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Photographic Documentation and Analysis In Vehicle Accident Reconstruction[1]

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Abstract

The use of the camera has become increasingly important in vehicle accident reconstruction work. A number of practical techniques have been developed which go beyond simply documenting what is seen at a particular time. The camera may be used for making measurements, for establishing lines of sight and for analyzing photographs taken by others. This paper briefly reviews photographic methods currently in use in accident reconstruction and presents several techniques which have been developed to expand the use of the camera. Photographs taken from actual accident cases are used to illustrate these new techniques.

INTRODUCTION

The process of accident reconstruction involves the following steps:

- Documenting evidence
- Studying evidence
- Explaining what happened

Photographs aid in all three steps. They provide:

1. Information on items related to the accident but not caused by it, like vehicle type, model, VIN, site location, presence of traffic signs, light poles, buildings, trees, visibility obstructions and lines of sight;
2. Documentation of specific evidence such as severity, type and location of damage to vehicles, presence of worn out components (tires, brakes), failed vehicle components, gouges and tire marks, pot holes, damaged guard rails and debris;
3. A basis for measurement and causal analysis when compared with other photographs.

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In addition to the photos you take in your accident investigation, accident-related photographs can be obtained from a variety of sources: police files, insurance and private investigators, newspapers, towing services, family members and friends of plaintiffs and defendants, attorneys, professional photographers and experts.

GENERAL TIPS FOR TAKING PHOTOGRAPHS

The objective of taking photographs is to capture images useful for documentation, for presentation, for taking measurements and for analysis. With this in mind the following general procedures are recommended:

- Take a series of photographs starting with overall views, then progressively close in on details of interest.
- Photograph vehicles from all four sides, standing directly in front of each side. This is important if it is necessary to scale dimensions from the photographs.
- Show what is not damaged as well as what is damaged.
- Leave sufficient margin around the subject of the photograph to allow for cropping during processing.
- Request contact sheets to assist in organizing photographic sequences and locating specific frames.

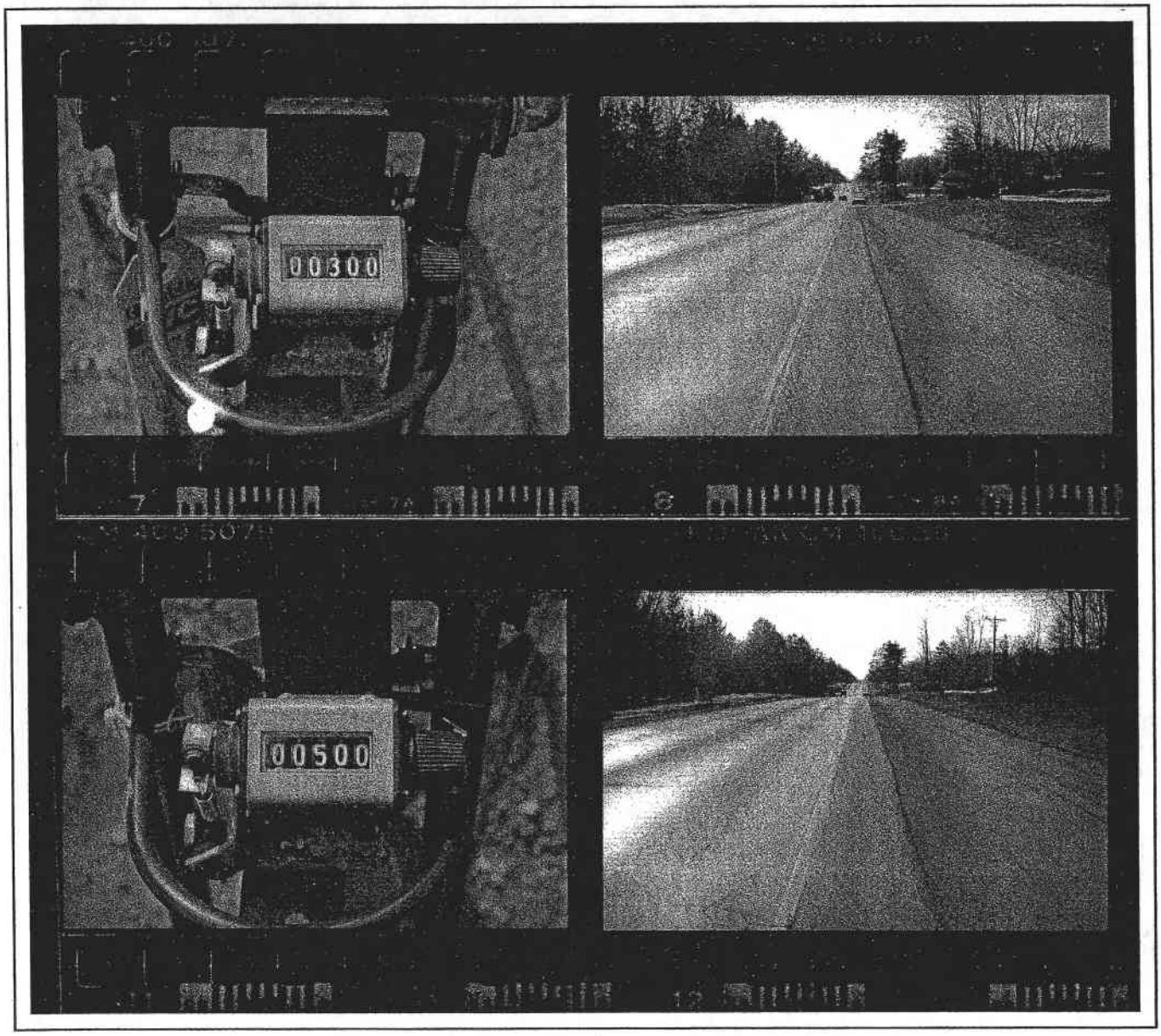

Figure 1 - The photographs in frames 8 and 12 of the film strips were taken 300 feet and 500 feet respectively from the reference point, which is at the entrance to the driveway on the right-hand side just in front of the car parked on the shoulder.

DESCRIPTION OF ACCIDENT-RELATED ITEMS

Documenting Lines of Sight Using a Measuring Wheel

The following is a simple way of documenting lines of sight:

- Determine a reference point, like the point of impact, and set the measuring wheel counter to zero at this point.
- Walk away from the reference point a desired distance, such as 100 ft, photograph the counter, then the view towards the reference point.
- Walk an additional desired distance and repeat the procedure.
- Print a contact sheet.

Each view of the reference area would correspond to the distance shown on the prior frame. The contact sheet in Figure 1 demonstrates the use of this method. The point of reference is the entrance to the driveway in front of the car on the right shoulder.

A similar procedure would involve marking numbers on the pavement at the desired distances then photographing the number on the pavement prior to photographing the view (Figure 2). For presentation purposes photographs of the numbers can be pasted on enlargements of the views as shown in Figure 3.

Figure 2 - The photographs in frames 2 and 7 of the film strip were taken 50 feet and 100 feet respectively from the cone positioned at the entrance to the driveway.

Documenting Mutual Views

Sometimes it is important to be able to demonstrate the view of each driver prior to a collision. A simple two-camera technique can be used for this purpose. The method has been used for a motorcycle/automobile collision in Figures 4 and 5.

This procedure involves the following steps:

- Estimate the speed of each vehicle.
- Locate the collision point on the road using available evidence.
- Using the estimated speed, determine and mark the location of each vehicle 1, 2, 3...seconds prior to impact.
- Place similar vehicles at locations corresponding to equal times, and from each vehicle location photograph a number portraying the appropriate time followed by a photograph of the other vehicle.

Views from each vehicle may then be compared at the same point in time.

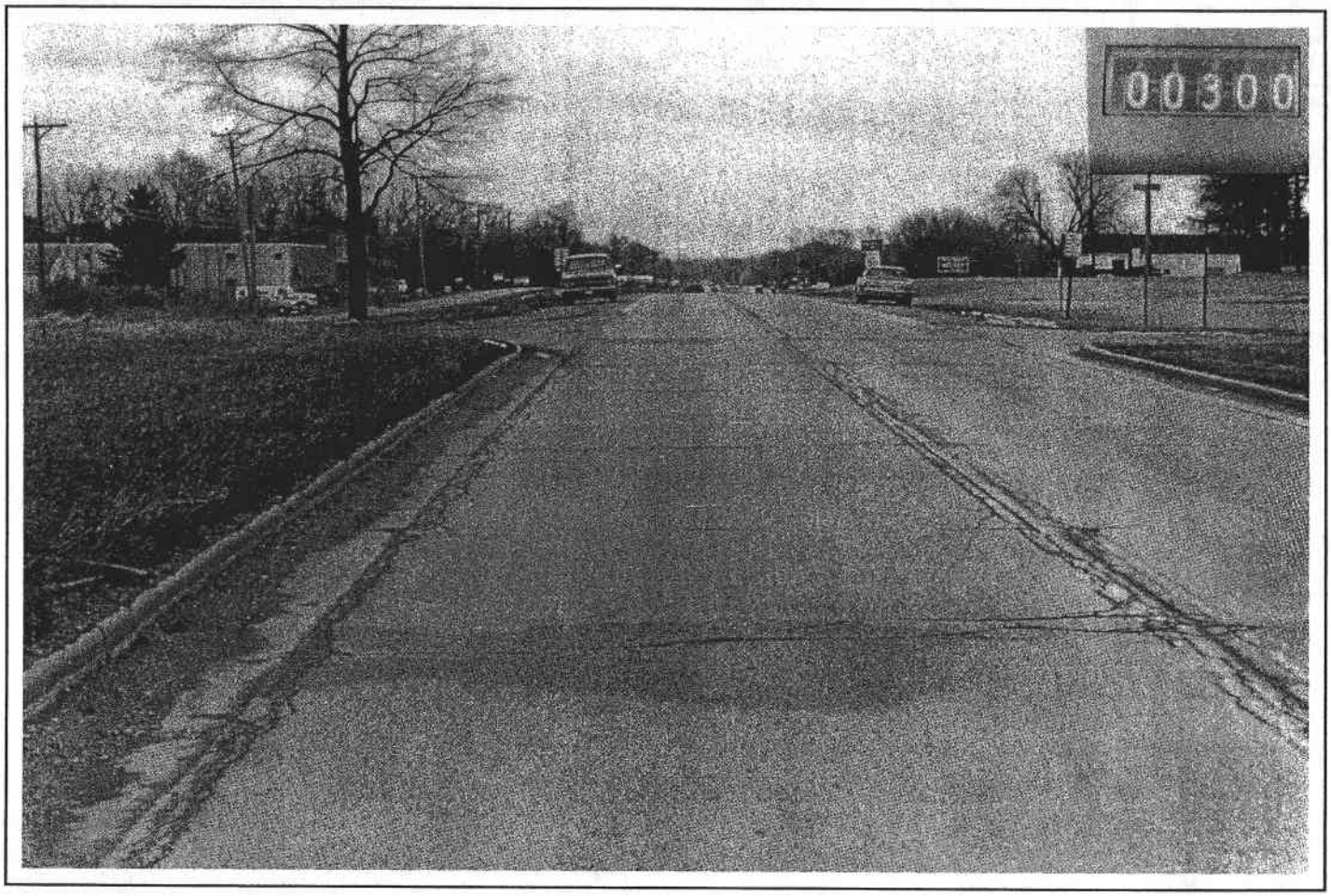

Figure 3 - A print of the measuring wheel counter pasted on an enlargement of the above photograph, demonstrates the photographer's position 300 feet from the truck parked on the left shoulder.

Figure 4 - Frames 13 and 11 on the film strip are views of the automobile as seen by the motorcyclist as both were positioned at distances corresponding to locations 1 and 2 seconds respectively prior to collision.

Figure 5 - Frames 12 and 10 on the film strip are views of the motorcycle as seen by the automobile driver as both were positioned at distances corresponding to location 1 and 2 seconds respectively prior to collision.

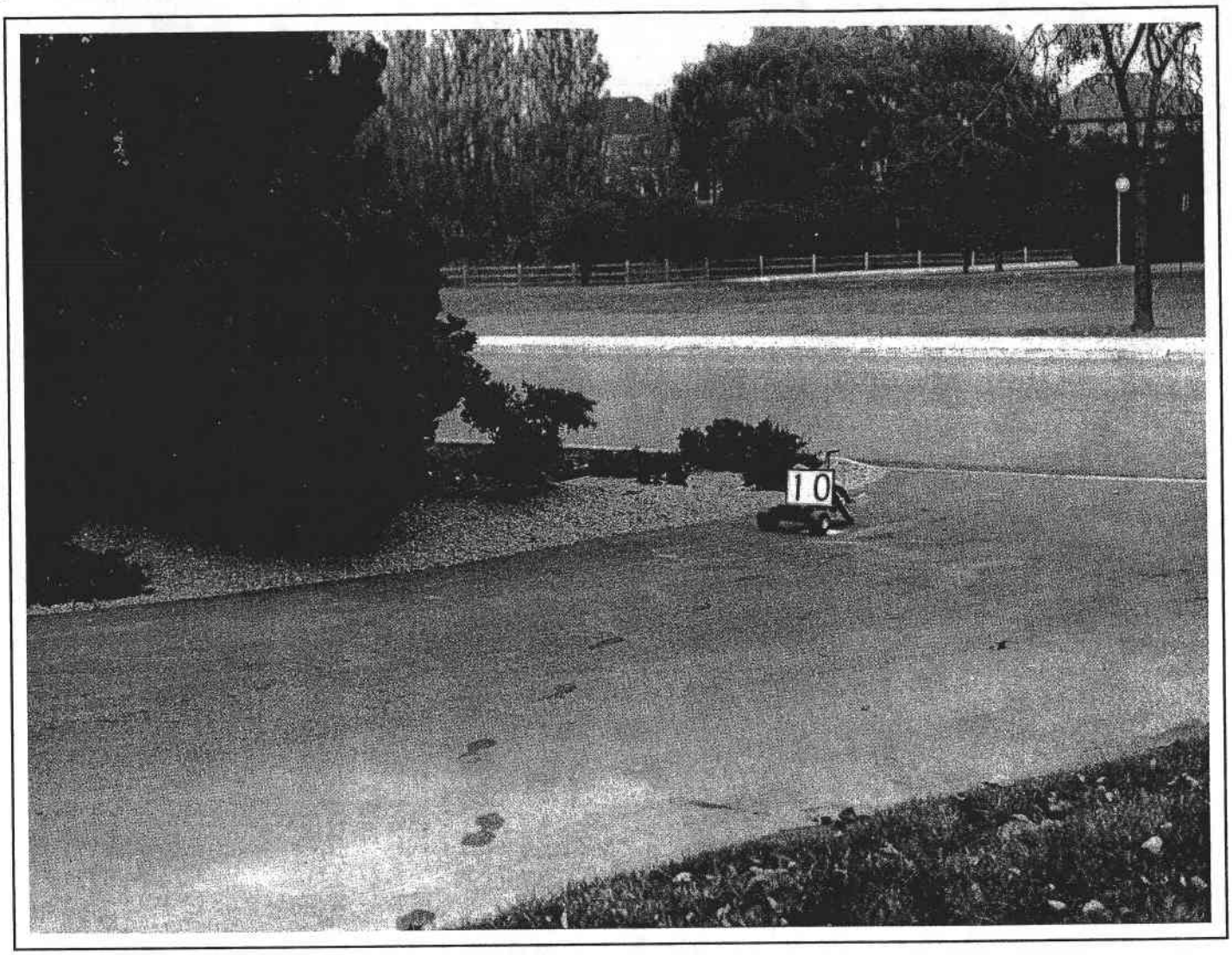

Figure 6 - A Big Wheel tricycle is positioned with its front wheel 10 feet from the edge of the pavement.

Marking Vehicle Position

When it is necessary to demonstrate how a vehicle would be seen at a certain distance from a desired location (in front of the bumper of another, from a stop sign, etc.), a number portraying the distance can be positioned on the vehicle in a distinctive location. A Big Wheel tricycle behind a tree in the driveway in Figure 2 was positioned 15 feet from the curb. The same tricycle is seen in Figure 6 positioned 10 feet from the edge of the road. Figure 7 demonstrates a truck driver's view of a car placed such that its rear bumper is positioned 10 feet in front of the truck's front bumper.

DOCUMENTATION OF SPECIFIC EVIDENCE

Documenting Vehicle-Related Measurements

It is common for a tape measure to be placed in a photograph but the scale does not always show well in photographs. The thin marking lines on the tape may 'wash out'. Portable stadia rods are marked in thick lines. These lines are clearly visibile as shown in Figure 8. Since the background color alternates each foot along the stadia rod, dimensional estimates can be made from the photographs even if the numbers are not clearly visible. Commercially available adhesive tape marked in inches may also be used as shown in Figure 8. For two-dimensional documentation, a grid drawn on transparent material can be used as shown in Figures 9 and 10.

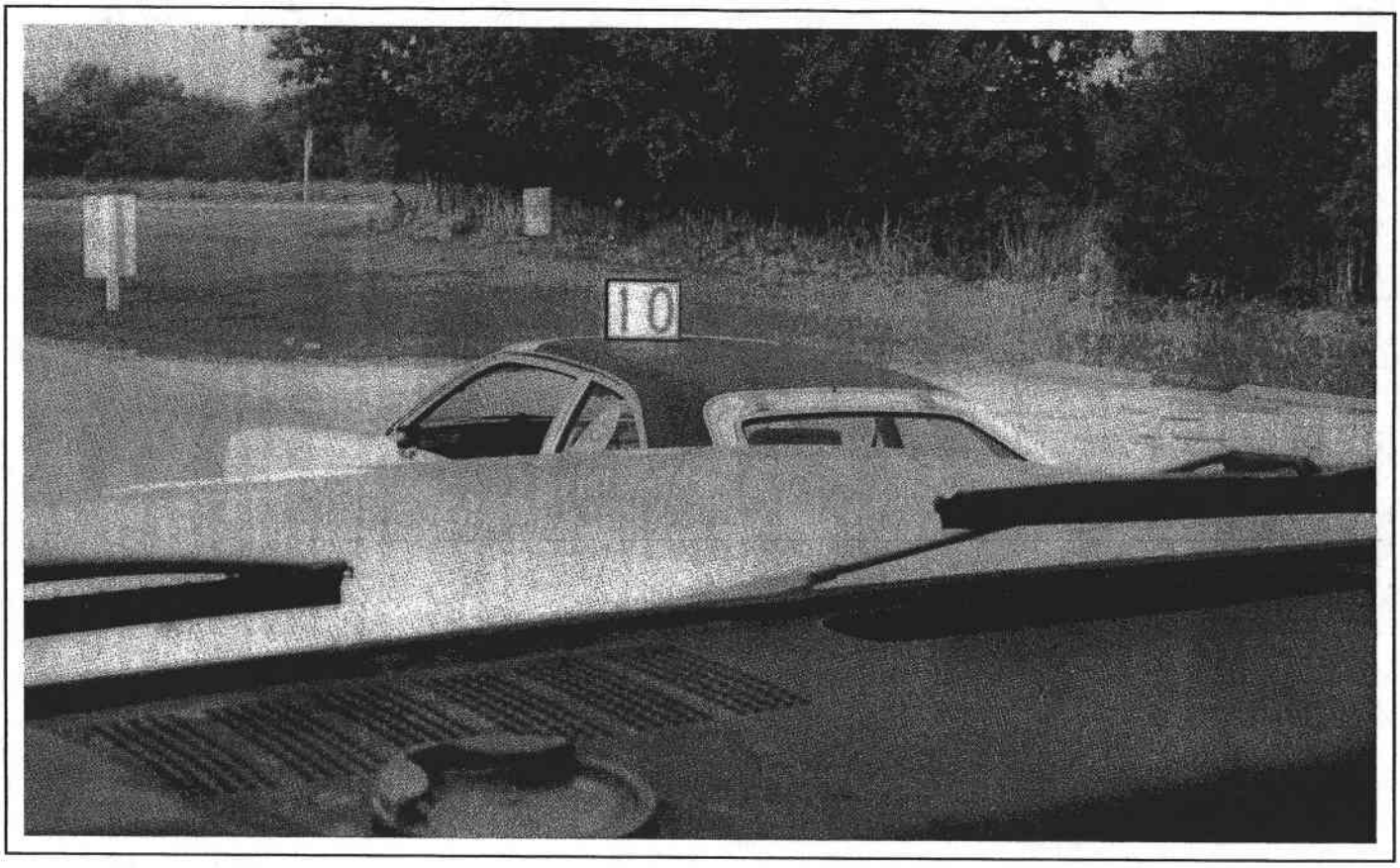

Figure 7 - A truck driver's view of a car positioned with its rear bumper 10 feet away from the truck's front bumper.

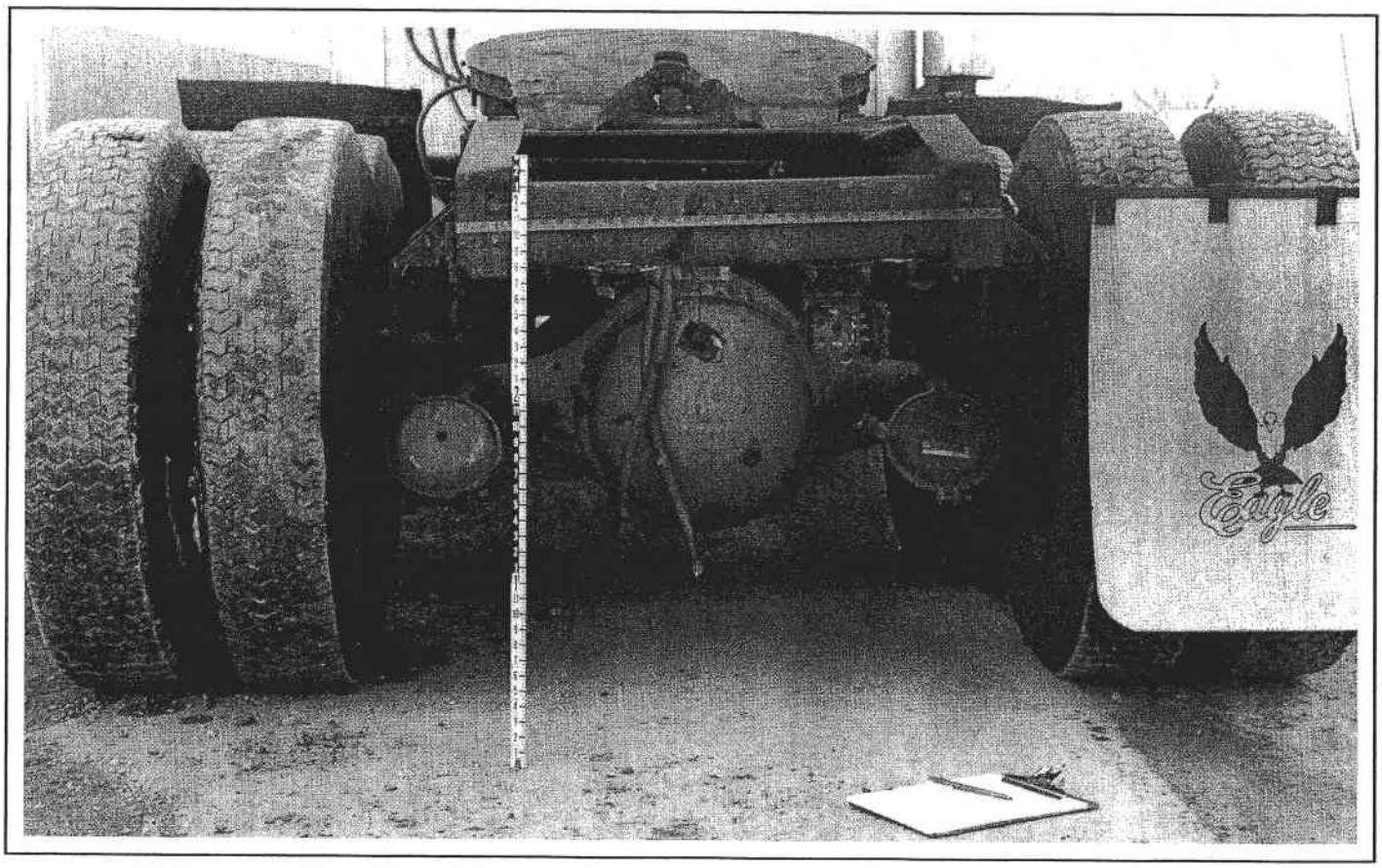

Figure 8 - Vertical dimensions of this truck's frame were documented using a portable stadia rod. The horizontal dimensions were documented using marked adhesive tape.

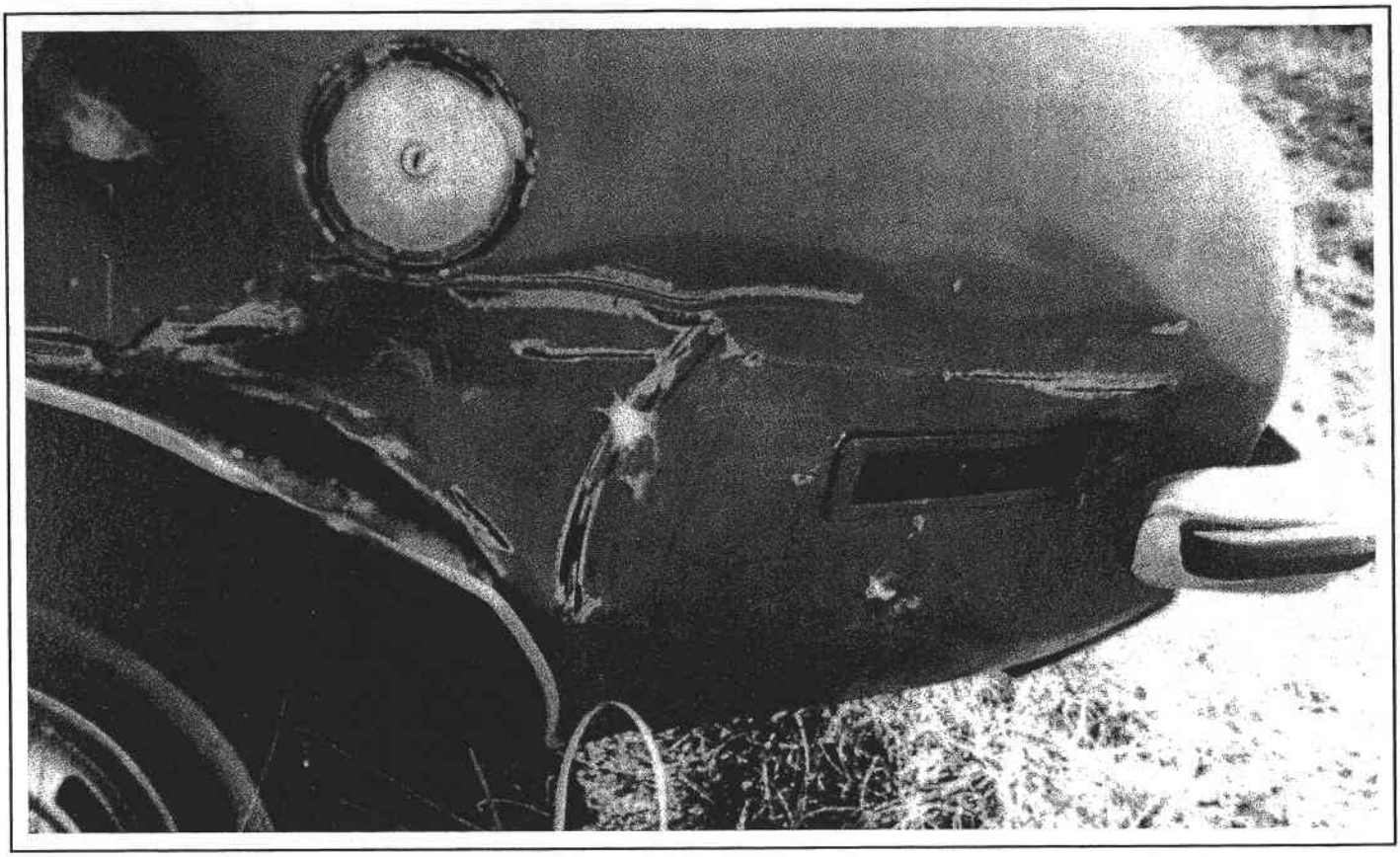

Figure 9 - Documenting this complex damage pattern on the car's quarter panel using conventional measuring techniques is a difficult and tedious job.

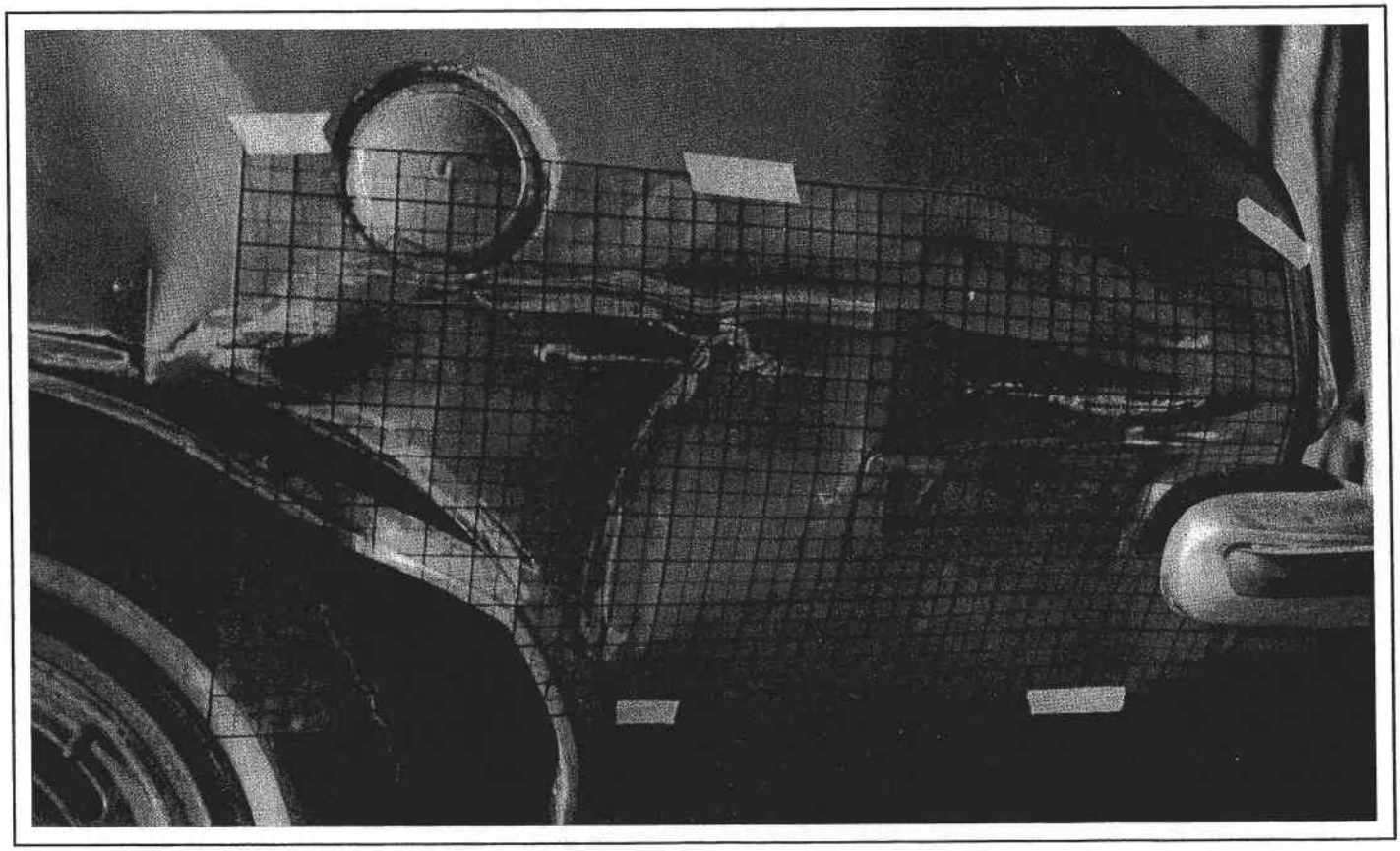

Figure 10 - A photograph of a transparent grid placed over the damage pattern in Figure 9 quickly and easily documents all the necessary details.

Documenting Pavement Markings

Since evidence on a highway cannot be preserved, it is essential that it be documented as soon as possible after the accident and as accurately as possible. This often requires documenting complex tire marks, gouge marks and other pavement details. Manual measurement of the various types and shapes of markings is slow and often difficult to complete with an acceptable degree of accuracy, especially in heavy traffic situations.

A very effective way of documenting pavement markings involves the introduction of additional pavement markings (using spray chalk or other non-permanent marker) which create a grid in the area being documented. The added grid, which appears in the photograph together with the recorded evidence provides a 'scale' by which the location of the evidence can be established. Location of intermediate points within the grid can be fixed using a perspective grid. (Ref. 1)

Figure 11 - Pavement markings placed on a busy interstate using spray chalk.

The accident site shown in Figures 11 and 12 was marked in the following way:

- A reference point (permanent station mark on the pavement surface) was selected;
- Marks were made at 10-foot intervals and numbered along the roadway throughout the accident site;
- At points of interest, marks 1-foot apart were made along lines perpendicular to the roadway or shoulder;
- A large number of photographs were taken, covering the area in detail.

The detailed photographs enabled most of the information necessary for the preparation of a scale drawing to be obtained directly from the photographs.

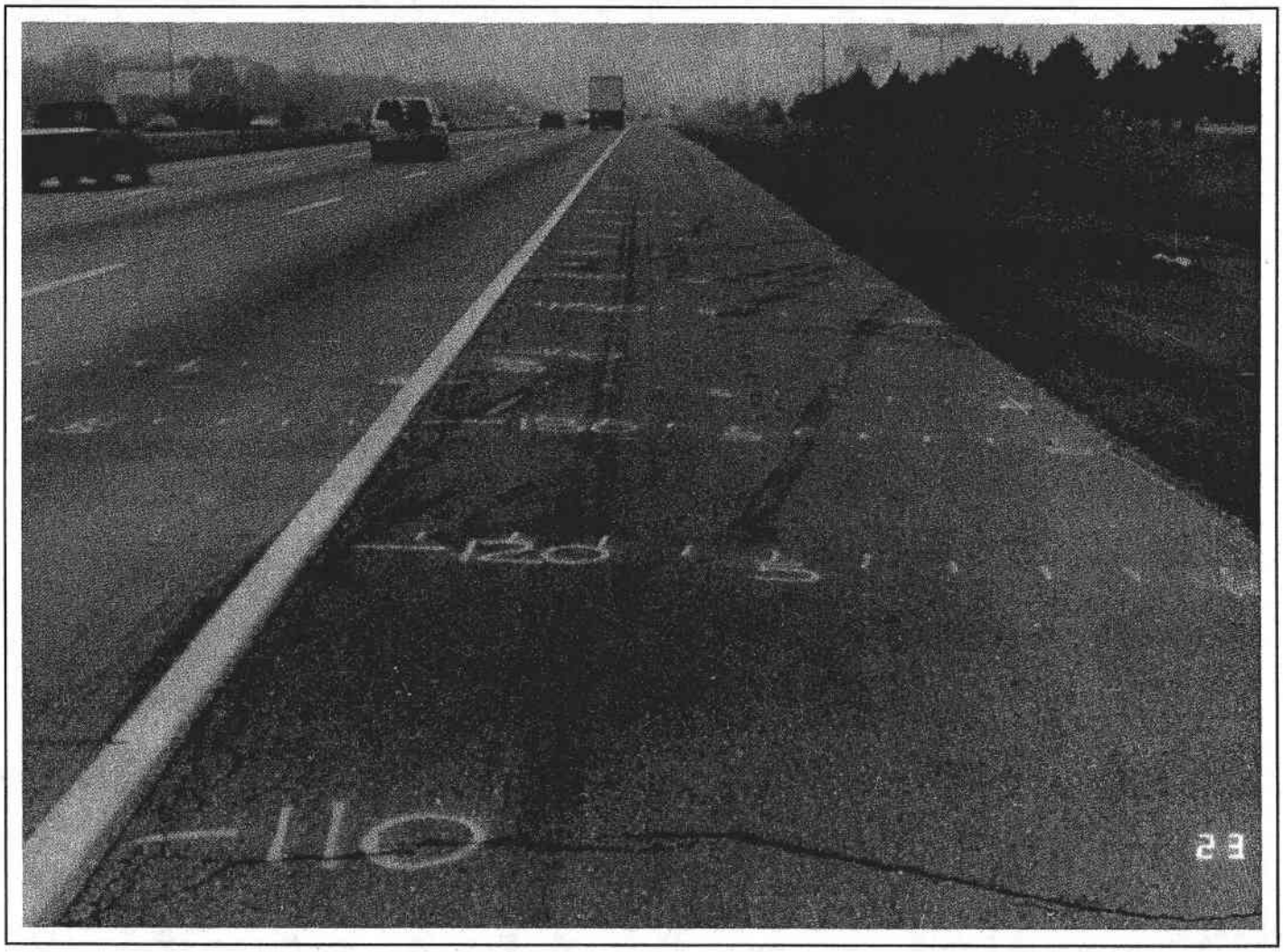

Figure 12 - Detailed grid placed on an interstate shoulder to document a complex array of skid and gouge marks.

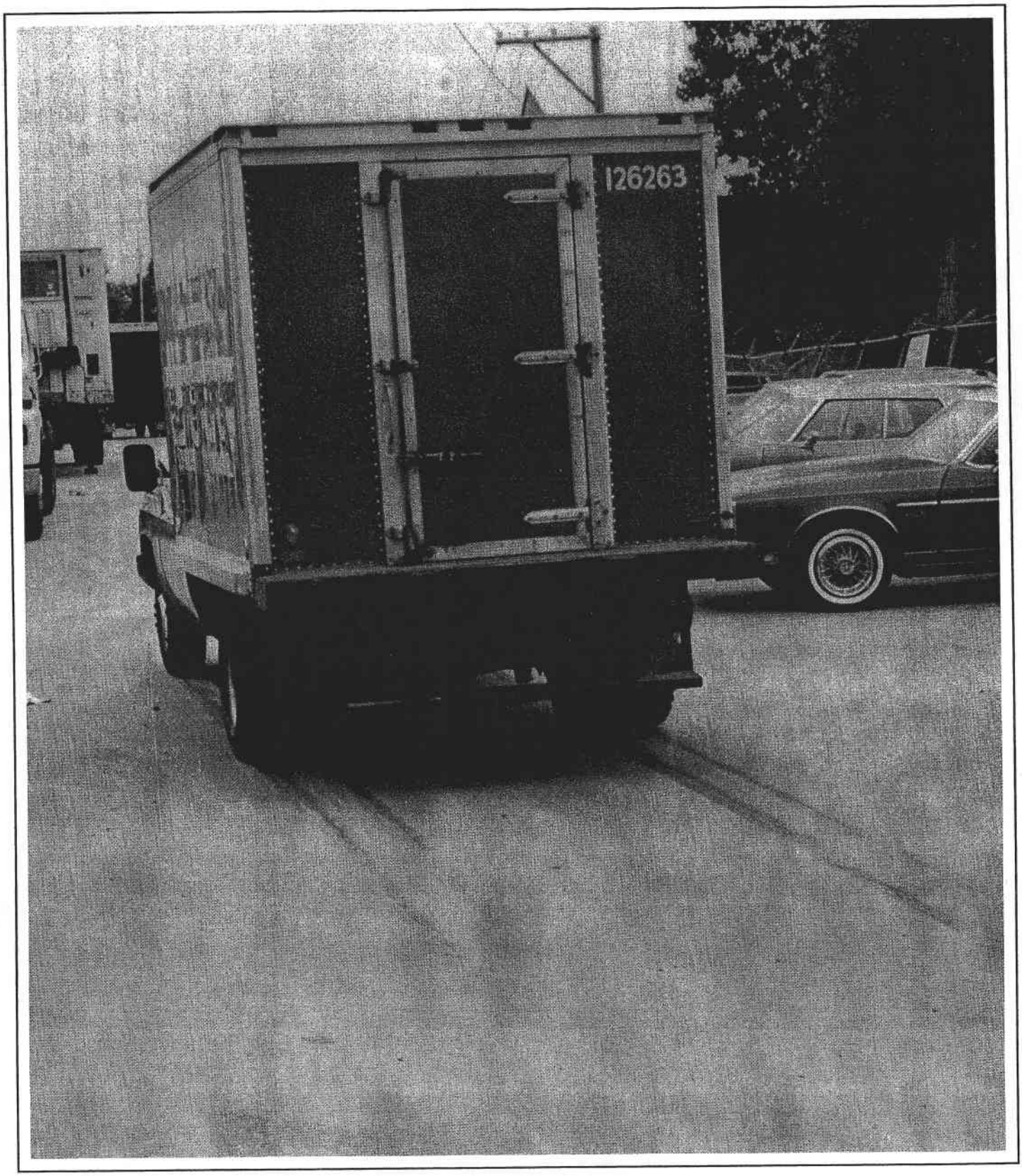

Figure 13 - Skid marks left by a vehicle allegedly having a complete brake system failure.

Documenting Condition of Vehicle Braking System

When the condition of a vehicle's braking system needs to be demonstrated, and the vehicle in question is driveable, a brake test which leaves skid marks on the road can provide useful evidence. A photograph of the pavement near the vehicle's wheels with the vehicle standing at the end of the brake marks is an effective way to document the test results. Figure 13 demonstrates the result of a braking test performed with a vehicle which allegedly suffered a brake failure. Figure 14 represents a test during which one half of a diagonally split braking system was disconnected at the master cylinder.

ANALYSIS

Framing and Scaling Photographs

This method is used to compare a photograph taken right after an accident with one taken later. The method is useful for dimensional evaluation of evidence shown in a photograph taken by others for which no information is available or information is in dispute. It is based on the existence of landmarks which do not change within the photographed scene, the planting of new landmarks at known locations, and the retaking of photographs to compare with the originals. The procedure is as follows:

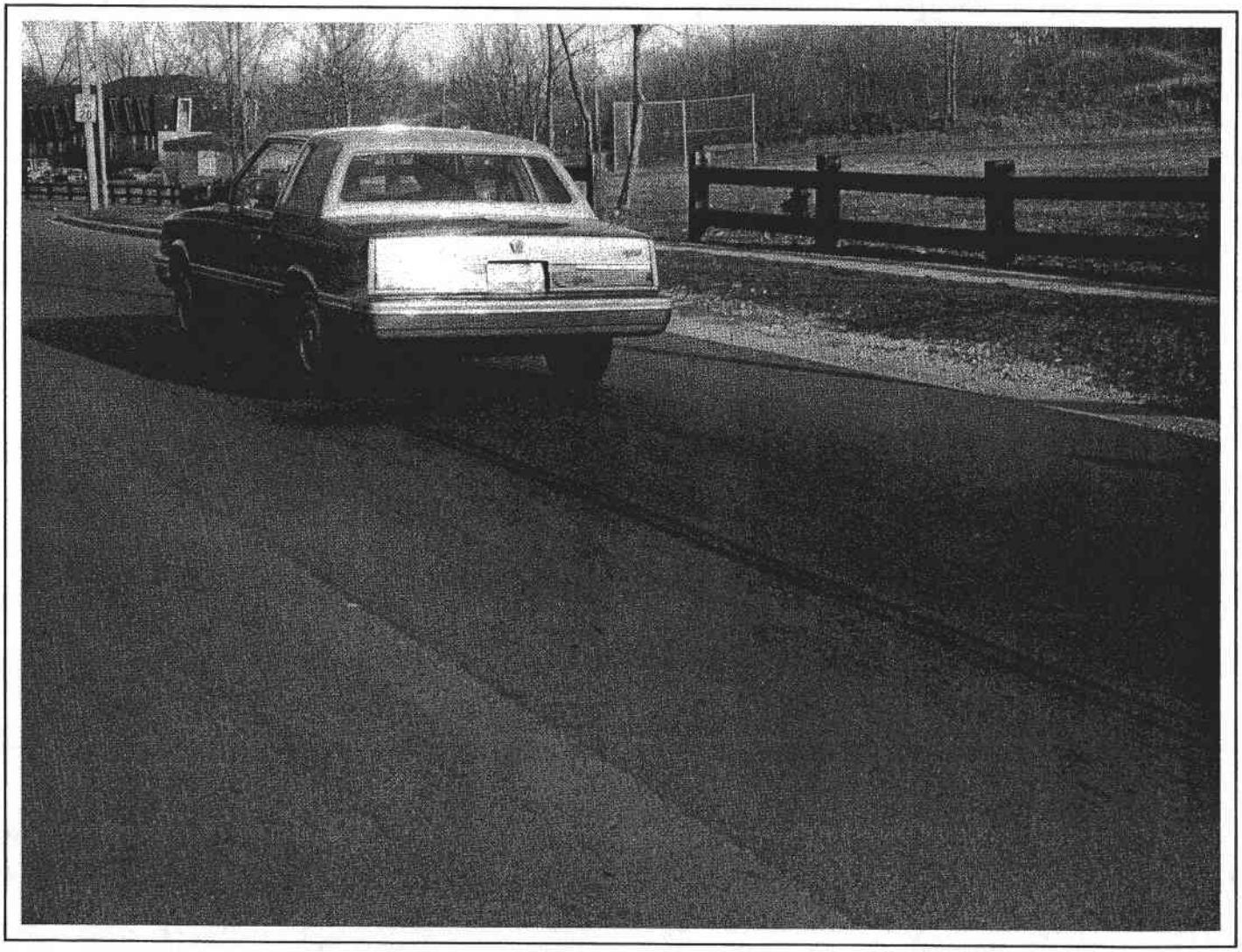

Figure 14 - Skid mark by a vehicle equipped with a diagonally split braking system with one half of the system disconnected.

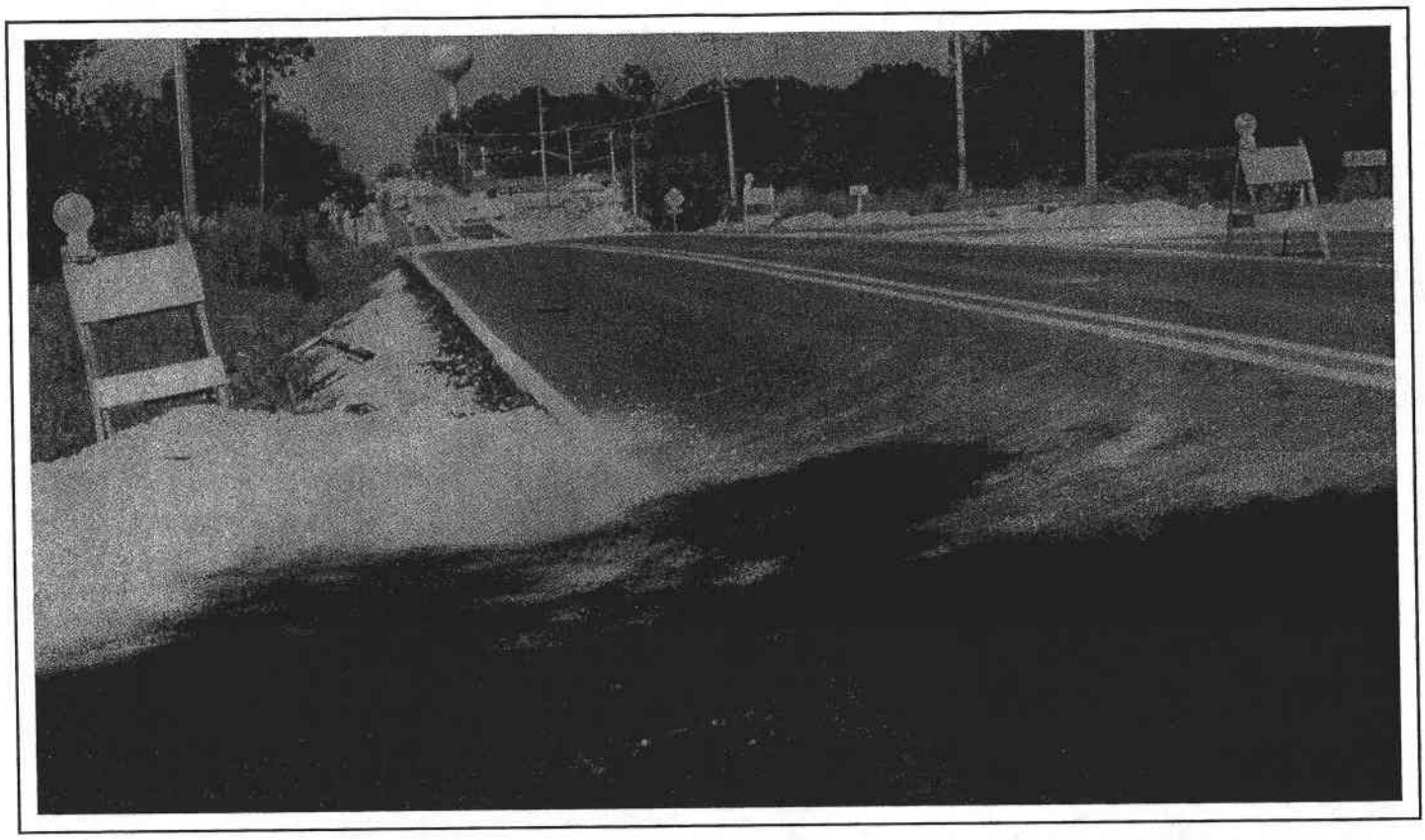

Figure 15 - A motorcycle/car crash site. The added black line marks the beginning of the motorcycle's skid mark.

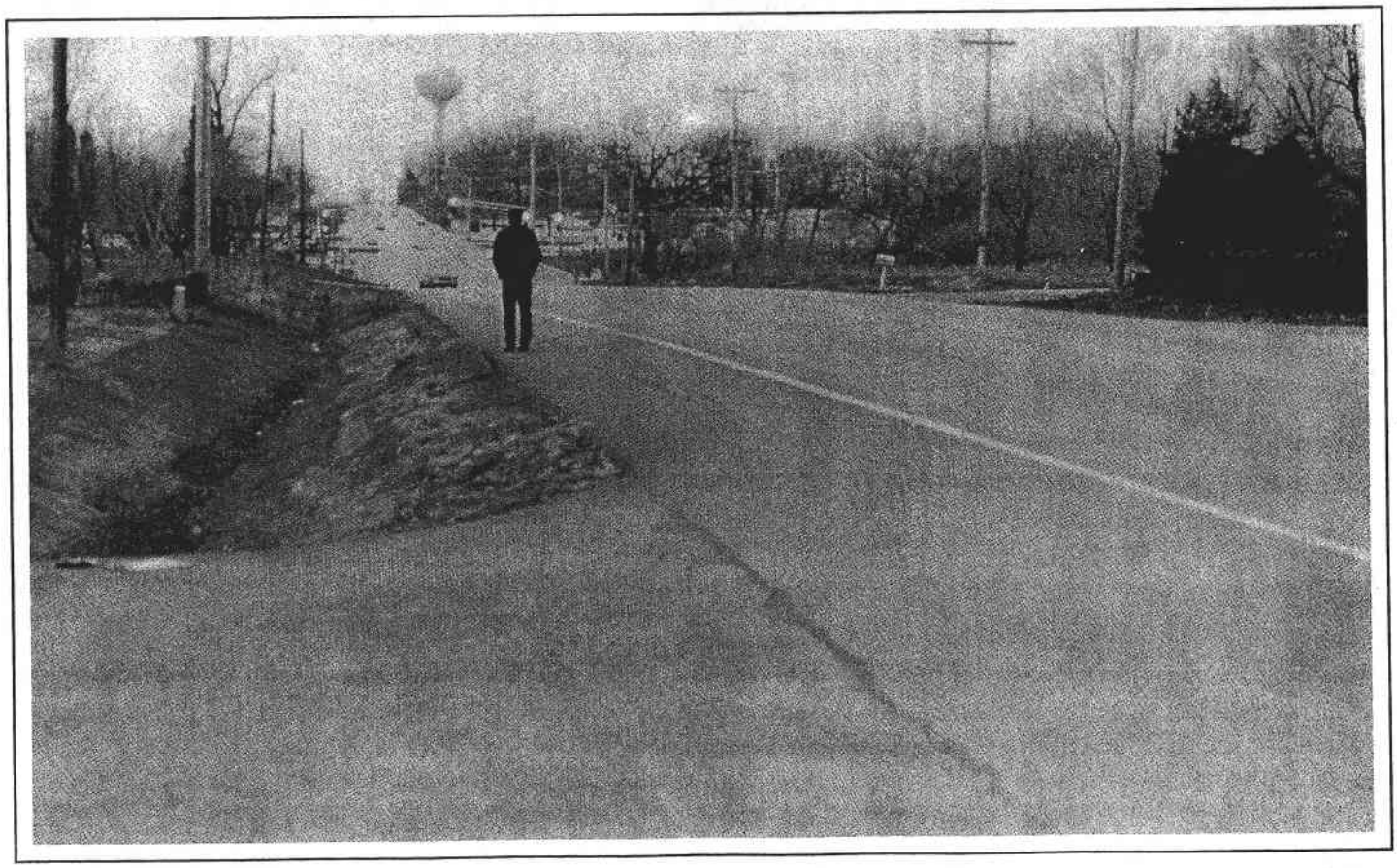

Figure 16 - Site of the motorcycle/car crash shown in Figure 15 as viewed two years after the accident. The man in the photo is standing on the road 76 feet from the collision area.

- Observe the previously taken photographs and attempt to locate the camera as closely as possible to the location from which the original photograph was taken, using unchanged background landmarks (trees, poles, buildings, etc.,) and the edges of the photo.
- Place new landmarks such as pavement markings or cones at known locations within the desired area.
- Retake the photograph from the approximated original camera location, showing the reference marks.
- Compare the two photographs.

Two accident examples will be used to illustrate how the method has been used in the field. The first involved a night-time accident which occurred when a police car turned left in front of an oncoming motorcycle. The motorcyclist applied the rear brake and left a skid mark prior to colliding with the police car. The police report indicated the skid mark length to be 176 feet. A member of the motorcyclist's family also measured the skid mark and found it to be only 76 feet long. Since the motorcyclist's speed, which would have related to the skid mark length, was an important factor, the correct length had to be established. The road had been resurfaced some time after the accident and about two years elapsed between the time of the accident and the site inspection. A photograph, taken by a family member on the morning following the accident (Figure 15), was used for the analysis. Locating the point of collision within a few feet was not difficult as the collision occurred in the entrance to a driveway. Distances of 76 and 176 feet were measured out along the path of the skid mark and a person was asked to stand at each point. Photographs were then taken using unchanged landmarks as guides.

Comparing the resulting photographs (Figures 16 and 17) with the original (Figure 15) clearly established consistency between the skid mark length and the 76 foot distance.

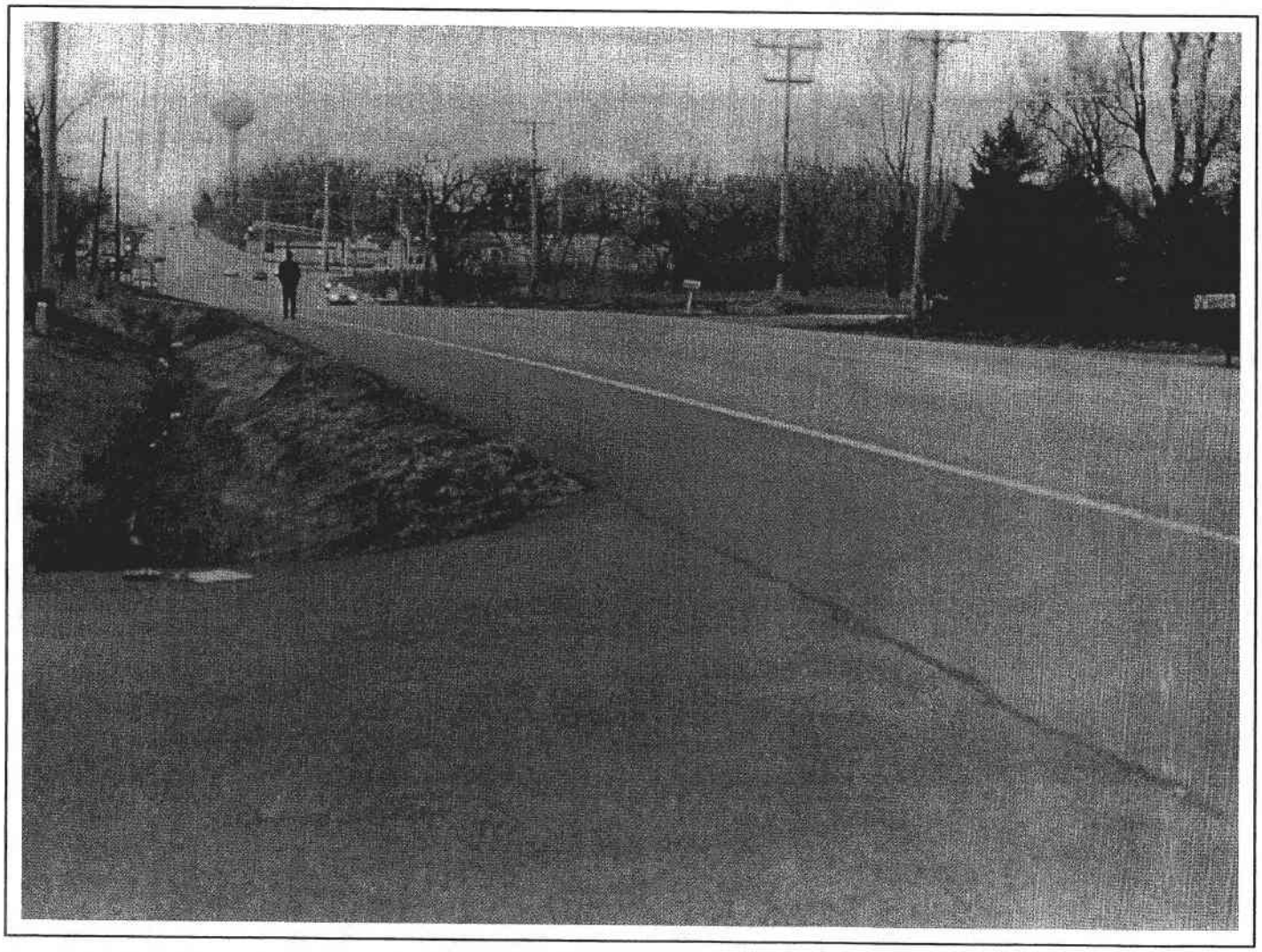

Figure 17 - Site of the motorcycle/car crash shown in Figure 15 as viewed two years after the accident. The man in the photo is standing on the road 176 feet from the collsion area.

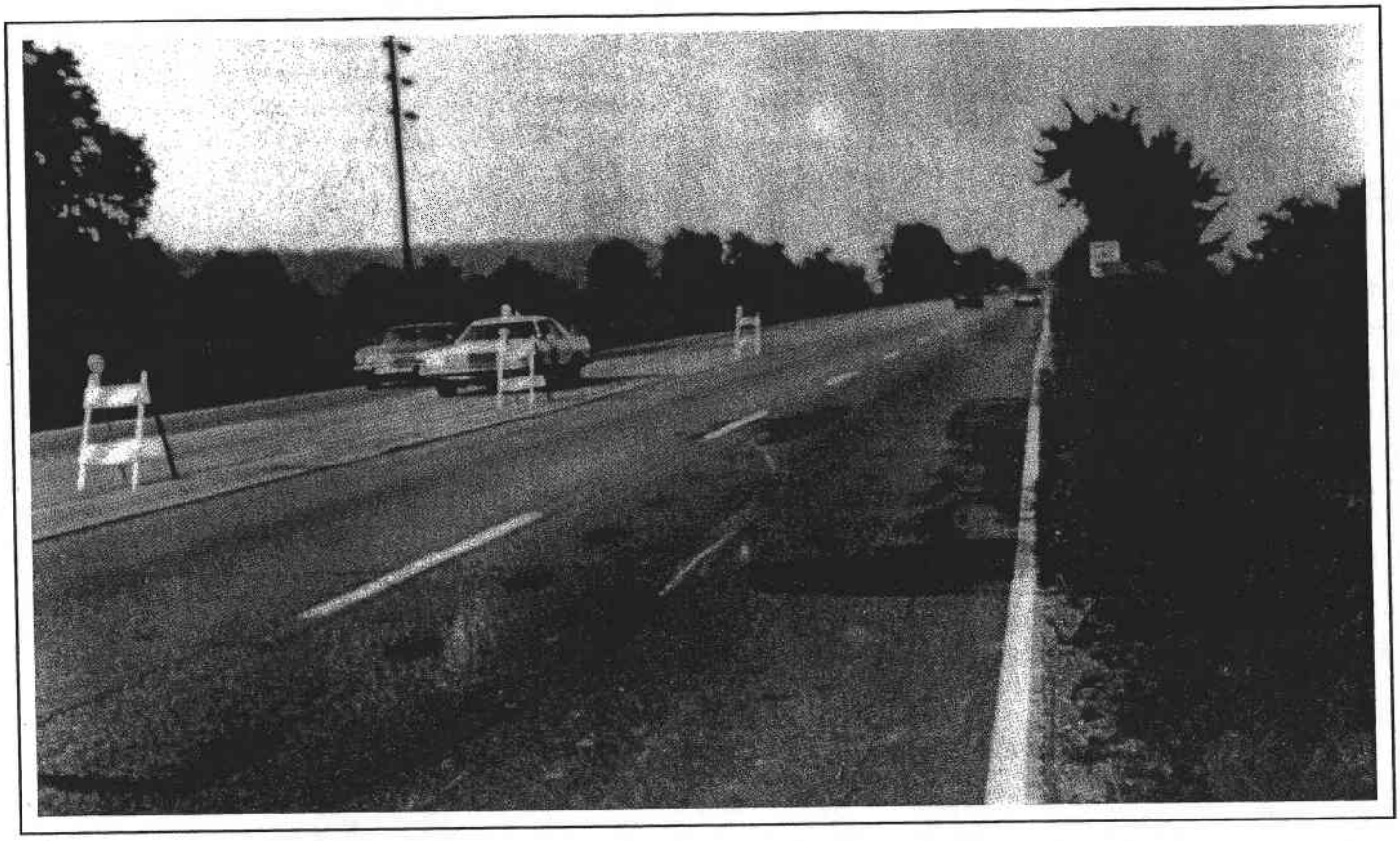

Figure 18 - Police photograph taken shortly after the accident.

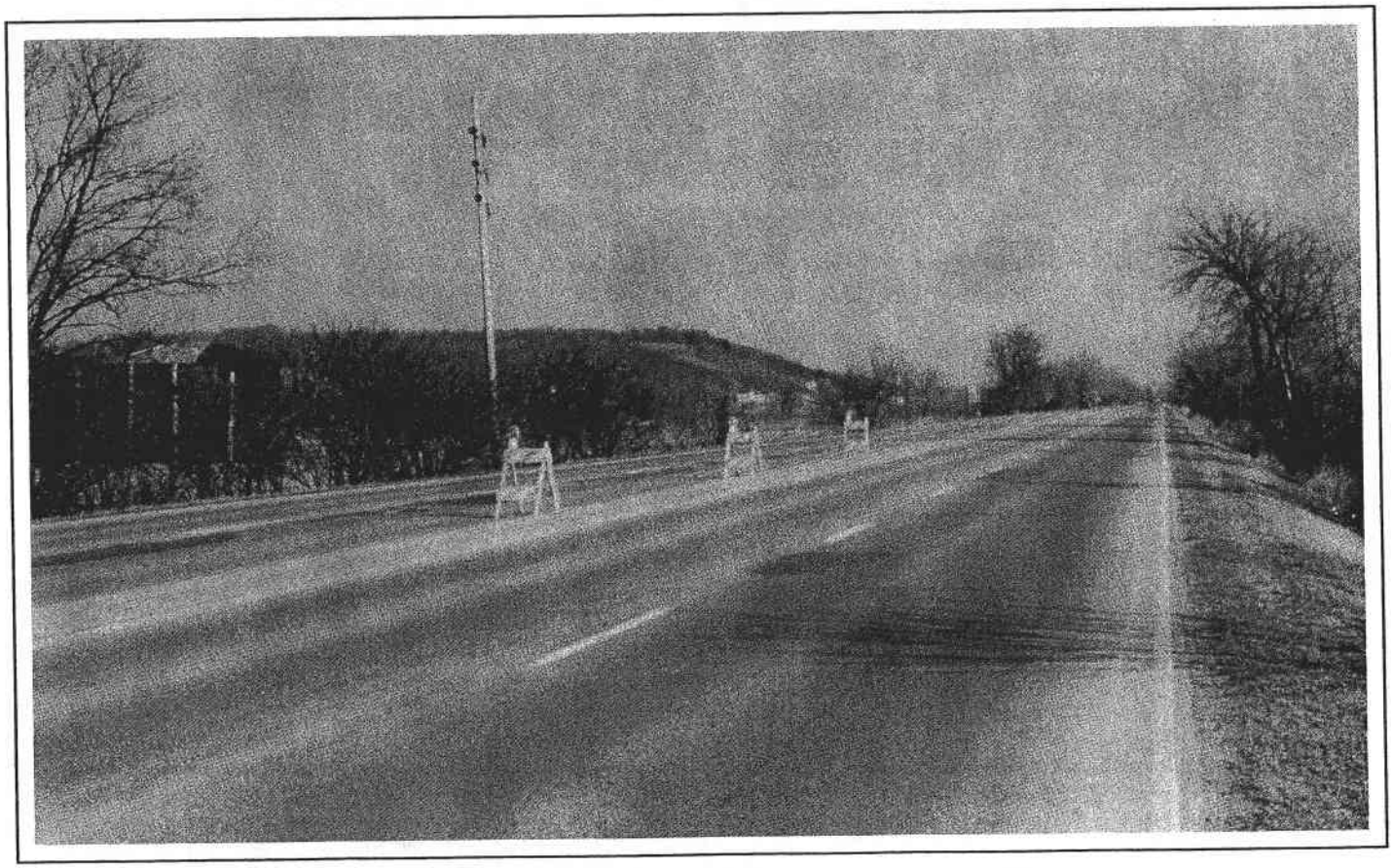

Figure 19 - Same site shown in Figure 18 with barricades set 50 feet apart.

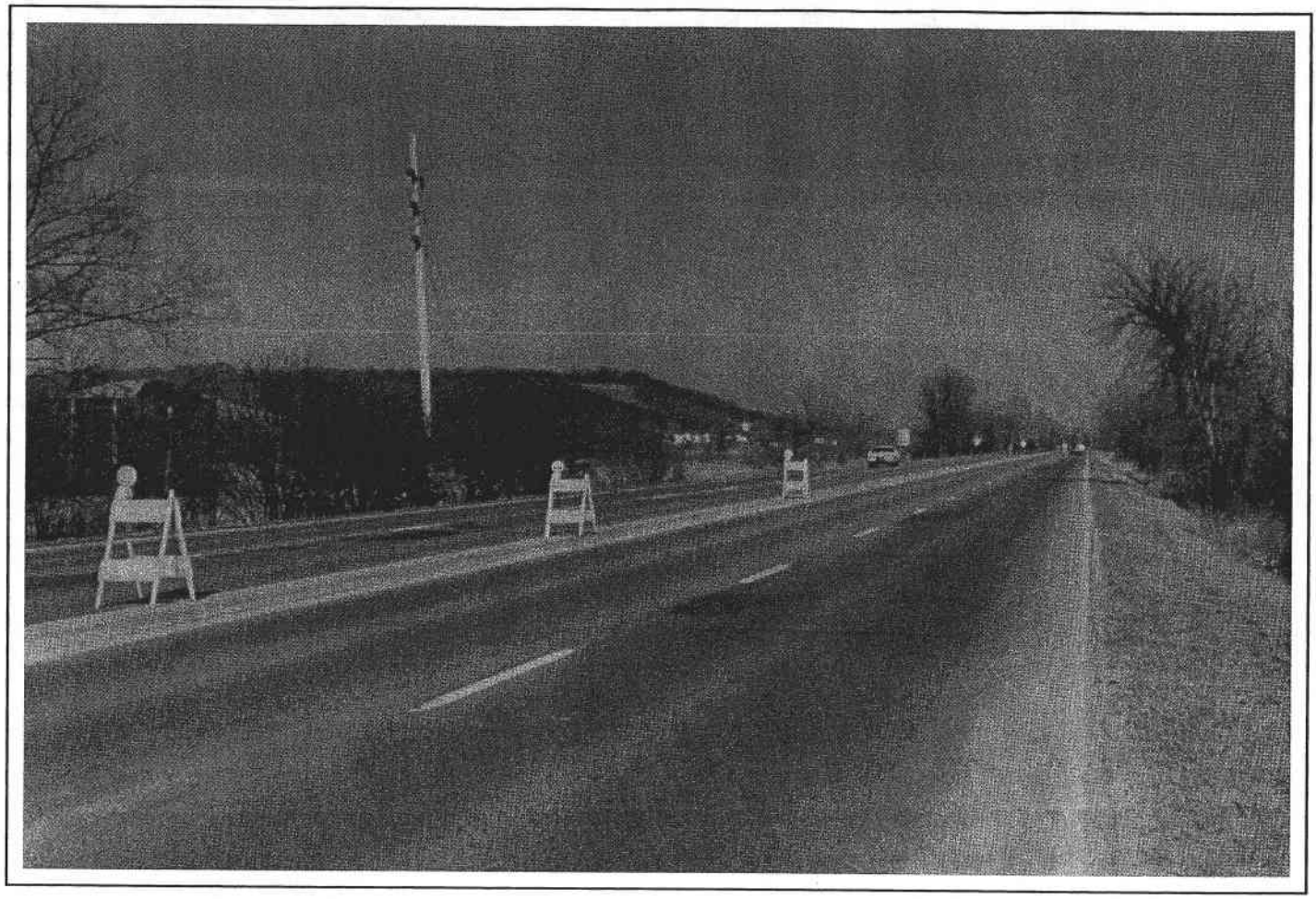

Figure 20 - Same site shown in Figure 18 with barricades set in positions similar to the way they appear in the original police photograph.

A second accident involved two women riding in a small pickup truck, approaching a construction zone where a lane closure had been designated. The driver, who tried to pass a tractor-trailer near the beginning of the lane closure without success, turned sharply to the left. The pickup truck turned on its side across the opposing lanes with the roof facing oncoming traffic. An approaching automobile impacted the roof of the pickup resulting in the death of both women.

One of the claims brought by the plaintiffs against the road contractor was that the taper area defined by the lane closure barricades was too short. This claim was based on the number of barricades as shown in police photographs and on an assumption that the barricades had been set 50 feet apart. At the time of the accident site inspection, the construction project had long since been completed. Since the police report located the first barricade relative to a gas line marker which could still be pinpointed, it was possible to set up barricades starting at this point, spacing them at any desired distances. 'Framing' of a police photograph was then used for the analysis. The police photograph showing the first three barricades as originally set up by the contractor (Figure 18) and a photograph showing the three barricades set 50 feet apart in accordance with the plaintiff's assumption (Figure 19), clearly indicated that the actual distances between barricades had to exceed 50 feet. Positioning the second and third barricades as shown in Figure 20 such that they appear to be in similar locations to those shown in the original photograph allowed measurements to be carried out. The actual distances were found to have been 60 feet and 80 feet respectively.

CONCLUSION

Effective use of the camera reduces the time required for documentation and analysis in accident reconstruction. This paper has described some techniques developed for use in the field and found to be of practical help to anyone involved in the investigation of vehicle accidents.

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The definition of a defective product in a state may be found in the case law of that state. In each issue we explore leading product liability case law for one or more states. Triodyne relies on the trial bar for selection of the cases cited.

LOUISIANA

In Louisiana, a plaintiff in a product liability case long had the burden of proving that the product "was defective, i.e., unreasonably dangerous to normal use." Weber v Fidelity & Casualty Insurance Co. of N.Y., 250 So. 2d 754 (La., 1971). Thus a defect is that characteristic of a product that makes it unreasonably dangerous to normal use.

In 1988, Louisiana enacted a comprehensive products liability statute, LSA- R.S. 9:2800.51 et seq. Section 9:2800.54 provides that a manufacturer "shall be liable to a claimant for damage that renders the product unreasonably dangerous when such danger arose by a reasonably anticipated use of the product by the claimant or by another person or entity." This section specifically changes the "normal use" of Weber to "a reasonably anticipated use."

Section 9:2800.54 specifies the four instances under which a product may be "unreasonably dangerous," and Sections 9:2800.55 through 9.2800.58 describe more particularly those specific instances.

The Louisiana Products Liability Act became effective September 1, 1988. There are few, if any, cases interpreting the new act. It therefore seemed useful to include Sections 9:2800.51 through 9:2800.59 of the Act, as an example of one state's law on state defects.

Chapter 3.
Louisiana Products Liability Act

§ Section 2800.54 Manufacturer responsibility and burden of proof

A. The manufacturer of a product shall be liable to a claimant for damage proximately caused by a characteristic of the product that renders the product unreasonably dangerous when such damage arose from a reasonably anticipated use of the product by the claimant or another person or entity.

B. A product is unreasonably dangerous if and only if:

(1) The product is unreasonably dangerous in construction or composition as provided in R.S. 9:2800.55;

(2) The product is unreasonably dangerous in design as provided in R.S. 9:2800.56;

(3) The product is unreasonably dangerous because an adequate warning about the product has not been provided as in R.S. 9:2800.57; or

(4) The product is unreasonably dangerous because it does not conform to an express warranty of the manufacturer about the product as provided in R.S. 9:2800.58.

C. The characteristic of the product that renders it unreasonably dangerous under R.S. 9:2800.55 must exist at the time the product left the control of its manufacturer. The characteristic of the product t hat render it unreasonably dangerous under R.S. 9:2800.56 or 9:2800.57 must exist at the time the product left the control of its manufacturer or result from a reasonably anticipated alteration or modification of the product.

D. The claimant has the burden of proving the elements of Subsections A, B and C of this Section.

§ Section 2800.56 Unreasonably dangerous in construction or compostion

A product is unreasonably dangerous in construction or composition if, at the time the product left its manufacturer's control, the product deviated in a material way from the manufacturer's specifications or performance standards for the product or from otherwise identical products manufactured by the same manufacturer.

§ Section 2800.57 Unreasonably dangerous in design

A product is unreasonably dangerous in design if, at the time the product left its manufacturer's control:

(1) There existed an alternative design for the product that was capable of preventing the claimant's damage; and

(2) The likelihood that the product's design would cause the claimant's damage and the gravity of that damage outweighed the burden on the manufacturer of adopting such alternative design and the adverse effect, if any, of such alternative design on the utility of the product. An adequate warning about a product shall be considered in evaluating the likelihood of damage when the manufacturer has used reasonable care to provide the adequate warning to users and handlers of the product.

§ Section 2800.57 Unreasonably dangerous because of inadequate warning

A. A product is unreasonably dangerous because an adequate warning about the product has not been provided if, at the time the product left its manufacturer's control, the product possessed a characteristic that may cause damage and the manufacturer failed to use reasonable care to provide an adequate warning of such characteristic and its danger to users and handlers of the product.

B. A manufacturer is not required to provide an adequate warning about his product when:

(1) The product is not dangerous to an extent beyond that which would be contemplated by the ordinary user or handler of the product, with the ordinary knowledge common to the community as to product's characteristics; or

(2) The user or handler of the product already knows or reasonably should be expected to know of the characteristic of the product that may cause damage and the danger of such characteristic.

C. A manufacturer of a product who, after the product has left his control, acquires knowledge of a characteristic of the product that may cause damage and the danger of such characteristic, or who would have acquired such knowledge had he acted as a reasonably prudent manufacturer, is liable for damage caused by his subsequent failure to use reasonable care to provide an adequate warning of such characteristic and its danger to users and handlers of the product.

Notes of Decision

Warning 1

1. Warning

Manufacturer of valve did not have duty to warn user that valve was subject to phenomenon known as "pressure lock" or to instruct user that handle of certain length was needed to open valve when it was under "pressure lock"; user's uncontradicted testimony showed that he had actual knowledge or, at minimum, should have known of dangers associated with operation of valve under great pressure. Gautreaux v. Tex-Steam Co., E.D. La. 1989, 723 F.Supp. 1181.

§ Section 2800.58
Unreasonably dangerous because of nonconformity to express warranty

A product is unreasonably dangerous when it does not conform to an express warranty made at any time by the manufacturer about the product if the express warranty has induced the claimant or another person or entity to use the product and the claimant's damage was proximately caused because the express warranty was untrue.

§ Section 2800.59
Manufacturer knowledge, design feasibility and burden of proof

A. Notwithstanding R.S. 9:2800.56, a manufacturer of a product shall not be liable for damage proximately caused by a characteristic of the product's design if the manufacturer proves that, at the time the product left his control:

(1) He did not know and, in light of then-existing reasonably available scientific and technical knowledge, could not have known of the design characteristic that caused the damage or the danger of such characteristic; or

(2) He did not know and, in light of then-existing reasonably available scientific and technological knowledge, could not have known of the alternative design identified by the claimant under R.S. 9:2800.56(1); or

(3) The alternative design identified by the claimant under R.S. 9:2800.56(1) was not feasible, in light of then-existing reasonably available scientific and technological knowledge or then-existing economic practicality.

B. Notwithstanding R.S. 9:2800.57(A) or (B), a manufacturer of a product shall not be liable for damage proximately caused by a characteristic of the product if the manufacturer proves that, at the time the product left his control, he did not know and, in light of then-existing reasonably available scientific and technological knowledge, could not have known of the characteristic that caused the damage or the danger of such characteristic.

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