Whatever the technical system, and this includes road traffic, accident analysis is thought to be an indispensable tool for the improvement of safety.

This is not, however, necessarily obvious as it refers to an event with a sequence that has already been completed when data is collected. It is not therefore sufficient to have available data, it is also necessary to have the data we can work with.

Just counting the number of accidents does not suffice, as for many of these accidents, although they involve bodily injury, no police report is drawn up. This situation may however vary, particularly with regard to those involved and the number and seriousness of their injuries.

The reliability of information collected when an accident is subject to routine police investigation depends to a great extent on the type of data involved. Certain factual variables are easily detectable e.g. date, when other ones are not always reliable, e.g. - in all countries - location.

To go deeper into understanding the relevant mechanisms requires each case to be analysed individually. This is done first by returning to the site, which enables us to understand the malfunctions by analysing infrastructure design and the behaviour observed.

When this operating mode is not sufficient, a second stage is carried out by conducting an ad hoc collection on the accident site, and setting up a technical investigation at the same time as that carried out by the emergency services and the police.

Before dealing with data collection and accident analysis, the objectives and underlying models for this work should be indicated. This procedure, natural for a researcher, then enables us to understand and categorise the different types of work listed under the heading "accident analysis". Reference in this respect could be made to the speech given by Siem OPPE during the course of this conference.

There may be different types of objectives. First, accident analysis can be used to understand unsafety-related problems and thus system malfunctions. It is needed if we are to answer the essential question: "which is the best system, A or B?". This question will serve as a guideline when choosing the person to head this inquiry. Sometimes the question is not raised in this alternative form, but is more likely to involve the direction in which the system should develop to ensure greater safety. Thus our attention, and consequently accident analysis, is no longer focused on the malfunction and the unsafety problems this
reveals, but on the relevant mechanisms that have to be understood if a safer system is to be designed.

After diagnosing and planning the relevant action, the newly created situation should be evaluated to assess the progress made with regard to safety and the behaviour of those involved. This is a necessary stage if we are to gain experience and improve our knowledge, in particular that of system modifications. When following up safety measures this is obviously essential, to be able to adapt their application procedures and restrict the negative effects.

The system may be analysed at the different stages to which the different levels of understanding and action may correspond. There are therefore different levels of accident analysis that depend, in particular, on the degree of data aggregation. This therefore influences the choice of data source for the accidents used:

- accident files, already available on a computer
- police reports, that require an analysis of existing documents
- in-depth investigation, when the routine data collection is insufficient.

All the papers presented during this session refer, each in their own way, to these different questions and show how they are dealt with for a specific problem.

Two papers consider aggregated data and refer specifically to the statistical aspect of accident risk with the more or less short term objective of comparing different road layouts from a safety standpoint.

The paper presented by Karin BRUNDELL-FREIJ and Lars EKMAN from the Department of Traffic Planning and Engineering of the Lund Institute of Technology emphasises the difficulty of comparing situations using accident rates calculated in relation to exposure.

The empirical data used to illustrate their comments is the number of conflicts between cyclists and motorists at intersections in relation, more specifically, to car flow. Statistical analyses show the non-linear relationship between these two variables that may be explained by the influence of different factors, notably infrastructure. Layout characteristics are indeed significantly related to traffic level.

This data leads on to a discussion on the statistical models that are generally used, in particular, the use of linear regression to describe relationships between variables. Continuing this statistical analysis work could be a promising way of both interpreting the empirical results and examining the relevance of the use of an exposure measurement when calculating accident risks.

Work by Herbert NOWAKOWSKI of the Highway Administration of the Federal Ministry of Economical Affairs in Vienna also deals with a level of aggregated data analyses on unsafety. In this instance, the aim is to identify road sections where the road surface is in need of repair. The road is indeed resurfaced almost every ten years, but this work is programmed according to the urgency of the work required. The epidemiological approach used in this work compares skid coefficients and rut depths in the road with accidents. Data was collected on a large scale using high capacity measurement devices over several thousand kilometres of motorway throughout Austria.

Statistical analyses show the links that exist between the various geometrical road characteristics. It also makes it possible to reveal the ability of the driver to adapt, as particularly unfavourable conditions do not always give rise to high accident risk.
Other work is based on an analysis of police accident reports. The methods of analysis clearly raise the question of the models referred to and, in particular, those used to describe how the human operator functions.

Wolfgang BERGER from the Traffic Institute of the University of Bodenkultur in Vienna presents his experience in the context of black spots. He emphasises the various levels of analysis. Statistical analysis is used to focus attention on locations with the highest risk rate and so reorganise these areas as effectively as possible. Empirical work dealt with more than one hundred black spots for which the accident reports had been analysed and completed by an analysis of traffic organisation and on-the-spot behavioural observation.

The analysis of reports refers to knowledge regarding the ability of operators to acquire and process information. In most cases, the accident analysis reveals a "failure" on the part of users in the course of these processes. This then goes on to reveal the informational inadequacies of the various sites before being able to remedy them.

This work shows that the analysis of information sequences required by the individual sometimes produces unexpected results on the cause of these accidents.

Piet NOORDZIJ from the Institute for Road Safety Research (SWOV) in Holland, presents his work on accident analysis using police reports.

The accident data base is in some instances limited. Firstly it is not exhaustive, as all the accidents are not recorded. This apart, the recording contains a considerable amount of information that is not always relevant and above all makes it impossible to rediscover the accident sequence dynamic. Numerous attempts in this direction have proved unsuccessful.

This consideration therefore results in working directly on accident reports and adapting the information available. Work is backed up by two different experiments: one involves accidents that occurred on roads with a speed limit of 80 km/h and the other accidents that involve bicycles. Work consisted of revealing each accident scenario and then categorising all the cases to present a review of the safety problems specific to each of these two situations.

The main conclusions of this work are to reveal the need to modify report coding by replacing useless or unreliable information by other more relevant information and formalising behavioural dynamics, which again requires considerable research work and coordination with other work.

When the information usually collected on the site is not sufficient, it becomes necessary to design a data collection specific to the accident site.

Yves GIRARD from the Institut National de Recherches sur les Transports et la Sécurité (INRETS) in Salon-de-Provence, France, presents the experiment conducted by the Department of Accident Mechanism Analysis with regard to in-depth investigation. This work was performed for research purposes and to reveal the mechanisms involved in the accident sequence. Data is collected by a multi-disciplinary team, first on the accident site by investigating the accident sequence. A second collection is performed at a later date and involves more in-depth questioning. By using a model designed specifically for this purpose, a kinematic reconstruction is used to obtain at each instant the respective position, speed and acceleration of each of those involved. During the analytical phase the sequence is broken down into different phases that can then be studied separately to reveal the relevant mechanisms and how they are linked.
An accident example is presented to show this research process at work and the advantage of integrating in-depth investigation into a complete research programme to compare other forms of analysis involving accidents, the road, vehicles and behaviour.

The discussion that took place during this session showed the importance of correctly defining the analytical objective and the models to be used as a reference. All these presentations deal with this aspect, that opens the way to any analytical work. This is well worth remembering as all too often, researchers are asked to study accidents in cases where there is thought to be a specific safety problem.

The action procedure comprises various phases: diagnostic and revealing problems, action planning, setting up, evaluation and follow-up. Accident analysis should obviously be used in the first and last stages of this process.

Analyses can be performed on very different overall levels ranging from a clinical approach to highly aggregated processing. The resources used therefore depend on the level of accident analysis.

The question of the reliability and relevance of data is therefore significant for an event analysed a posteriori. The same applies to the choice of variables and coding. Discussions showed the advantages of co-operating and exchanging analytical models and formalising information.

Accident analysis is not a tool to be considered in isolation in a research process. This aspect is implicitly present in most of the papers presented. It should therefore be co-ordinated with other tools such as conflicts which reveal certain malfunctions, in-situ and laboratory behavioural observations, which include simulators, functional analyses of the road system, risk exposure analyses...

In other words, accident analysis in its many different forms has its place - no more but no less - in the overall process of research aimed at improving safety. This was clearly shown in the course of the discussions that took place during the session devoted to "Statistical and in-depth analysis of the accidents".