THE RECONSTRUCTIONIST
AN ACCIDENT RECONSTRUCTION NEWSLETTER

W Poplin Engineering   **June 2014**

"How Fast Was He Going?"
Speed Evaluation

An engine module download gave a detailed description of this truck's speed as it approached collision
"Exactly the speed limit"

A momentum analysis clearly showed that a truck **did not stop for the intersection**

There are a variety of ways a reconstructionist can evaluate a vehicle's speed. Different mathematical formulas are used in these methods. While these may at first appear intimidating, the actual math is usually basic algebra and geometry.

The evaluation of speed will usually be conducted with one or more of the following six methods:

1. Momentum/Energy Analysis

The post collision velocities for each vehicle are evaluated from the physical evidence. The pre collision speeds are then calculated using the principle of "Conservation of Momentum". The basic premise of a momentum analysis is that the linear momentum (weight times the velocity) immediately following a collision is the same as the linear momentum immediately preceding a collision. Any momentum "lost" by one vehicle is "gained" by the other.

2. Damage/Energy Analysis

The basic premise in a damage analysis is that the forces causing the collision damage can be evaluated analytically by comparing the damage profile of the accident vehicle with

the damage profile produced by a controlled test.

3. Centrifugal Force Analysis

Centrifugal forces are created whenever a vehicle is not traveling along a straight path. This analysis technique is usually applied in accidents that occur on curves or as a result of evasive maneuvering.

4. Launch, Fall or Vault Analysis

When a vehicle or an object loses support from the ground it is "launched". It then travels at the same horizontal speed at which it was "launched" until it "falls" back to the ground. The "fall" may start as an initial upward, level or downward movement.   The geometry of the fall is combined with the acceleration due to gravity to evaluate the "flight time" leading to the speed that will provide the appropriate time.

5. Geometry and Timing Analysis

Consider an accident in which an automobile driver rounds a curve and observes a pickup backed across the roadway. The driver of the automobile states, "as soon as he came around the curve, he saw the pickup and braked hard until impact". The analysis combines the sight line geometry with the physical evidence and the expected perception reaction time to evaluate a speed.

6. Event Data Recorders and Other Electronics

Airbag Control Modules (ACM) were introduced into automobiles as a by product of airbag implementation. The airbag has to deploy in time to protect an occupant during a collision. Sensors collect information which is processed in an electronic module. When some combination of the inputs exceeds the designated threshold, the airbags are activated. The systems are designed to retain portions of the input data in electronic memory. Following an accident, the data can be retrieved.

Engine control modules (ECM) were placed on engines to monitor the engine operation to reduce maintenance and increase service life. This data may include speed and braking from the hard brake applications that accompany many accidents.

Today, we also have an ever increasing array of GPS, cellphone records, security video, etc. to evaluate in determining the speed of a vehicle.

Intersection Collisions are analyzed with a momentum analysis
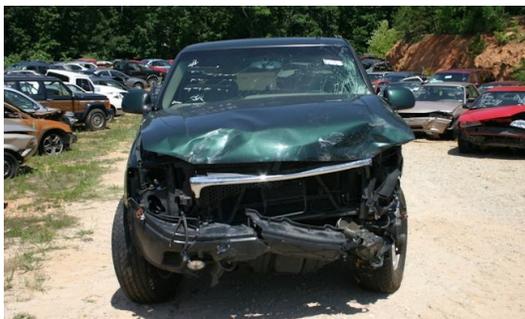
The tractor trailer evasive maneuvering allowed a speed calculation from the geometry and a timing analysis

Pre impact skidding is an energy analysis
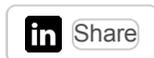
Frontal Damage Analysis

The airbag control module showed that this truck approached the intersection at more than **"twice the speed limit"**

Truck overturn requires a centrifugal force analysis

UPDATED Passenger Vehicle Crash Data Retrieval (CDR) - Summaries by Manufacturer and Year

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