C16 Changes in Scientific Concepts in Accident Reconstruction Since the 1960s

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After attending this presentation, the accident reconstruction specialist and forensic consultant will be conversant with changes in the practice of accident reconstruction methods, constants, and inputs.

This presentation will impact the forensic community and/or humanity by demonstrating an approach to correct misinformation in the forensic arena. In addition, the younger research engineers in the accident reconstruction field will find the development of the newer research more meaningful.

The purpose of this paper is to help the accident reconstruction specialist become aware of older references and concepts that are often recognized but are in error and need to be updated. Most accident reconstruction is based on applied physics relying on Sir Isaac Newton's three principles. The proposition of this paper is to show that although the basic physics is usually correct, the interpretation of input may give incorrect answers. The method of updating the analytical calculations is to review the latest research from the technical research papers presented by the Stapp Car Crash Conference, the AAAM, Society of Automotive Engineers, and the International Research Organization for the Biomechanics of Injury, as well as technical papers from Canada, Europe, and Australia, together with the research at the Trauma Research Group, Dept of Surgery, UCLA. The questionable inputs and assumptions used for calculations have been printed in a number of accident reconstruction publications and State and Federal brochures. The content of this paper also includes the 1960s and 1970s research by the Trauma Research Group, which showed that some of the input by Northwestern University and many others in the accident reconstruction field was incorrect. The areas and formulae covered in this paper include updated concepts for the prediction of acceleration, cruise, cornering path, cornering acceleration, steering input, hydroplaning, perception reaction time, emergency braking values, impending skid distance, crash events including Barrier Equivalent Velocity, change of speed, direction of impact, principal direction of force and impact duration, peak g versus average g.

The result of each original concept is discussed and the new and improved method of input or calculation follows. A very simple example is to assume a set of four skids of different lengths. Assuming a coefficient of friction of 0.7 g, one takes the average length of the four skids, according to a University Publication, to obtain the pre-braking speed. A better method is to take the longest skid or to take the center of gravity distance from start of skid to point of rest. However, this gives the speed at the start of skid, not the start of braking. It is now recognized that 15 to 20 percent of the braking energy is expended prior to the visible skid marks. This has to be added to obtain the probable cruise speed, which is the speed at the start of braking. The old literature talks about the coefficient of friction of the road. In fact, one needs to know the type of vehicle, such as tractor-trailer combination, light truck, automobile, or sports car, as well as the ambient condition for the particular road surface. A more appropriate term than coefficient of friction is drag factor which is measured in terms of units of g.

There are still states in America who are presenting 0.7 and 0.75 seconds for the daylight reaction time of a driver. The newer research by Olsen and others and the accepted Perception Reaction time in most State Superior Courts, the Criminal and Federal Courts is usually about 1.5 seconds.

The material in this paper has been shown to be enlightening to even the seasoned forensic engineer, as well as stimulating and informative to the younger engineer.

Older References, Reconstruction Updates, Reconstruction Corrections