THE INVESTIGATION OF TRAFFIC ACCIDENTS BY THE POLICE

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ABSTRACT

This paper presents the state of the art of the investigation of traffic accidents by the police in Switzerland. After marking the traces at the scene of the accident a stereopair of photographs is taken, showing the entire scene. By analysing these stereophotographs in the lab a scaled situation plan is obtained. All material of evidence is secured and analysed at the crime lab by order of the district attorney. The results of such analyses are presented. Special attention will be given to accidents with pedestrians and with two-wheel drivers.

INTRODUCTION

The Swiss Vehicle Act of Traffic Rules and Regulations states: "If accident victims suffer visible injuries or if internal injuries are assumed, the police must be informed immediately." "The situation at the scene of the accident may only be changed in order to protect the injured or to maintain the traffic until the police arrives. The original situation should be marked on the road."

Therefore it is the duty of the police to investigate the accident and to obtain all possible evidence. This duty is made up of three things:

1. The report of facts by a police officer

In this report the factual findings of the police, statements of the accident victims and of witnesses are to be recorded. The report gives informations concerning the scene of the accident, such as weather and road conditions, the time when the accident occured and the description of all parts involved and injuries as well. Additionally, the report contains informations about the vehicles, e.g. tires, lights, damages and so on.

2. Documentation of situation and damages The police cars are supplied with necessary equipment such as cameras, measuring tapes, etc. In all accidents where only minor bodily injuries were caused, the police officer reporting the scene makes all the documentation himself. He starts with a general photographic survey. Step by step he goes on to details. First the final positions of the cars involved are photographed, then the traces and damages. The final position of the vehicles and the traces are measured for making a scaled situation plan. During the time these measurements take place, the traffic around the place of the collision must be blocked off. Complicated situations are rather time consuming in order to record all the needed measurement. Therefore the Zurich City Police Department started already over 50 years ago to work with a stereometric camera. In the meantime most of the Swiss police departments have followed this example.



In all traffic accidents with bodily injuries or with complicated situations, a special team supplied with a stereometric camera is sent there for securing and preserving the evidence.

With a gypsum powder marker all traces of the accident are emphasized so that they contrast well with the surrounding.



This procedure is used mainly for skid marks of vehicles, scratch marks, the zone of scattered glass or car paint and car parts which fell or broke off. After the stereometric camera had been set up properly, a stereopair of photos is taken, showing the entire scene of the accident. On the photos all the necessary informations are saved, so that the road can after this immediately be reopened for traffic. The stereophotographs are subsequently analysed in the lab by a so called autograph. With this method the two central perspective photos are transformed into a scaled situation plan.



The method of stereophotography is fully accepted by Swiss courts and has the following advantages:

- The situation is recorded on the spot within the shortest time possible, so the road can soon be opened again for traffic
- The analysis can be done in the office without pressure of time and in a 3-dimensional way. Details of eminent importance can be given more attention than at the place of the accident. In case of doubt, a reexamination is possible at any time.
- The photogrammetric analysis permits an exact, complete and sequenced recording of even the most complicated accident scenes.
- The scene to be photographed does not need being entered. Non touchable objects, such as vehicles or buildings on fire or about to explode, can be photographed without difficulties and later be evaluated. Objects of a limited duration time, but of great importance in the evaluation of facts, such as snow piles, construction sites, broken off branches etc. are fixed to analyse for ever.
- The photos can be enlarged to any desired size and can be used like "ordinary" photos for the factual report. A stereoscopic view with a mirror stereoscope shows a 3-dimensional true-to-life view of the scene which is of great importance e.g. in court proceedings.
- The accuracy of the method is better than 1 cm within distances up to 30 meters.
- When the scene of an accident extends over dozens of meters, the situation can be photographed sequencially by repeated positioning and new setting up of the stereometric camera.

Later the situation plans can be put together like a puz-

zle and provide a complete picture of the accident situation.

3. The securing of material evidence

All police cars are supplied with the necessary equipment to secure the material evidence. The City of Zurich Police Department started 35 years ago with using adhesive tape to record those traces which are not, or barely visible by the naked eye. For instance slightest rubbed off paint particles, textile fibers on a vehicle from the clothes of an accident victim, rubbed off traces on the road from shoes etc. Larger traces such as blood, hair or tissues of victims are secured by other suitable methods. Broken car parts such as mouldings, bumpers, side mirrors a.s.o. are also taken as evidence, as well as lamps, damaged tires, safety belts or tachographic charts.

Depending on the situation, a mechanical check-up of the vehicle may be required concerning the condition of brakes, tires, lights etc.

All material of evidence taken will be analysed at the crime lab - the "Police Science Department" - by order of the district attorney. The results of such analyses are recorded in form of forensic expert reports.

Before I refer to such expert reports, some words are to be said on computer-aided-evaluation of single photos. Wide spread opinions exist, that this procedure has by now replaced stereophotography, the latter being obsolete. In fact computer-aided evaluation enables to establish a correct scaled situation plan with an ordinary photocamera and the corresponding computer program. However, its accuracy depends largely on the observation of certain rules and is by no means equal to the accuracy of stereophotography.

As a base for computer evaluation four points have to be fixed. These points must lay on one plane and can present themselves in free distance, which have to be measured exactly. The computer program allows exact recording to scale of all points, such as the final positions of vehicles and the site of traces which are lying on the same plane. However, nowadays the process described above is not possible if, for instance, skid marks extend from the road unto the sidewalk, or if the road is uneven. Because of the perspective character of photos a slight unevenness in the background has a bigger influence than those in the foreground. In general the accuracy of evaluation decreases towards the background, therefore the application of the single photo method is limited. Furthermore it is not possible to put together situation plans of several photos which is possible by stereophotographs.

Experts therefore agree, that the computer-aided evaluation of single photos will neither now nor in the near future be a complete substitute for stereophotography. Its use is only possible when the whole scene of the accident is lying on one plane and is recorded on one photograph. By these limitations the method is accepted by Swiss courts.

EXAMPLES

The most important duty in the investigation of traffic accidents is the search and securing of evidence. If mistakes or omissions are made during this stage, they cannot be compensated even with the most sophisticated laboratory investigation methods.

By searching evidence, it is specially important that good sources of light are used, either natural or artificial. The full length of a brake or skid mark can often only be seen if the road is examined in a flat angle. On a careful examination of such tire marks irregularities such as cracks, flaws, interruptions or concentrations of rubber are revealed. They are caused by exterior influences, for instance when a pedestrian is loaded on the hood of a car. The location of such irregularities indicates the exact point of collision much more precise than any calculations.

An expert for the securing of evidence who examines the scene of an accident thoroughly, can suddenly recognize a trace that was not noticed previously for instance in the light of an arriving car. Or he may discover some evidence at an unexpected place. This evidence might be the one piece that completely solves the case.

A pedestrian crossing the street was hit by a car and thrown down in the direction the car was travelling. The car stopped without producing skid marks and it appeared first that a calculation of its speed would not be possible. Prior to the accident the pedestrian had shopped at a grocery store and the milk she carried was spilled and splattered around as a result of the collision. Small splashes of milk were found at the front side of a traffic sign, located at the edge of the crosswalk in the driving direction of the car.



This proves that the point of collision was <u>in front of the</u> <u>crosswalk</u> and therefore the pedestrian had not crossed the street on the crosswalk. Considering this site of the collision in relationship to the final position of the pedestrian and to the damages of the car, we can conclude that the driver of the car has probably violated the speed limit on this part of the road.

An additional example which shows the importance of an investigation of the accident scene:

A car collided with a boy returning home from a trip and carrying a pair of skis and ski poles. The final position of the boy caused the driver to assume that the boy had ran into the road from behind of one of the two houses bordering the street.



The driver claimed to have been surprised by the sudden appearance of the boy. On a spot marked on the plan by position "A", a piece of paint approximately 3 x 16 mm was found, which showed light-and-dark stripes. This trace matched to one handle of the ski poles and fitted as the missing piece into the colour design of the handle (see Figure on next page).

With this evidence the point of impact on the road of the ski pole was established. It is therefore certain, that the site of collision was not left of position "A" but rather to the right of position "A", proving that the boy was walking on the street towards the coming motorist.



In every accident, the involved cars must be checked for traces scrupulously. The location of wiped off zones on a slightly dusty surface of a car gives first hints that there has been a contact. In these places traces of textile fibers can sometimes be found. These traces can be compared with the clothes of an accident victim by microscopic, micro chemical and spectrophotometric methods. Traces of hair can be examined by the same methods.

After an accident a driver insisted that an animal had jumped in his car causing him to lose control of the car. The hair found on the front of the vehicle was examined and determined to be of a fox. Curiousely, the hair was free of blood and tissue. The elemental X-ray spectroscopic analysis showed, however, substantial amounts of aluminium on the hair. From these findings we concluded, that the hair was taken from a piece of tanned fox hide. Confronted with these facts, the driver admitted that he had lost control over his car and that he had wanted to disguise his accident.

At a junction a truck collided with a motor bike driver, the latter being seriousely injured. Since at first the driving direction of the motor bike was not known, we checked the whole truck. We found on the right front side of the bumper a wiped off trace and imbedded in it over 40 synthetic and cotton fibers that came from the pants of the motor bike driver. Together with the evaluation of the tachographic disc and the trace location, it was established that the truck had stopped at the junction. Starting again he collided with the motor bike that was passing the truck on the right side. Further traces of evidence enabled a complete reconstruction of the sequence of this accident where the motor bike was run over by a wheel of the truck.

When an injured person is found on the street, we examine in detail his clothes for possible traces that point to a traffic accident. In several cases we have found minute rubbed off traces from paint that gave a specific indication of the colour of the hit and run car. A seriously injured motor cycle driver was found on the road. The question arose whether he himself had suffered an accident, or if he had been hit by a vehicle. Below the left knee of the motor cyclist's blue jeans we found red paint particles pressed into the fabric. Obviously this paint was pressed into the fabric by great force. Instrumental analyses proved, that this paint came from a car that had collided with the motor cyclist. In another case, where an older motor-bike driver became injured, we found paint traces ground-in on the right brake lever of the motor bike. These traces corresponded with the paint of a truck parked on a road bend. Thus it was evident, that the motor-bike driver had collided with this truck.

Traces of paint transferred from one car surface to another sometimes allow a chronological order in the interpretation of multiphased accidents. Owing to the analysis of transferred traces of paint we could prove the following sequences of a highway accident:



- First, the Volvo started to slid, then collided with the center divider, turned on its side and finally landed on its top
- the driver of the Oldsmobile that was following the Volvo was able to stop his car without collision in the passing lane
- then the Alfa Romeo crashed into the rear end of the Oldsmobile, pushing it towards the right side of the road, where it collided with the overturned Volvo;
- the BMW finally, riding in the right lane, crashed into the right side of the Oldsmobile.

A special kind of paint analysis helps to clear accidents involving pedestrians, namely if paint traces from the crosswalk markings are pressed or rubbed in the sole of a shoe. With those traces the exact point of collision is incontestably established. It is clear that such microscopic findings are further investigated by instrumental analyses. Furthermore we check if these findings are compatible with the accepted results of pedestrian accident calculations. A further case:

The driver of a heavy road train said that he had stopped at a traffic light and by starting to move again he had felt something unusual. After stopping the second time he noticed that he had run over the driver of a motor-bike, which he alledgedly had not seen. When asking him how the accident happened, he supposed that the driver of the motor-bike must have passed him on the right sidewalk and had fallen under his truck. The analysis of the traces led to a classical crossing of traces between the left side of the seat and the licence plate of the bike on the one hand and the disc of the right front wheel of the truck on the other hand. This enabled a reconstruction of the situation of collision of both vehicles.



On the outside of the right twin tire of the truck's rear axle we found an accumulation of blue cotton fibres, which matched with the clothes of the motor-bike driver. Thus it was established which wheel had run over the teenager. According to the analysis of the tachographic disc the truck had continually increased his speed over a distance of about 500 meters, to get a final velocity of approximately 37 kilometers per hour. Then it stopped abruptly. The alledged start to move again after the stop was not recorded and therefore the recordings of the diagram were in contradiction with the statement of the driver. Also the traces observed at the site of collision contradict to his statement:

The first scratches caused by the motor-bike are located more than one meter in front of the crosswalk marking and the traffic light. They are on the sidewalk and spread out with interruptions over a distance of approximately 5.5 meters up to the final position of the motor-bike.



From these scratch traces two conclusions can be drawn: First, the point of impact, respectively the point where the motor-bike driver was not in a stable course, is at least approximately 2 meters in front of the crosswalk marking. Second, the length of scratches of approximately 5.5 meters is not matching with a practically stopping or barely beginning to move again vehicle; it points rather to the fact, that the motor-bike had to have a speed in the range of about 30 kilometers per hour at the time of collision. Therefore we can say that the driver of the truck collided at full speed with the motor-bike driver who was riding at practically the same speed in front of him in the same direction.

At another traffic accident, a sliding car was swerved into a field and overturned. In addition a motor cyclist was hit and killed. At first, the exact sequence of the accident was not clear. We found paint traces from the motor cycle and a characteristic hexagonal impression below the left rear fender of the car. The only place where a hexagonal fastening bolt was mounted was the end of the motor cycle carry rack. Therefore the position of the two vehicles at the time of collision could be reconstructed which was nearly at a right angle. The tire marks at the scene of the accident gave a clear picture of the sliding course of the car, and therefore the point of collision could also be determined very precisely. So we could prove, that the fatally injured motor cyclist had been riding correctly near the right edge of the traffic lane.

The variety of the methods of accident investigation will now be documented by selected trace examples. At a car accident, a person was thrown out of the car and killed, while the other person, practically unhurt could get out of the car before the police came to the scene. In the examination of the clothing of both persons, we found a black spot of melted plastic about 20 mm long and 3 mm wide on the right side of the survivors cotton sock. The corresponding point of contact on the car was the plastic cap of the clutch pedal. On its left lower corner a bunch of white cotton fibers stuck, fused together with the plastic cap. This classical crossing of traces proves that the survivor must have abruptly slipped along the side of the clutch pedal and therefore he was the driver of the vehicle. Confronted with these findings he confessed. In another case we could determine the driver of a car by examining the safety belt. On the belt of the driver's seat we found in a narrowly limited area around the left shoulder a substantial amount of textile fibers compressed into the belt's

texture. These fibers came from the pullover of one of the victims. In night accidents it is often claimed that e.g. the bicycle's

lights were not on. A microscopic examination of a vehicle's lamps allows to answer such questions. These examinations are based on the following principles:

The filaments in a light bulb are made of tungsten wire and are very brittle in cold state. When submitted to an impact they can break at any place and the surfaces of fracture will show a typical crystalline structure. In cold state, filaments can hardly be deformed.

If electric current passes through the filament the material is much more elastic. At an impact it can be deformed permanently.



Such deformations can cause a disintegration of the filament, showing at its broken ends taperings and melt-pearls or other traces of melting. All these traces are evaluated unter the stereomicroscope and if necessary, additionally under the scanning electron microscope. If in course of collision the glass bulb becomes destroyed or leaking while electric current passes a filament, oxygen from the air comes in touch with the glowing filament. The tungsten oxidizes producing yellowish tungsten oxide that evaporates and condenses at cooler places, such as at the electrodes, the low beam filament shield etc. If the electric current is interrupted just before the bulb breaks, the filament cools down in air which leads to famous colours at the filament or at the shield caused by the temperature. At a head-on crash between a car and a motor cycle, the driver of the car insisted that the light of the motor cycle was not

of the car insisted that the light of the motor cycle was not on. The head lamp bulb had remained intact. The low beam filament was broken, both parts not being deformed. The main beam filament however, was considerably stretched and melted through. The conclusion that electric current passed the main beam filament at the moment of impact confirmed the statement of the motor cyclist.

CONCLUSION

Often pedestrians or cyclists are after an accident in a position in which they cannot give statements of the occurences of the accident at all or only partially. The other side often takes advantage of such situations knowingly or unknowingly to place themselves in a better position.

A reliable recording of the facts by the police and a sophisticated examination of accident evidence are often the only possibilities to present the facts objectively and to clarify contradictionary statements of victims and witnesses. In Zurich and in the rest of Switzerland we can be proud that at any moment "state of the art" equipped experts record the facts and evaluate the secured evidence with the aid of appropriate methods of investigation.

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