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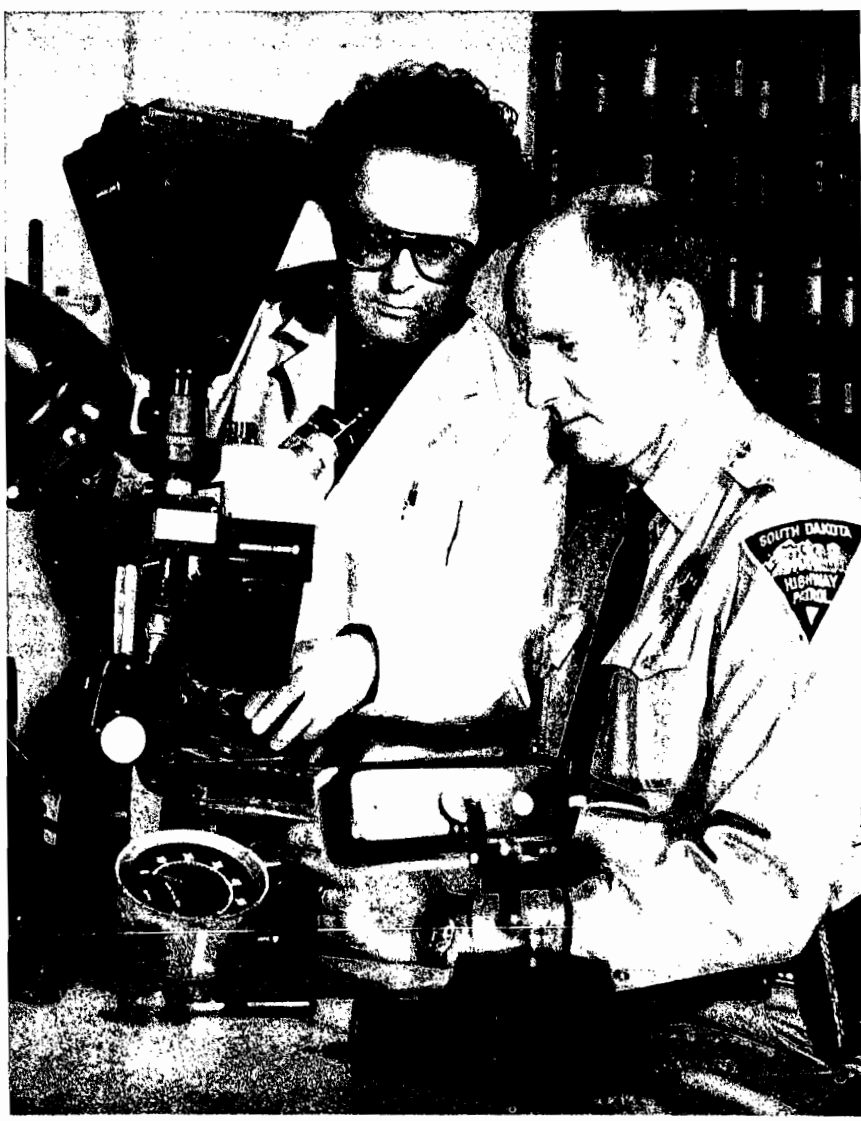
65920

SPEEDOMETER EXAMINATION AN AID IN ACCIDENT INVESTIGATION

Investigative Aids

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A very important factor to be determined in any accident investigation is the speed of the vehicle at impact. Law enforcement agencies employ various methods to determine this factor, the most common of which is skid-mark analysis. Although this is a good method to use, there are many accidents in which skid marks are not left at the scene. Another way is to examine the vehicle and estimate the damages it sustained from the collision. In practice, these estimates are made by comparing the damages with those observed in other accidents in which vehicles collided with fixed objects at known speeds. However, in such cases, estimations depend more on guess and the officer's experience and familiarity with the results of similar collisions than on objective calculations.

Many times, especially in head-on or fixed-object accidents, there is little evidence found at the scene which can be used to determine vehicle speed. In head-on collisions, the damages may

Photo 1—Needle jammed during collision indicates vehicle's speed at time of impact.

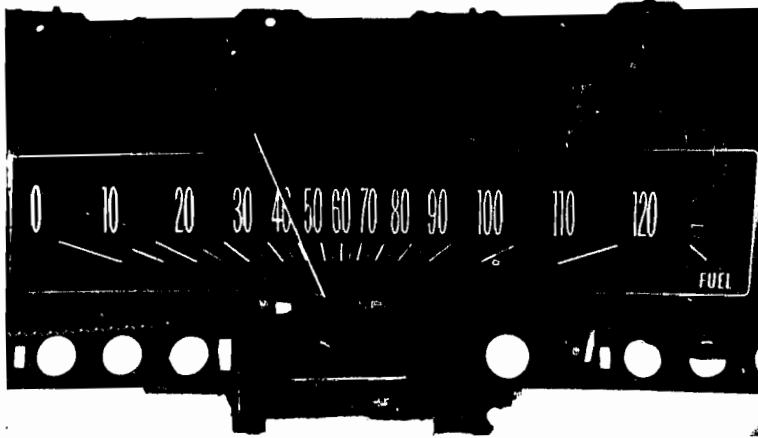
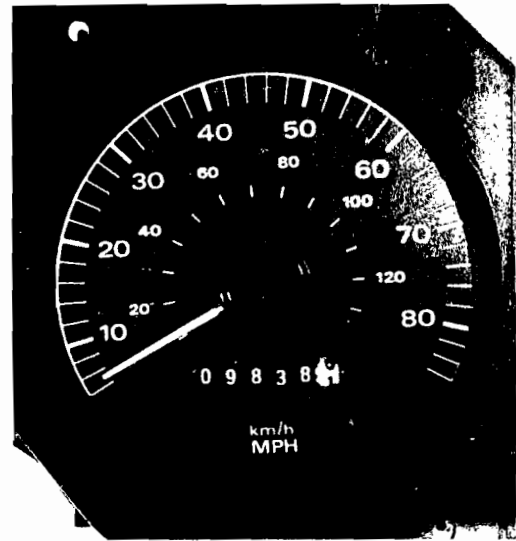


Photo 2—Although speedometer reads near zero after collision, other evidence indicates that vehicle was moving at time of impact; therefore, zero mph reading is not valid.



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be so severe and the approach and departure angles so critical that conservation of momentum equations are almost impossible to use unless the speed of one of the vehicles is known at the time of impact. Collisions into fixed barriers can also present problems when making speed calculations.

One of the other methods to determine vehicle speed at impact is to examine the speedometer, tachometer, and tachograph.

All passenger vehicles sold in the United States are required to be equipped with a device that indicates speed in either miles per hour (mph) or kilometers per hour (kmh) and is easily viewed by the driver. A vehicle may also have a tachometer to indicate the revolutions per minute (rpm) of the engine. Both instruments consist of a numbered dial and a needle or indicator. Usually, the scale and numbers on the dial's background are white, but they can also be multicolored, particularly on the newer models designed to indicate both mph and kmh. The needle is coated usually with an orange or red luminous paint.

The above-mentioned instruments have been installed in vehicles in one form or another since their origin, yet they are seldom used to determine the speed of vehicles involved in accidents. By examining the speedometer, the speed of the vehicle at the time of impact may be determined, but it should be remembered that a direct speedometer reading of a stuck needle after an accident may or may not be the impact speed of the vehicle. Many times, the indicator becomes jammed or stuck indicating a speed (see photo 1), but it is usually at or near zero. The amount of damage to the speedometer and the vehicle may suggest that the direct reading is or is not valid. (See photo 2.)

In some instances, head-on or fixed-object collisions may be so severe that the speedometer needle makes a mark (stamp) on the dial as it pushes against the face of the speedometer during impact. This stamp or mark can sometimes be seen with the naked eye. (See photo 3.)



Photo 3—Closer examination of this speedometer revealed a mark near the 50 mph reading, even though the needle returned to zero.

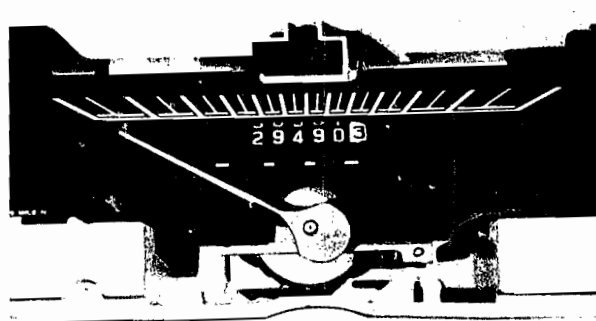


Photo 4—Speedometer with invisible needle marks photographed under normal light.

At other times, some part of the driver's body or other objects within the vehicle will come in contact with the speedometer during collision, bending the needle and causing it to push against the dial. The needle may stick in this position or it may not. If it sticks and all damage is relatively straight from front to rear, the location of the needle can very likely indicate the vehicle's speed at the time of impact. Again, damage and other evidence may substantiate if this speed is probable.

Examining speedometers of vehicles involved in accidents may not be feasible when the force of impact was from the rear. A rear-end collision will most likely move the needle away from the dial than toward it. If there are substantial skid marks prior to collision, the speedometer of the vehicle making the skid marks will probably register zero (or near zero) at the time of impact. And whenever the gear mechanism of the speedometer cable becomes inoperable, the needle will return to zero even though the vehicle is still moving.

When a passenger vehicle is struck from the side and has very little forward speed at the time of impact, chances are that no marks will be made on the speedometer dial by the needle. If the vehicle has a high rate of speed and is involved in a collision from the side, it is possible that there will be enough forward momentum to make marks on the dial.

There are also other marks which could be used for speed determination, even though the needle does not stay at the point that it struck the dial. These marks are the paint smears on the dial which the needle may have left at the time of impact. If the vehicle is being driven at a high speed and is involved in a collision from the front, side, or even rear, there may be enough forward momentum to cause these paint smears. However, these paint smears are not usually detected by the naked eye or a magnifying glass; laboratory examination is necessary.

The speedometer of a heavy truck that has collided with a standard-sized vehicle will very seldom receive enough force to cause paint smears. However, the truck may be equipped with a tachograph, which should be examined by the investigator. The disc of the tachograph should indicate any change in the truck's speed and the time of change.

Tachometers give the rpm of an engine and not the mph of the vehicle. Therefore, whenever any speed calculations are to be made from a tachometer, it is necessary to know the gear in which the vehicle was being driven and what speed will be obtained from the given rpm for that gear. For instance, if a truck has an accident while descending a grade, comparison of the tachometer findings with those found on the speedometer of the same vehicle may help determine the gear in which the vehicle was operating.

The success of any speedometer examination in the laboratory and its use as evidence is going to be valid only if the speedometer is properly removed from the damaged vehicle by the investigating officer. Occasionally, speedometers and tachometers can be cut out of the wreckage easily so

Jerry Baum, Director
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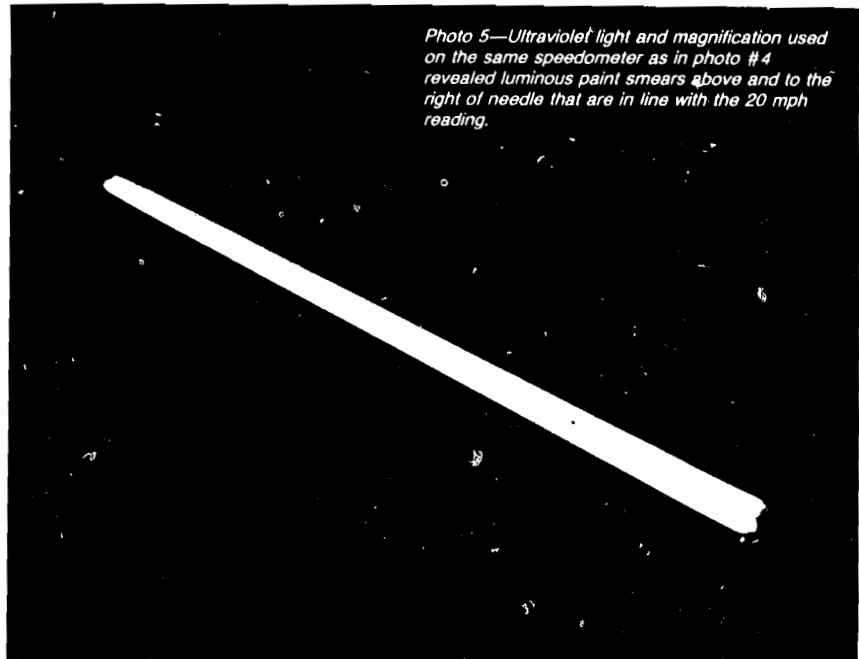


Photo 5—Ultraviolet light and magnification used on the same speedometer as in photo #4 revealed luminous paint smears above and to the right of needle that are in line with the 20 mph reading.

that they can be taken to a laboratory for examination. The following are guidelines for the removal of speedometers:

1) Photograph the speedometer, whenever possible, before it is removed from the wreckage.

2) Remove the complete instrument panel, if possible. On motorcycles, this would also include the tachometer.

3) Handle the speedometer gently. Try to remove the instrument panel without using a cutting torch. If a torch has to be used, cover the speedometer to protect it from heat and sparks, especially the dial and needle. When removing the speedometer with levers or pry bars, etc., be especially careful not to jar or further damage the speedometer needle or face. Often, it is better to cut the speedometer cable with a bolt or wire cutter several inches back from the speedometer head rather than trying to disconnect it. This will help prevent further damage to the interior of the speedometer.

4) Do not touch or wipe the needle or dial.

5) Do not rotate the needle or cable to see if the speedometer still works.

6) Do not shake or jar the speedometer.

7) Do not remove the cover glass. If the glass is broken, do not disturb the pieces, if possible.

8) Do not disassemble the speedometer.

As soon as possible after removing the speedometer or instrument panel, cover or wrap it with a plastic wrapping material or place it in a plastic evidence bag, paper sack, or any other clean and dry container to prevent further damage or contamination. This container should then be sealed, labeled, and identified by the investigating officer.

The removal of the speedometer can only be done within the legal procedures of gathering evidence. The investigating officer should maintain and keep short the chain of custody of such evidence, as with any other evidence. Therefore, delivery to the crime lab should be done as soon as possible, preferably by the investigating officer.

A request for examination should be submitted with the speedometer when it is delivered to the lab. This request or letter of transmittal should contain a short narrative of the accident, any speed calculations, other pertinent data, and the usual required information. This will help confirm the findings of the laboratory examination.

The laboratory examination consists of observation, microscopical analysis, and photomicrography under normal lighting conditions and ultraviolet light. During the laboratory examination, the speedometer or tachometer is initially observed and photographed under normal light. Examination under binocular stereoscopic microscope, in some instances, could reveal some indentations or scratches on the dial of the speedometer. Usually, no superimposition of foreign paint can be seen on the dial during this observation. (See photo 4.) The next step is examination under ultraviolet light. Any ultraviolet light source could be used, but high-intensity UV light is preferable.

Photo 6—Closeup of a small portion of the dial. The minute luminous particle of paint from the needle can be seen and easily distinguished from all other particles by its red color.

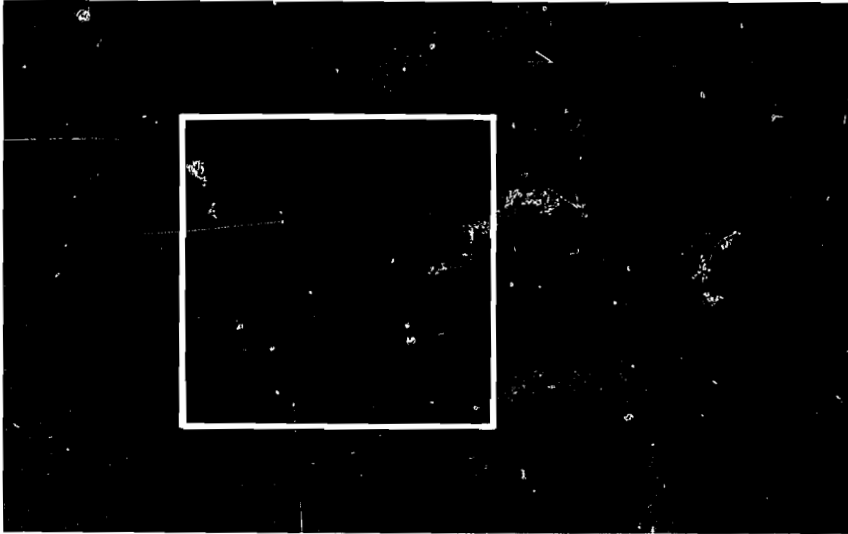


Photo 7—Ultraviolet photomicrograph of circled area in photo #6 shows the minute luminous needle mark at 62 mph.



The "Blak-Ray" Longwave UV Lamp, model B-100A, which is used in the crime laboratories for many other examinations, has worked successfully for the speedometer examination. If there are any transfers of luminous paint particles from the needle to the speedometer dial, they can usually be seen quite easily when observed under ultraviolet light through the stereoscopic microscope. (See photo 5.)

It is more difficult to take a photograph of these small particles under UV light than it is to observe them. In the South Dakota Division of Criminal Investigation Crime Laboratory, we are using a Nikon Multiphot camera with a Polaroid 4 x 5 Land film holder model 545, Polaroid 4 x 5 Land film Polacolor 2 Type 58, lens $f=65\text{mm}$, two UV lamps and a Wratten filter #15 (yellow) between lens and film. Under conditions listed above, the exposure varied from 30 seconds to 5 minutes, depending on intensity of luminescence, magnification, diaphragm (aperture of lens), and size of particles. (See photos 6 & 7.)

In some cases, a heavy smear may be found at the speed mark the needle was indicating at the time of collision. This smear may then go either toward a higher or lower reading. In such cases, when paint particles are spread on the large part of the dial, it is more difficult to determine the position of the needle and speed at the time of impact. In many other cases, when the paint particles are distributed on the dial as a straight line or as a row of dots from the pivot point of the needle outward to the edge of the dial, it is easy to determine the place of needle-dial contact, and consequently, the reading of the speedometer or the speed of vehicle at the time of impact.

FBI



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Division of Criminal Investigation