Traffic Accident Reconstruction

The Expert Approach

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TRAFFIC ACCIDENT RECONSTRUCTION

INTRODUCTION

Accident reconstruction is the method to determine from whatever information is available how the incident occurred. Reconstructionists essentially interpret data that has already been gathered during previous levels of investigation, or in many cases interprets data gathered by other investigation sources such as the police and private investigators. The traffic accident reconstructionist must have special expertise which provides the skill to find undetected facts in available information. Specialized training provides the knowledge to evaluate the facts to determine a theory of how an incident occurred.

Besides using hand calculations based upon the laws of physics, currently there are several computer aided tools that fine tune these calculations. These tools include powerful and useful microcomputer base programs for accident reconstruction. One example of this is **WinCRASH**, based on the CRASH 3 (Calspan Reconstruction of Accident Speeds on the Highway), that is used to reconstruct single and two-vehicle accidents. The program determines impact conditions including vehicle speeds at impact and dynamic severity of the impact using information obtained from the vehicles and the incident site. Another useful tool available is **WinSMAC**. This program is based upon the program called SMAC which was developed by Calspan. WinSMAC uses a set of assumed or estimated initial conditions, including positions and velocities and predicts the outcome of the incident. The accident investigator can use WinSMAC to determine how the accident may have occurred. By repeat adjustments of the initial conditions and driving, braking (or acceleration) and steering inputs, the accident reconstructionist can converge on the data which best matches the known incident site evidence.

Yet another tool available to accident reconstructionists is one that could be termed “a witness tucked underneath the dashboard.” Since 1994, General Motors (GM) airbag equipped production vehicles have recorded airbags data and crash severity data for impacts that caused a deployment, often referred to as **Black Box**. Many of these systems also recorded data during “near deployment” events (i.e., impacts that are not severe enough to deploy the airbags.) GM design engineers used this information to improve the performance of airbag sensing systems and NHTSA researchers have used it to help understand the field performance of alternative airbag system designs. Beginning with the 1997 model year, the capability to record precrash vehicle speed, engine RPM, throttle position, and brake switch on/off status has been added to GM vehicles. Other information such as seat belt usage, warning light status, pretensioner deployment, and transverse acceleration/decelerations have been added with later years. The list of data stored is continually growing with each generation of GM vehicle developed. The data from these Black Boxes can be downloaded to an equipped computer using a crash data retrieval tool available in the public domain. In 2001, Ford was the first manufacturer to follow GM’s lead by making the data on their airbag sensors retrievable through the same tool. Since then, several automobile manufacturers and brands have followed suit so that currently, in 2013, there are 37 brand names alphabetically listed from Acura to Volvo that have downloadable data stored in the airbag sensors or “Black Boxes.”

In the hands of the skilled accident reconstructionist, the data retrieved from the “Black Box” system, combined with the physical evidence collected from the vehicle(s) and the road, can make a compelling case.

TRAFFIC ACCIDENT RECONSTRUCTION

TECHNOLOGY RESOURCES

A skilled accident reconstructionist may use one or more of the following tools to reconstruct vehicular collisions and demonstrate the results:

- Total Station Survey Scanner
- High Definition Survey (HDS) - Laser Scanner
- Computer-Aided Design (CAD)
- Computer Animations 3-D
- Computer Aided Accident Reconstruction
- Computer Aided Collision Prediction (Simulation)
- Vehicle Event Data Recorder (EDR or Black Boxes)
- Digital Photography
- Video
- Global Positioning Systems (GPS)
- Surveillance Cameras
- Light Meter

INCIDENTS INVOLVING

Vehicles

- Automobiles
- Trucks
- Trailers
- Buses
- Trolley Cars
- Motorcycles
- Bicycles
- Pedestrians
- Roadside fixed objects
- Golf carts
- All-terrain vehicles

Locations

- Highways
- Local Roads
- Intersections
- Work Zones
- Sidewalks
- Islands
- Pedestrian Crossings

Issues

- Drainage
- Lighting
- Roadside Maintenance
- Traffic Signal Timing/Sequence
- Traffic Control Devices
- Utility Trenches

INCIDENT SITE EXAMINATION

An incident site is subject to change due to environmental/natural conditions, new construction or unauthorized alteration. Site conditions can change moments after an accident, years later, or remain the same. A site examination documents and preserves the evidence that will be used to determine the nature, cause and responsibility for an incident. A prompt, thorough investigation defines the site, reduces assumptions and speculations. Evidence that is collected from a site examination includes the following:

Tire Marks

- Length
- Type (skid, yaw, rolling wheel, acceleration scuff)

- Direction
- Track Width
- Tread Pattern
- Flat Tire Scuffs
- Collision Scrub
- Crooks (bend or offsets)
- Pre Collision and Post Collision tire marks

Road Surface

- Type of road surface (asphalt, portland cement, gravel, etc.)
- Locations of gouges and scrape marks, chips and grooves
- Locations of vehicle liquids (spatter, dribble, puddle, run off etc.)
- Location of roadway and lane marking
- Paint marks from police investigation

Collision Details

- Point of impact
- Approach angle of vehicles
- Departure angle of vehicles
- Final rest position of vehicles
- Distances from collision to rest

Highway or Roadway Details

- Geometry
- Profile
- Drainage
- Lighting
- Pavement markings
- Sight distance
- Signage and traffic controls
- Fixed object locations

EXAMINATION OF INCIDENT VEHICLES

The incident vehicles provide the other pieces of evidence for the overall accident reconstruction puzzle. Some of the evidence provided by the vehicles will compliment and confirm what the road evidence is showing. Other evidence from the vehicles will provide new information to complete the puzzle. This information is unique to the vehicles and can only be provided by examination of the vehicles themselves.

The evidence collected from the vehicle examination includes the following:

- Crush measurements
- Material transfer marks
- Observations and measurements of scratches, scrape and gouges
- Tire evidence (condition, tread, make and model)
- Lamp and bulb evidence
- Underside damage that caused marks on road surface
- Black box download
- Seatbelt evidence
- Airbag evidence
- Instrument controls evidence (switches, radio, navigation, etc.)
- Vehicle crash worthiness
- Vehicle defects
- Vehicle recalls
- Brake and steering systems
- Occupant related damage

- Adjustable seat positions
- Metal breakage
- Maintenance records
- Modifications
- Cargo location, type and weight
- VIN number

POLICE ACCIDENT INFORMATION

- Review Officer's notes
- Review police files
- Interview investigating officer
- Review police and rescue squad photographs

WITNESSES: DRIVERS, PASSENGERS, AND PEDESTRIANS

- Age
- Driving restrictions
- Alcohol/Drugs
- Prior physical conditions
- Attentiveness
- Statements
- Clothing (type and color)
- Walking/Running ability
- Height and weight

WORK ZONES

In special cases where the accident reconstruction involves a work zone and/or construction area further evidence should be gathered about the contractor or utility that is performing the work. Roadway traffic patterns, traffic flow and sight distances may be affected.

Depending on the circumstances of the work, specific requirements for identification of a temporarily modified roadway condition to the driver and pedestrians may be necessary. Work Zone set-up is documented under the Manual on Uniform Traffic Control Devices and State Department of Transportation Publications.

Short Term Duration Work

- Approved work zone permit plan
- Construction vehicle infringement
- Duration of work
- Overhead work
- Roadside obstacles
- Roadway surface condition
- Speed limits
- Traffic intensity

Long Term Duration Work

- Construction site drainage
- Debris, dust, and foreign materials
- Detours
- Guarding-barricades, plates, etc.
- Roadway construction staging
- Traffic signals, signage, lighting
- Utility trenches—sheeting/shorting
- Work Zone set-up as noted short term duration work

MAINTENANCE, CONSTRUCTION AND DESIGN INFORMATION: UTILITIES OVERHEAD AND UNDERGROUND

Check utility types and reasonable parties:

- Cable TV
- Electrician
- Gas
- Lighting
- Oil
- Overhead obstructions
- Contractors
- Drawings
- Maintenance records
- Specifications
- Sanitary sewers
- Steam
- Storm sewers
- Telephone
- Water

ENGINEERING ASSISTANCE FOR ATTORNEYS

An attorney often encounters technical documents, information, or engineering experts that provide data of unknown significance. Sometimes an attorney needs help to interpret what is technically necessary to look for or inquire about during discovery. The expert engineer can provide technical assistance to an attorney in performing tasks including the following:

- Vehicle lights on/off analysis
- Seat belt usage evidence
- Braking system analysis
- Tire evaluation
- Comparison of “black box” or airbag data with physical evidence
- Traction control analysis
- Determination of the approach and departure paths of the vehicles
- Evaluate vehicle crash worthiness
- Determination of the thrust direction
- Evaluate vehicle mechanical condition
- Dynamic control analysis
- Vehicle speed determination
- Measure and record vehicles’ collapsed or deformed shape
- Occupant seating arrangement analysis
- Map incident scene with total station or laser scanner
- Perform a computer simulation or critique a simulation from opposing expert
- Produce an animation for trial presentation or analyze animation from opposing side

OTHER SERVICES THE EXPERT ENGINEER CAN PROVIDE THE ATTORNEY

- Interpret engineering or scientific terms
- Interface with public utilities
- Identify code requirements and change codes
- Interview Streets and Water Departments
- Identify and explain engineering and construction general practice criteria
- Obtain, review and interpret records
- Review drawings, contracts, and design documents
- Identify useful engineering information
- Coordinate and organize available information

The information presented in this booklet is intended only to be used as a guide in assisting clients concerned with or involved in the legal process where litigation or potential litigation is an issue. The information is further intended to inform clients that Consulting Engineers and Scientists, Inc. has both the expertise and the capability to provide direction and guidance in the specific disciplines and areas presented in this booklet. It is important to note that the information also is general and is not intended to completely cover the specific nuances of a particular matter. If there are any questions concerning this information, please feel free to contact us.www.ces-experts.com