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 accident occurred. Reconstructionists essentially interpret data that has already 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 which is based on the CRASH 3 (Calspan Reconstruction of Accident Speeds on the Highway) which 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 vehicle accident site inspections. 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 1974, General Motors (GM) airbag equipped production vehicles have recorded airbags data and crash severity data for impacts that caused a deployment. 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 1999 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 more recently. The list of data stored is continually growing with each generation of GM vehicle developed. The data from the black boxes can be downloaded to an equipped computer using a crash data retrieval tool available in the public domain. Ford has followed GM’s lead by making data stored in black boxes on their vehicles available through the same crash data retrieval tool. Ford data is retrievable from certain models starting from 2001 onwards. Currently in 2006, it has been rumored that certain Japanese manufacturers are working on making similar data available to the general public and accident reconstructionists from Japanese vehicles

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) along with the road evidence can make a compelling case. The computer generated 3D simulation and 3D animation can provide the icing on the cake if and when the incident has to be presented to a jury in court.

CERTAIN VEHICULAR ACCIDENT TYPES

- Drainage
- Intersections
- Islands
- Lighting
- Right of Way
- Roadside maintenance
- Shelters
- Traffic control devices
- Traffic signal timing/sequence
- Utility trenches
- Vehicles:
  - Bicycle
  - Pedestrian
  - Pedestrian dart-out
  - Roadside fixed object
  - Sidewalk
  - Utility pole
  - Vehicle
- Work zones

ACCIDENT INVESTIGATION & EVALUATION

An accident 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 investigation documents conditions that will be used to assist in helping to determine the nature, cause and responsibility for an accident. A prompt, thorough investigation defines the site, reduces assumptions and speculations. Information that can be determined from a site investigation includes the following:

Evidence: Secure and Preserve

Attempt to SECURE evidence immediately following an accident.
PRESERVE evidence for future evaluation.

1. Lamps
2. Photographs
3. Roadway
4. Vehicles

Examination: Accident Scene

Compare information obtained on incident date against examined conditions.

1. Lamps:
   - a) Ground level
   - b) Aerial, if required
2. Environmental conditions:
   - a) Day lighting
   - b) Night lighting
   - c) Weather records
3. Vehicle Markings:
   - a) Fixed objects
   - b) Fluids
   - c) Gouges on pavements
   - d) Tire marks
4. Highway / Pavement:
   - a) Drainage
   - b) Fixed object locations
   - c) Geometry
   - d) Pavement markings
   - e) Profile
   - f) Sight distance
   - g) Signage
   - h) Traffic controls
   - i) Type and condition
   - J) Unevenness

TRAFFIC ACCIDENT RECONSTRUCTION

Examination: Vehicles

1. VIN
2. Airbag
3. "Black Box" or airbag sensor download
4. Brake system
5. Crash worthiness
6. Cargo location, type, and weight
7. Damage
8. Electrical system failure
9. Lamps
10. Maintenance records
11. Markings
12. Metal breakage
13. Modifications
14. Occupant related damage
15. Photographs
16. Seat belts
17. Speedometer
18. Tires

Maintenance, Construction and Design Information: Highway

1. Agreements
2. Job notes
3. Brake system
4. Crash worthiness
5. Contractors
6. Maintenance records
7. Nearby islands
8. Markings
9. Metal breakage
10. Modifications
11. Occupant related damage
12. Utility locations
13. Work zones traffic controls

Maintenance, Construction and Design Information: Utilities Overhead and Underground

1. Check utility types and responsible party:
   a) Cable TV
   b) Electrician
   c) Gas
   d) Lighting
   e) Oil
   f) Sanitary sewers
   g) Steam
   h) Storm sewers
   i) Telephone
   j) Water
2. Contractors
3. Drawings
4. Maintenance records
5. Overhead obstructions
6. Specifications

Police Accident Information

1. Interview investigating officer
2. Police Accident Report: Incident
3. Police Accident Reports: Prior incidents
4. Photographs
5. Review Officer's notes
6. Review Police file

Product Information: Vehicles

1. Brakes
2. Electrical systems
3. Frame systems
4. Mechanical systems
5. Metallurgical specifications
6. Product failure history
7. Recalls
8. Tires

Testing and Analysis

1. All wheel & 4 wheel drive
2. Black box data
3. Brakes
4. Failed metals
5. Reconstruction calculations
6. Road surface friction
7. Steering
8. Traction control
9. Vehicle dynamic control
10. Vehicle systems & sensors

Witnesses: Drivers, Passengers, and Pedestrians

1. Age
2. Alcohol / Drugs
3. Attentiveness
4. Clothing
5. Driving restrictions
6. Prior physical conditions
7. Statements
8. Walking / Running ability

WORK ZONE AND CONSTRUCTION AREAS

When a contractor or utility performs work on or near a roadway, traffic patterns, flow, sight distances, and vehicle capability 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

1. Approved work zone permit plan
2. Construction vehicle infringement
3. Duration of work
4. Overhead work
5. Roadside obstacles
6. Roadway surface condition
7. Speed limits
8. Traffic intensity

Long Term Duration Work

1. Construction site drainage
2. Debris, dust, and foreign materials
3. Detours
4. Guarding – barricades, plates, etc.
5. Roadway construction staging
6. Traffic signals, signage, lighting
7. Utility trenches – sheeting/shorting
8. Work Zone Set-Up as noted Short Term Duration Work

VEHICLE ACCIDENT RECONSTRUCTION

Often limited knowledge of an accident exists to aid in determining nature and cause of an accident. Witnesses are sometimes confused and provide conflicting or erroneous information. The accident scene must be documented by mapping and photographing. Pertinent information must be preserved for study and evaluation. When an accident reconstruction is warranted, the reconstruction analysis is often dependent upon evidence documentation before it is altered, lost, or destroyed. When possible, early identification of the need of ran accident reconstruction may be important to ensure that priority accidents are documented.

Areas for Engineering Analysis

- Airbag, deployment & effectiveness
- Analysis to determine vehicle lights on/off
- At-site investigation: immediate or delayed
- Braking system analysis
- Comparison of "black box" or airbag data with physical evidence
- Determination of the approach & departure paths of the vehicles
- Determination of the thrust direction
- Dynamic control analysis
- Measure & record vehicles' collapsed or deformed shape
- Occupant seating arrangement
- Seat belt usage evidence
- Tire evaluation
- Traction control analysis
- Vehicle crash worthiness
- Vehicle mechanical worthiness
- Vehicle speed determination

ENGINEERING ASSISTANCE FOR ACCIDENT INVESTIGATION

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:

- Converse in engineering language
- Identify code requirements and change codes
- Identify engineering & construction general practice criteria
- Identify useful information
- Interface & coordinate to obtain the available information
- Interface with public utilities
- Interviewing Streets & Water Departments
- Review drawings, contracts, & design documents
- Reviewing & obtaining records

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 & 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.