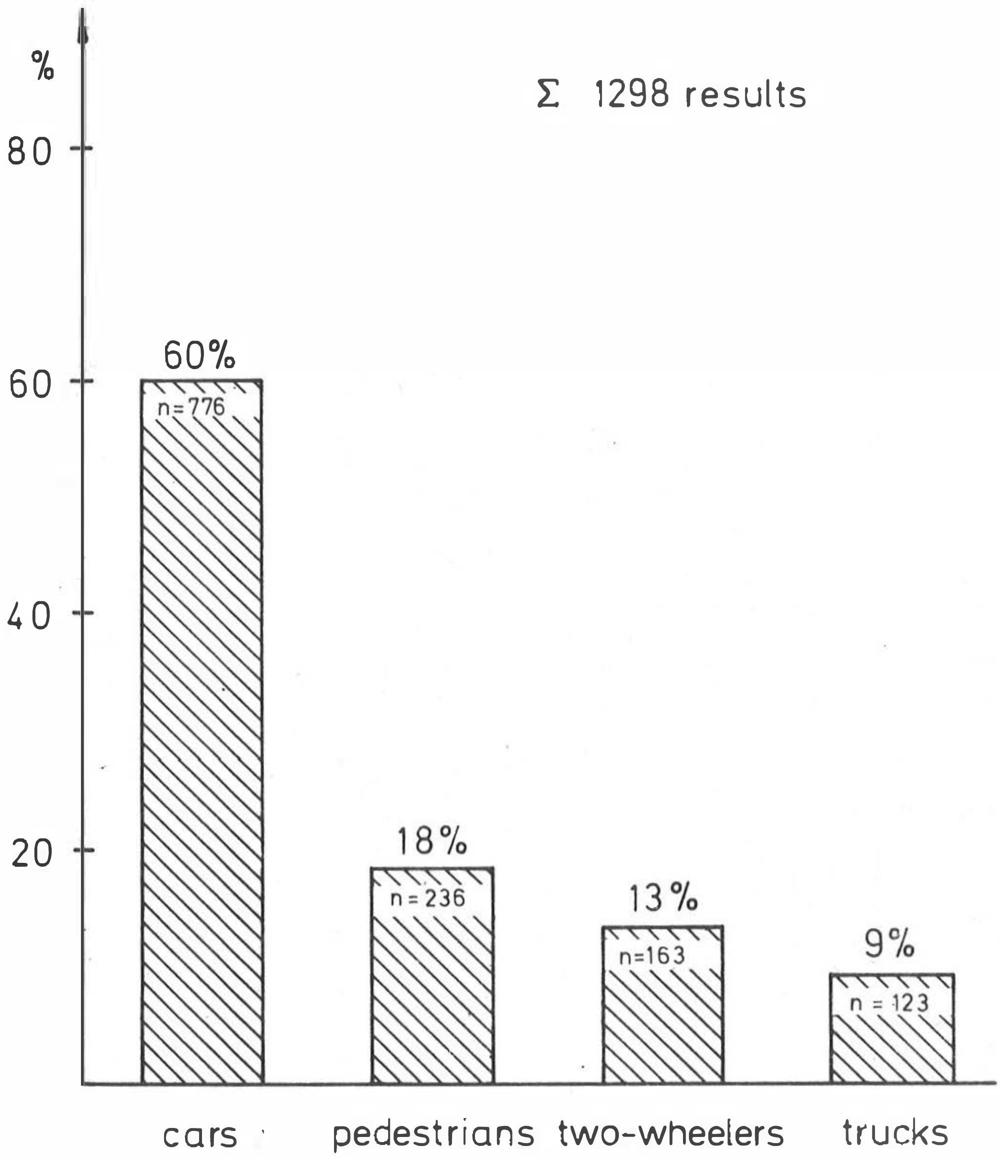
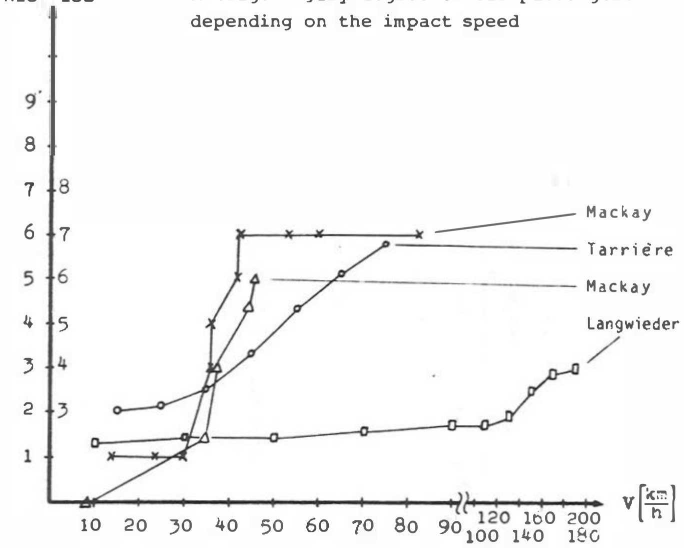
G 6 rescue service																																
G 7 cond. due to injury, period of convales.																																
G 8 recovery costs																																

Key-word matrix for trucks (L) Fig. 7



Distribution of the results among
the groups of traffic participants Fig. 8

Average injury degree of car-passengers depending on the impact speed



X (GB 1/2) Mackay 73, 10 cases, frontal impacts only, V = ETS, AIS-scale used

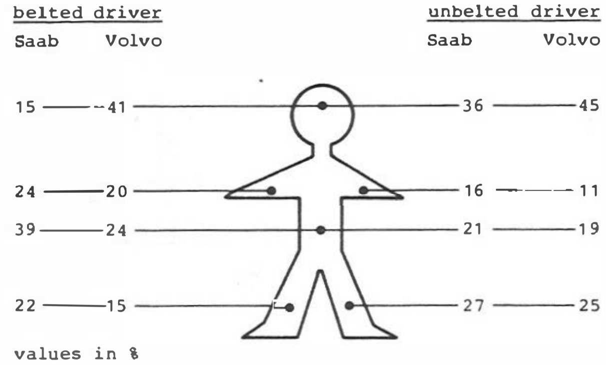
O (F 1/3) Tarrière 73, 87 cases, frontal impacts only, V = V, ISL-scale used (ISL = indice de sévérité des lésions), only ISL≥3; the points are the average in speed classes ranging from 5-15, 16-25, ... in km/h.

□ (D 2/5) Langwieder 73, 2231 cases, frontal impacts only, 690 non-injured not included, V = RCS (relative collision speed); the points are the average in speed classes ranging from 0-20, 20-40, ... in km/h. The AIS-values are averages.

△ (GB 1/5) Mackay 67, 425 cases of all types of accidents with car-passengers only, AIS-scale used, V = estimated mean relative impact speed.

Expl. 1

Frequency of injuries of belted and unbelted drivers



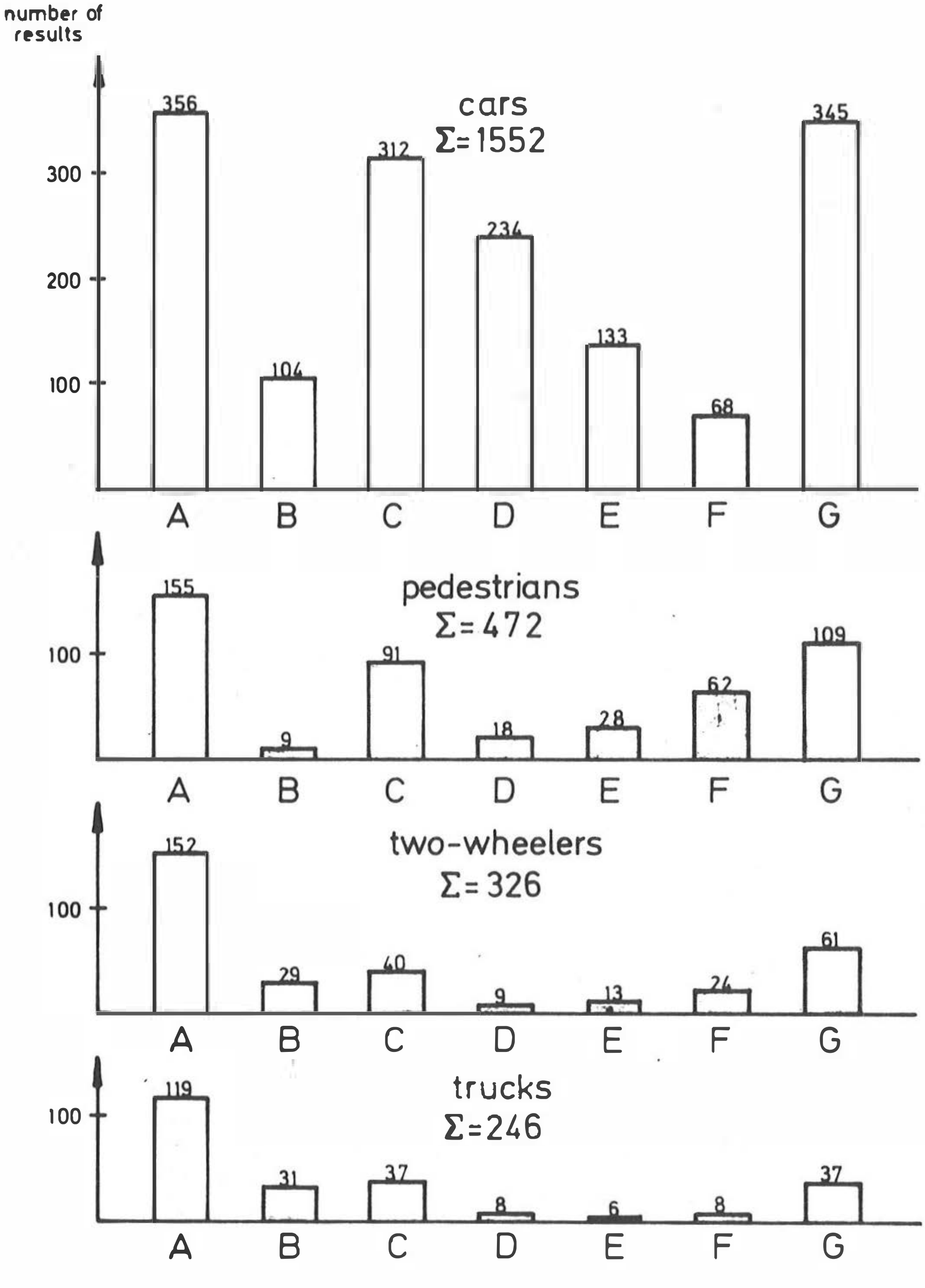
(S 2/1) Saab 73, 222 injured Saab car occupants in 158 accidents with at least 7000 swedish krons material damage

(S 1/1) Volvo 73, 366 injured Volvo car occupants in 996 accidents

Expl. 2

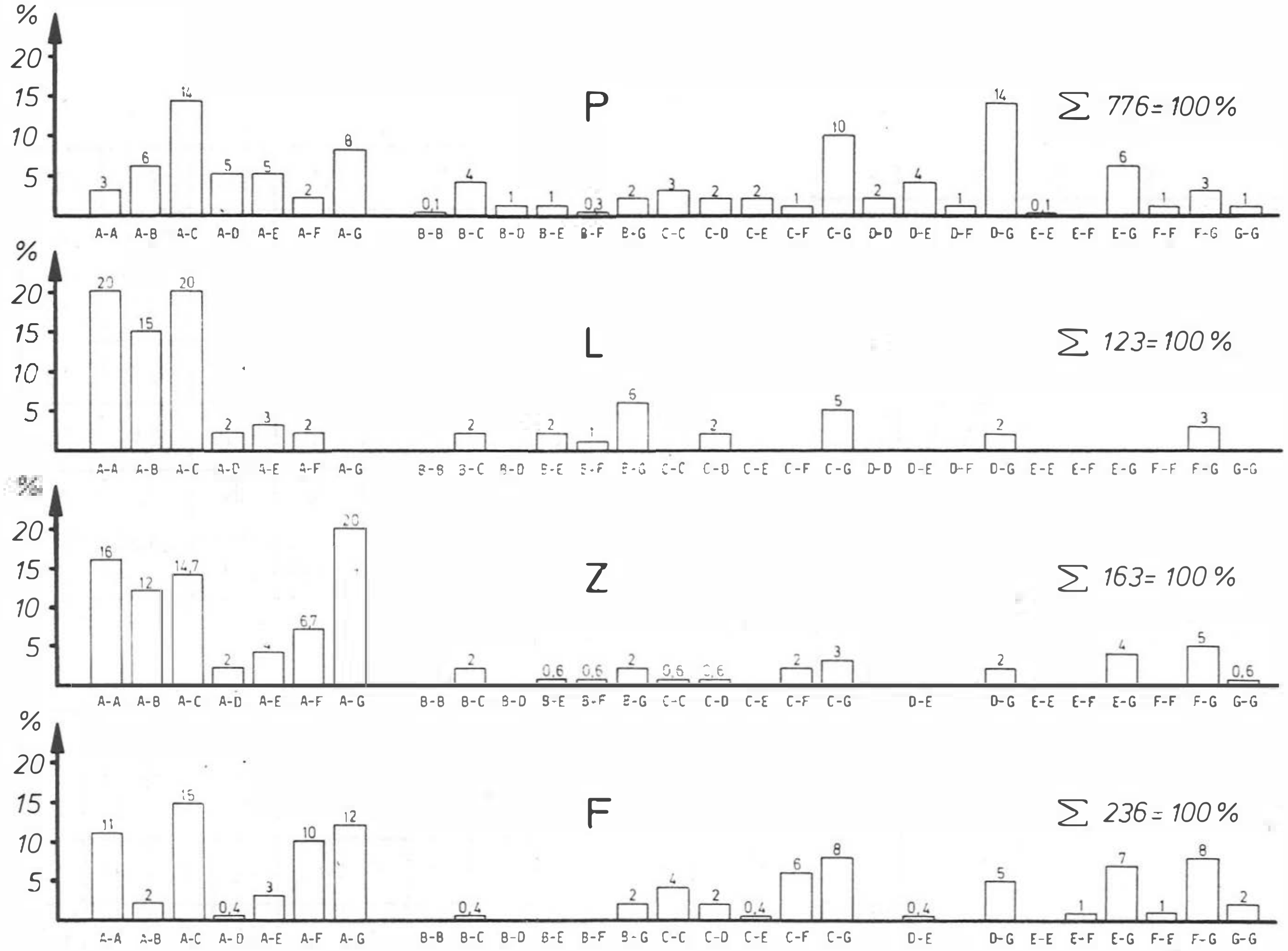
Examples for the difficulties to compare data acquisition results

Fig. 9



Distribution of the results among
the key-word groups

Fig. 10

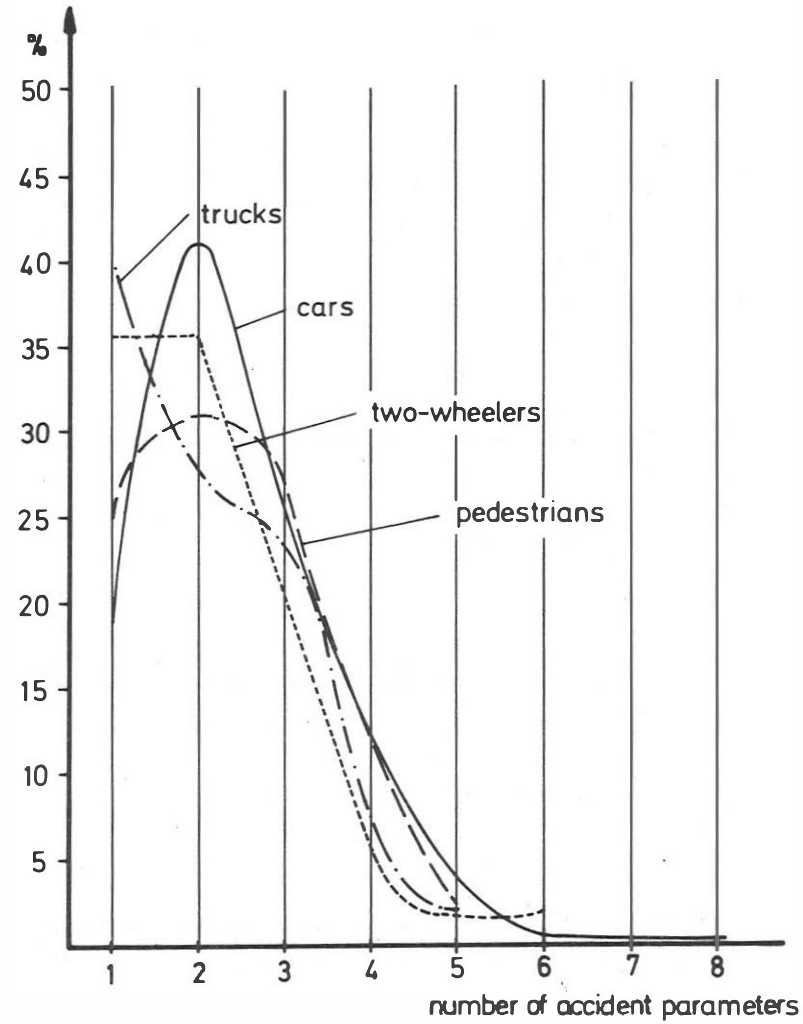


Distribution of key-word group combinations

Fig. 11

traffic participants \ number of results	number of accident parameters 1	2	3	4	5	6	7	8
cars	133	281	172	85	19	1	1	1
pedestrians	71	86	74	34	7	5	0	0
two-wheelers	39	39	23	6	2	0	1	0
trucks	19	13	11	3	1	0	0	0

	single parametric results		multiple parametric results		multiple parametric / single parametric results
	N	%	N	%	
cars	133	19	560	81	4,2
pedestrians	71	26	206	74	2,9
two-wheelers	39	35	71	65	1,8
trucks	19	40	28	60	1,5
all traffic participants	262	23	865	77	3,3



Distribution and ratio of single
and multiple parametric results

Fig. 12