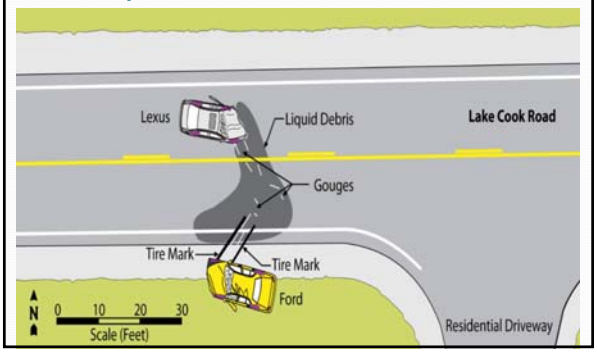
Serious and Fatal Crash Investigation for Evidence Technicians

Presented by Chris Weinbrenner
Introduction
Laws of Physics

After This Class

- Increased skills & knowledge
- Replace anxiety with confidence
- Provide you with skill in:
  - Measuring
  - Mapping
  - Photography
  - Recognizing and documenting crash scene evidence

When you arrive



Newton's Laws of Motion

1. An object at rest remains at rest, and an object in motion remains in motion at constant speed and in a straight line unless acted on by an unbalanced force.
2. The acceleration of an object depends on the mass of the object and the amount of force applied.
3. Whenever one object exerts a force on another object, the second object exerts an equal and opposite on the first.

Pieces of the Puzzle

- Crash causation
- Statements
- Witnesses
- Hospital
- Crash terminology
- Field sketches
- Coordinate method
- Data collection
- Vehicle dynamics
- Applying laws of physics
- Occupant kinematics
- Photography
  - Nighttime
- Vehicle examinations
- Evidence collection
- Electronic evidence

Stress

- Under stress we revert back to how we have been trained.
- What are we trying to prove or disprove?

What are the key issues?

- Trier of fact is often:
- Speed / position of each vehicle,
- Information available to each driver,
- Could the driver have avoided the collision,
- Driving actions before the crash (CDR),
- Disproving may be as important as proving.

- Reconstructionist:
- Where was each vehicle when the light turned yellow?
- What was the speed at that point?
- Could the driver successfully stop their vehicle?

Setting the tone

- What you do
- What your team does
- The impact can be for a day
- The impact can be for the rest of people's lives

Traffic Fatal versus Murder

- Put yourself in the victims' shoes for a day
- "My client made an honest mistake by drinking and driving, he did not mean to harm anyone!"
- "My client was just 'horsing around' when this unfortunate tragedy occurred. She had no intentions of hurting anyone."

Why investigate properly

- Civil vs. Criminal Wrong
- Roadway Safety
- Public Safety
  - Shut down an establishment
  - Repeat offenders

Serious and Fatal Crash Investigation for Evidence Technicians

Responding / Arriving at Scene & Basic Data Collection Terminology

Three contributing factors

- Human
- Environment
- Mechanical

Driver Contributing Factors

- Inattention
- Failure to obey rules of the road
- Poor driver strategy
- Poor implementation of evasive tactics

Road Contributing Factors

- Slippery or compromised road surfaces
- Missing or inadequate signing and controls
- Faulty design – below standard
  - Manual on Uniform Traffic Control Devices
- View obstructions

Vehicle Contributing Factors

- Poor visibility through windshield
- Defective equipment (lights, brakes, tires)
- Vehicle attributes

Levels of a Crash Investigation

- Basic data collection
- At-scene examination
- Technical compellation of all data
- Professional reconstruction
  - Cause & analysis
- You might not get a second chance at investigating this crime scene again
- Taking the time to document the scene properly will serve you in unknown ways to you at the time

Witnesses – General Questions

- Ask for DL.
- Where were you at that time?
- What drew your attention to the crash?
- How can I reach you if I have any questions?

Witnesses - Specific

- You don't know anything about this collision, do you? Vs. How did you first know about this collision?
- Be straight-forward
- Do not leave it unclear and indefinite
- How far is "way back"?
- Do not argue
- "Do you actually know..."
- Photograph

Driver – General Questions

- Which direction were you traveling before the collision?
- Who was driving the vehicle you were in?
- What was he (you) planning to do?
- Where were you when you first knew there was going to be trouble?
- Show me exactly where the collision occurred.

Driver - Specific

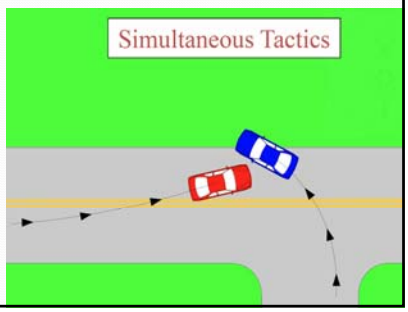
- You were traveling about the speed limit. Vs. How fast were you going?
- Make the driver think
- Stay with paramedics
- Locking them into statements
- Develop knowledge of subject
- What actions did you take to avoid the crash?

Strategy

- Any action while a motor vehicle is on a trip which increases the probability of successful evasive tactic by the driver
  - Speed
  - Road position
  - Consuming alcoholic beverages / drugs / medications
  - Cell phone
  - Signaling
  - Lane changes
  - Fatigue

Tactics

- Any action taken by a motor vehicle to avoid a hazardous situation
  - Steering
  - Braking
  - Accelerating
  - Nothing



Protect the scene

- Secure the vehicles
- Do not touch/move anything
- Look for scene evidence outside the obvious
- How big is the scene really?
- Are you visible?

What is the scene telling you

- Drowsiness
- Medical condition
- Distraction (i.e. cell phone)
- Momentum
- Totality
- Don't state opinions in report

- Reckless homicide
- DUI (aggravated)
- Traffic citation
- Nothing
- Avoid pre-conceived ideas

What crime occurred

Notifications

- Coroner
- Investigations
- Command Staff
- Shadow traffic
- Next of kin
- Family

Plan a Course of Action

Investigative Team Checklist

- Was anything moved? If so, what?
- Are the final rest positions uncontrolled / controlled?
- Is the roadway condition the same?
  - Weather / lighting?
- What evidence at the scene did you find?
- Witness / Driver / Passenger statements?
- Indication of impairment? DRE needed?
- Officer at hospital?
- Video in area?
- Investigators responding?
  - Interviews, charges, follow up work with team (i.e. EDR)

Checklist

- Involve ASAs Office
- Sketch the crime scene
- Still photograph the crime scene
  - With and without markings
- Scene Doc / Vehicle Examination Forms
- Capture physical evidence
  - Vehicles and pertinent objects (i.e. bike, ped, etc.)
  - Roadway markings
  - Perspectives

Checklist Continued

- Collect biological evidence (especially for 10-57s)
  - Shoe prints from pedestrian crash or from gas/brake pedal
  - Blood / DNA / Air bags
  - Hair fibers (many times in the windshield)
  - Clothing fibers (useful in pedestrian crashes, seat belts)
- To-scale diagram (Drone, 3D scanner)
  - Coordinate method is a great choice
- Thoroughly search the scene
- New damage on roadway or vehicle due to a move
- Reexamine and photograph scene in daylight
- Caution Addressing Media

At The Hospital

- Injuries
- Statements
- Release of Medical Information

Alcohol/Drugs?

- Toxicology: Blood serum (hospital) to whole blood (police) divide by 1.18
- Illinois Administrative Code Title 20 Part 1286
- DRE
- Blood for ethanol and THC
- Urine for other drugs
- Quantitative levels (i.e. nanograms)

Examine the Drivers

- Fatigue
- Distraction – Cell Phone
- Impaired
  - DUI Search Warrant Needed? Preservation Order?
  - DUI Kit
  - Aggravated DUI Statutes
- Medical Condition
  - Medical DL Reporting Form

625 ILCS 5/11-501.4 (Emergency Medical Treatment)

- (a) Notwithstanding any other provision of law, the results of blood or urine tests performed for the purpose of determining the content of alcohol, other drug or drugs, or intoxicating compound or compounds, or any combination thereof, of an individual's blood or urine conducted upon persons receiving **medical treatment** in a hospital emergency room are admissible in evidence as a business record exception to the hearsay rule only in prosecutions for any violation of Section 11-501 of this Code or a similar provision of a local ordinance, or in prosecutions for reckless homicide brought under the Criminal Code of 1961, when each of the following criteria are met:

625 ILCS 5/11-501.4 (Emergency Medical Treatment)

- (b) The confidentiality provisions of law pertaining to medical records and medical treatment shall not be applicable with regard to chemical tests performed upon an individual's blood or urine under the provisions of this Section in prosecutions as specified in subsection (a) of this Section. No person shall be liable for civil damages as a result of the evidentiary use of chemical testing of an individual's blood or urine test results under this Section, or as a result of that person's testimony made available under this Section.

HIPAA

- **45 CFR 164.512 Uses and disclosures for which an authorization, or opportunity to agree or object is not required.**
- ***(f) Standard: disclosures for law enforcement purposes.*** A covered entity may disclose protected health information for a law enforcement purpose to a law enforcement official if the conditions in paragraphs (f)(1) through (f)(6) of this section are met, as applicable.
- (1) Permitted disclosures: pursuant to process and as otherwise required by law. A covered entity may disclose protected health information: . . .
- 625 ILCS 5/11-500.1 Immunity

Terminology

Terminology - Crash

- Six ways damage can be categorized
  - Preceding the collision, but not contributing
  - Preceding the collision and contributing
  - During the collision
  - After the collision, but prior to final rest
  - At the scene following the collision
  - During removal and storage

Terminology – Contact Damage

- Contact damage: damage to any part of a motor vehicle by direct contact with some object which is not part of the vehicle
  - Internal
  - External

Terminology – Induced Damage

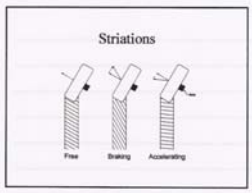
- Induced Damage: damage to any part of the motor vehicle caused by some other part of the same vehicle or the shock of the collision

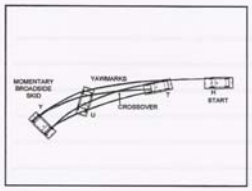
Terminology - Glass

- Tempered Glass: glass shatters forming small corn-size pieces
- Laminated Glass: two layered glass
  - Contact damage (spider web)
  - Induced damage (straight lines)

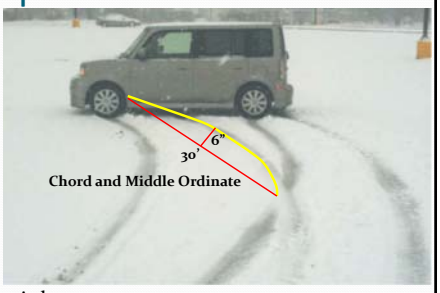
Terminology - Tires

- Tire mark: a tire that is slipping or sliding
- Skid mark: a tire sliding without rotation
  - Striations
  - Furrow
  - Roots
- Yaw mark: a tire that is rolling and side slipping
  - Striations / crossover
- ABS tire marks





Critical Speed Yaw



When traction is lost,
the rear wheels track outside of the front wheels

Terminology - Tires

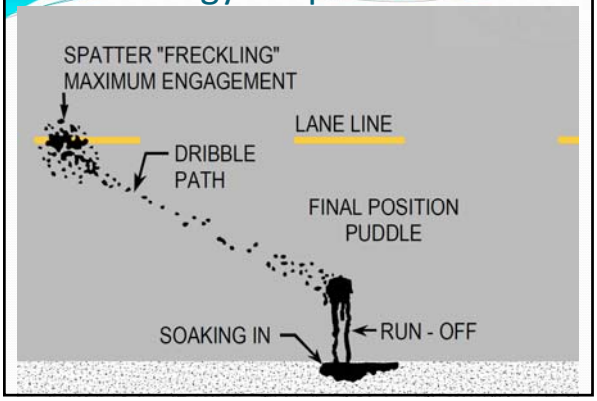
- Acceleration scuff
- Impression vs. Furrow
- Crook

- Immediately place markers (cones) at the start and end of visible tire marks

Terminology - Road

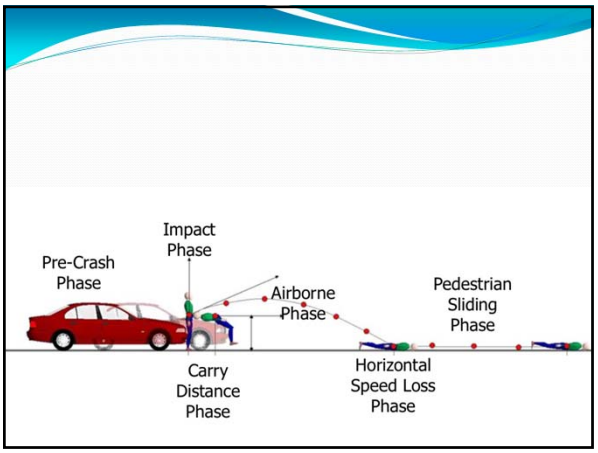
- Scratches and scrapes
- Chips
- Towing scars
- Scars on fixed objects

Terminology - Liquid



Serious and Fatal Crash Investigation for Evidence Technicians

Pedestrians, Trucks, Motorcycles & Bicycles

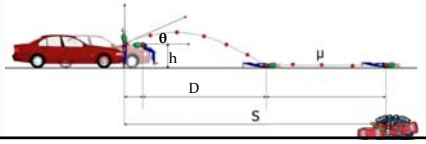


Considerations (Peds)

- Impact point
- Avoidance maneuvers. Before-after impact?
- Controlled-uncontrolled stop
- Smear marks (fibers)
- First ground contact
- Bumper heights / angles
- How body interacts with vehicle
- Visibility / contrasting colors

Considerations (Peds)

- Where did they enter the roadway?
- How did they enter (walk, jog, run, etc.)?
  - Generally, the load bearing leg (holding the body weight) will break first
- Pedestrian carry distance, fall distance, throw distance and slide distance



Considerations (Trucks)

- Correct licensing (CDL)
- Log book(s)
- Load / trailer secure
- In-Camera video
- Truck lighting (side markers, reflective tape, etc.)
- Check tires / braking system
- Event data BEFORE Level I ISP Inspection
  - Last Stop / 2 Hard Braking Events

Considerations (Cycles)

- Low side / high side
- Evasive actions (braking before-after impact)
- Helmet
- Contact marks (fibers)
- How body / motorcycle interacts with vehicle
- Visibility / contrasting colors
- Debris cone

Motorcycle Reconstruction

- First contact position
- Landing location
- Flight distance
- Wheelbase
- Tire size / pressure / direction
- Seat height (COM)
- Gear Position/Teeth
- Shifting Pattern

Considerations (Bikes)

- First contact position
- Controlled-uncontrolled stop
- Bicycle tire mark
- Bicycle seat height
- Smear marks (fibers) / bike scrapes
- Bumper heights / angles
- Visibility / contrasting colors

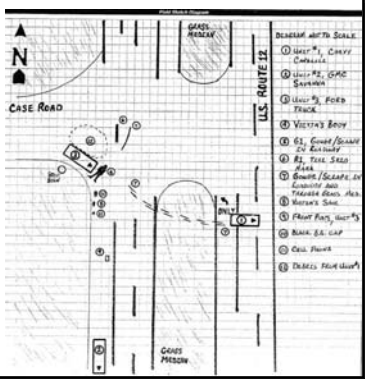
Serious and Fatal Crash Investigation for Evidence Technicians

Practical Preparation

WHY ARE WE MEASURING ?

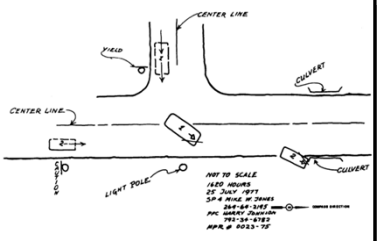
Field Sketch

- The field sketch should include:
  - Results of the collision
  - Roadway features
  - Significant contribution objects
- The field sketch is limited to factual data – no opinions



Field Sketch

- Indicate north on the field sketch
- Orient north toward the top of the sketch
- Legend (if necessary)



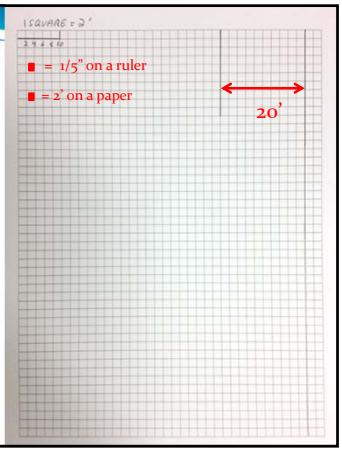
Field Sketch Showing Final Rest Position of Vehicles

Coordinate Method

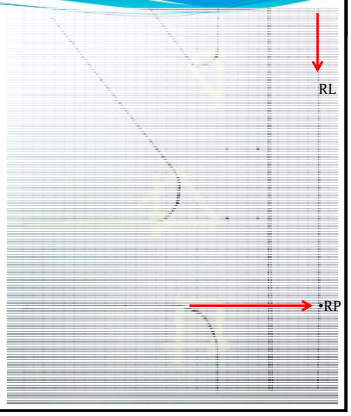
- Measurements made from two permanent, easily identifiable landmarks.
- One landmark is the reference line
- The other landmark is the reference point (origin)
- Record direction and distance from the two landmarks
- Nominal north

Vehicle Strikes a Bicyclist

- Draw east edge of roadway
- Draw west edge of roadway 20' (measured distance) from east roadway edge
- You decide the distance of west edge of roadway
- Each block = 2' on paper



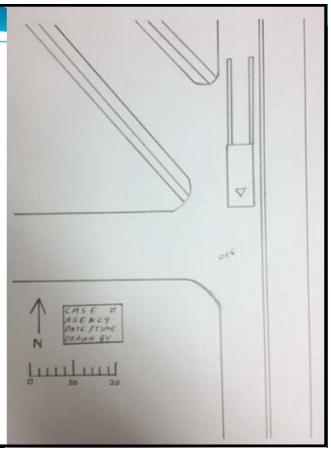
- Identify a reference point and a reference line
- RP = South edge of ____ Street
- RL = East edge of ____ Street



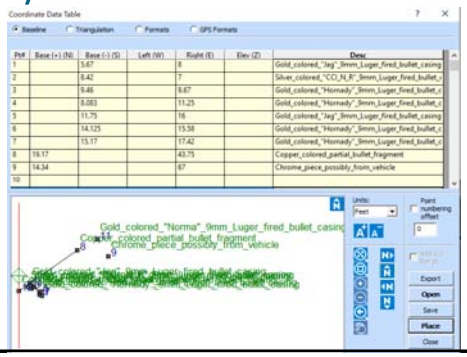
- Coordinate measurements
- Evidence Collection
  - Body
  - Vehicle
  - Tire Marks

	North	West
Head(H)	5'	20'
Belly Button (BB)	6'	17'
Left Front (LF)	17'	12'
Right Front (RF)	17'	18'
Left Rear (LR)	31'	12'
Right Rear (RR)	31'	18'
Skid 1 End (S1E)	31'	18'
Skid 1 Start (S1S)	51'	18'
Skid 2 End (S2E)	31'	12'
Skid 2 Start (S2S)	51'	12'

- Official Finished Product
- Not exact representation, but reasonable replication



Why Coordinate Method



Serious and Fatal Crash Investigation for Evidence Technicians

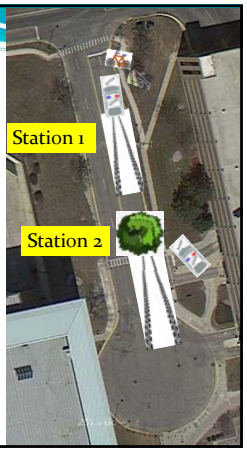
Outdoor Practical Packet

Your Scene

- Field Sketch
- Coordinate Form
- Graph paper

= 1/5" on a ruler

= 2' (max. 72' x 98')
or 3' on a paper (max. 108' x 147')



Coordinate

Minimum Speed Formula

$S_1 = \sqrt{(30)(d_1)(f)}$

- Coordinate Method (N, S, E, W measurements)
  - Reference Point _____
    - Offset from Reference Line _____
  - Reference Line _____
    - Vehicle (LF, RF, LR, RR)
      - Veh. front overhang _____; rear overhang _____; track width _____
    - Pedestrian (head, belly button or feet)
    - Bicycle (center of front and rear tire)
    - Skid marks (start and end); length of longest skid mark _____
    - Roadway width _____
    - Center of roadway (if divider line present)
- Use the Coordinate Form
- Drag factor (f): 0.___

COEFFICIENT OF FRICTION OF VARIOUS ROADWAY SURFACES

DESCRIPTION OF ROAD SURFACE	DRY				WET			
	Less than 30 mph (50 kph)		More than 30 mph (50 kph)		Less than 30 mph (50 kph)		More than 30 mph (50 kph)	
	From	To	From	To	From	To	From	To
PORTLAND CEMENT New, Sharp	0.80	1.20	0.70	1.00	0.50	0.80	0.40	0.75
Traveled	0.60	0.80	0.60	0.75	0.45	0.70	0.45	0.65
Traffic Polished	0.55	0.75	0.50	0.65	0.45	0.65	0.45	0.60
ASPHALT or TAR New, Sharp	0.80	1.20	0.65	1.00	0.50	0.80	0.45	0.75
Traveled	0.60	0.80	0.55	0.70	0.45	0.70	0.40	0.65
Traffic Polished	0.55	0.75	0.45	0.65	0.45	0.65	0.40	0.60
Excess Tar	0.50	0.60	0.35	0.60	0.30	0.60	0.25	0.55

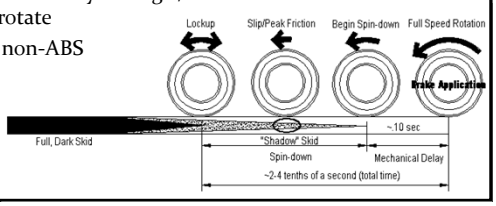
Coefficient of Friction

Minimum Speed Formula

$S_1 = \sqrt{(30)(d_1)(f)}$

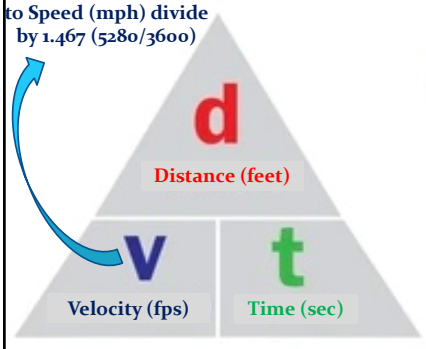
Tire Considerations

- Surface condition and grade
- Types of tires
- Vehicle rotation
- Wheels locked by damage / free to rotate
- ABS or non-ABS



Velocity Formula

Convert Velocity (fps) to Speed (mph) divide by 1.467 (5280/3600)



$d = v \times t$

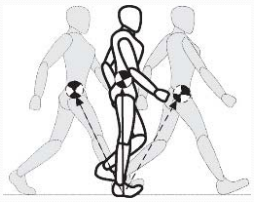
$t = \frac{d}{v}$

$v = \frac{d}{t}$

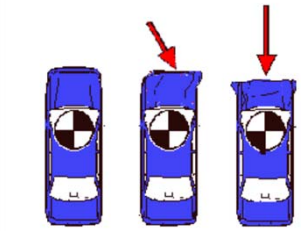
Serious and Fatal Crash Investigation for Evidence Technicians

Vehicle Dynamics
PDOF
Occupant Kinematics
PRT

Center of Mass



Principal Direction of Force



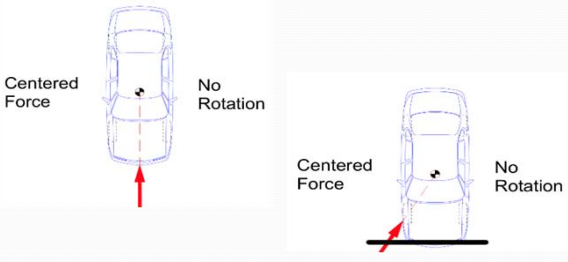
Note Force Vector Length is Equivalent to Magnitude and Direction is Dependent on the Collision

Principal Direction of Force

- PDOF is indicated by contact damage and crush resulting from the impact.
- The force is concentrated at the point of maximum penetration (a.k.a. maximum engagement)
- PDOF is from the center of damage.
- Rotation occurs around the center of mass.

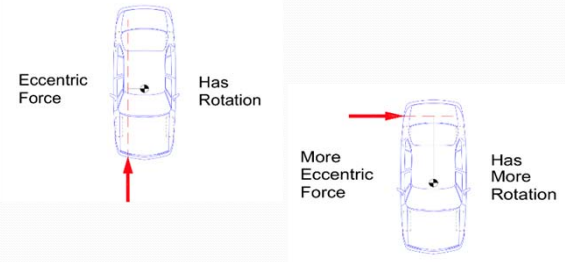
Force and Rotation

- Centered – no rotation



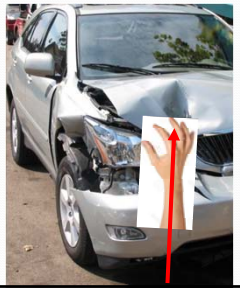
Force and Rotation

- Eccentric Force has rotation



Principal Direction of Force

- Where can I pull the car damage together to fix it?



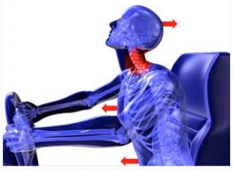
Principal Direction of Force

- Where can I pull the car damage together to fix it?

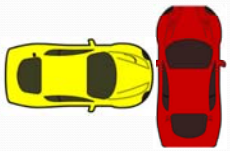
Occupant Kinematics

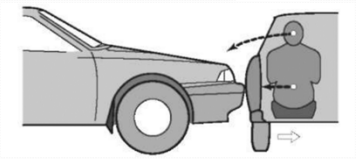
Speed 0 mph

Speed 35 mph

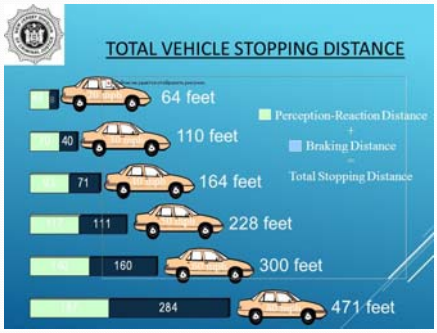


Occupant Kinematics



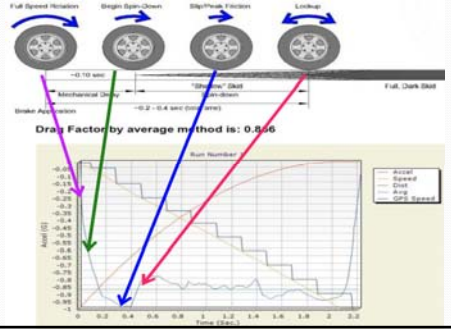


Perception Reaction Time



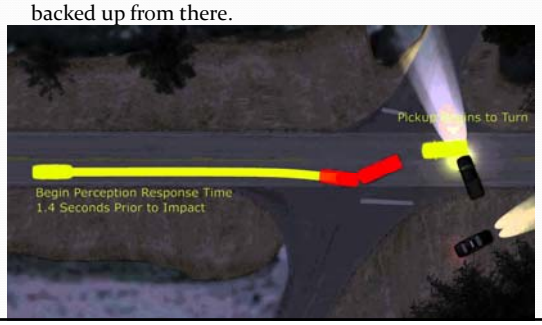
Perception Reaction Time

- PRT **VERY** General Average is 1.5 seconds.
- MPH to FPS (multiply by 1.466; can use 1.5 as general)

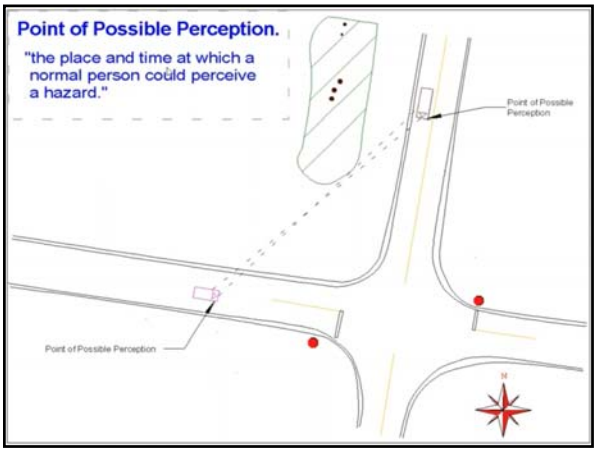


Perception Reaction Time

- Accident Reconstruction is from Final Rest and backed up from there.



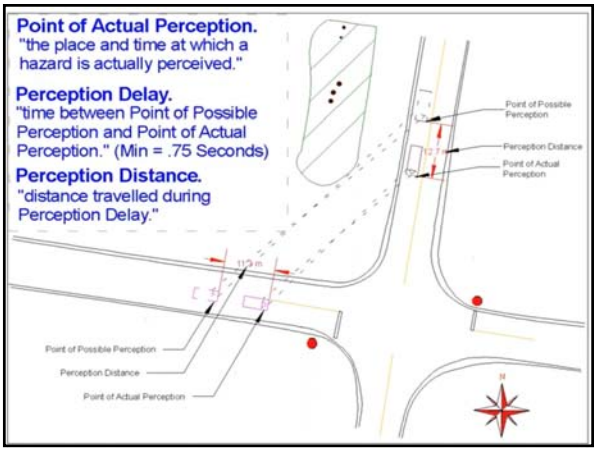
Point of Possible Perception.
"the place and time at which a normal person could perceive a hazard."



Point of Actual Perception.
"the place and time at which a hazard is actually perceived."

Perception Delay.
"time between Point of Possible Perception and Point of Actual Perception." (Min = .75 Seconds)

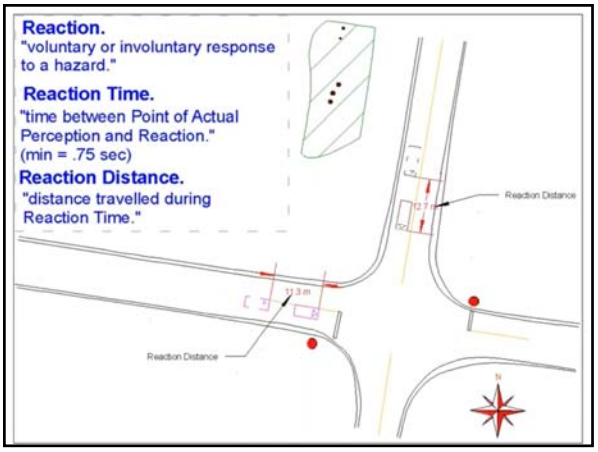
Perception Distance.
"distance travelled during Perception Delay."



Reaction.
"voluntary or involuntary response to a hazard."

Reaction Time.
"time between Point of Actual Perception and Reaction." (min = .75 sec)

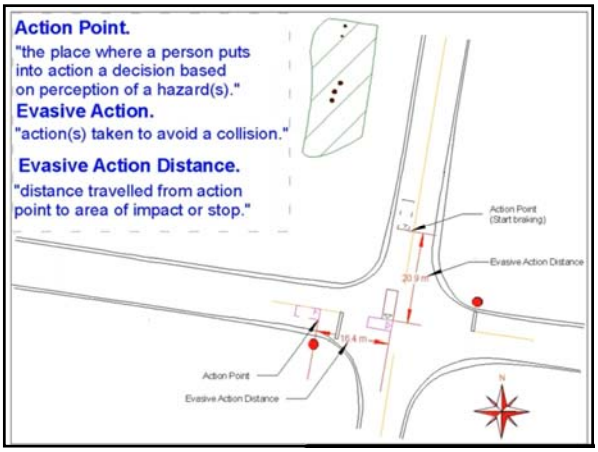
Reaction Distance.
"distance travelled during Reaction Time."



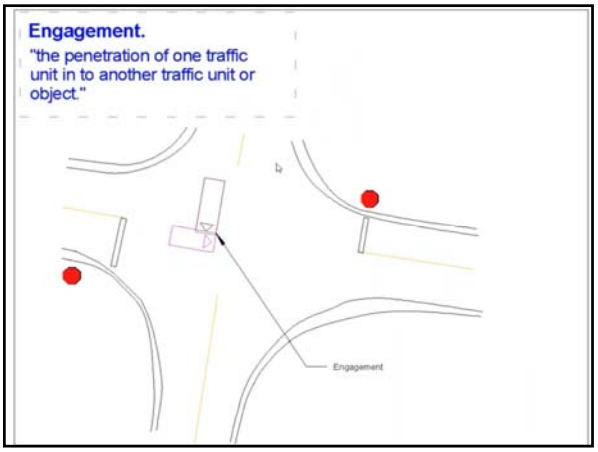
Action Point.
"the place where a person puts into action a decision based on perception of a hazard(s)."

Evasive Action.
"action(s) taken to avoid a collision."

Evasive Action Distance.
"distance travelled from action point to area of impact or stop."



Engagement.
"the penetration of one traffic unit in to another traffic unit or object."

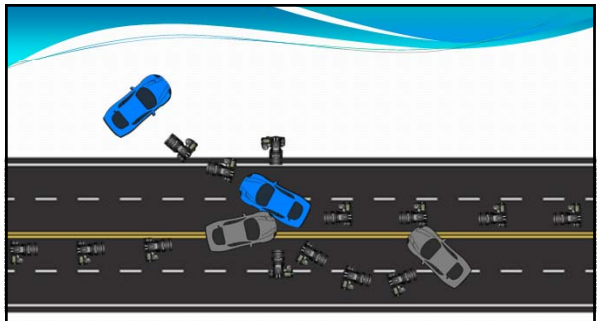


Serious and Fatal Crash Investigation for Evidence Technicians

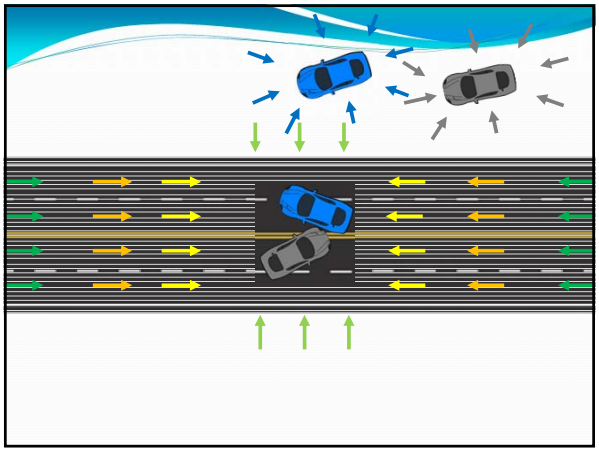
Photographing
and Documenting the Scene

Photographs

- Overall Photos (traffic control devices)
- Roadway evidence (tire marks / defects)
- Vehicle Identification
- Outside Vehicle (tires)
- Inside Vehicle (safety equipment)
- Signs of collision on the road
- All damage (crush, scraps)
- Any evidence (cell phone, alcohol)
- Field of view

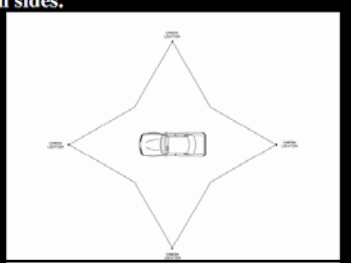


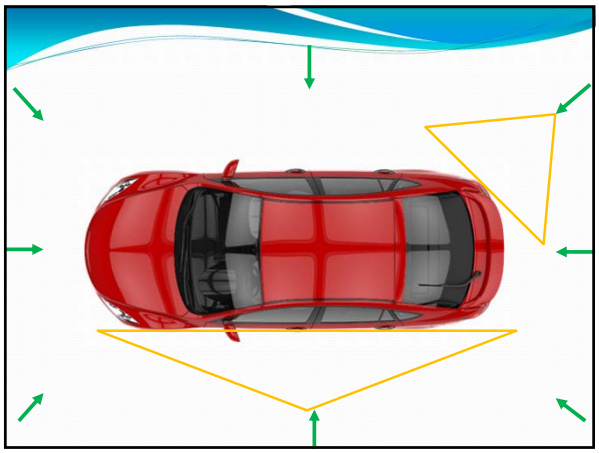
Telling the FACTUAL story



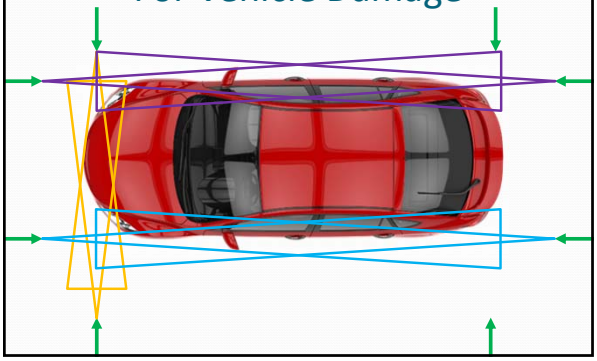
Minimum

The basic four photographs that should be taken are: straight front, straight rear, and both sides.

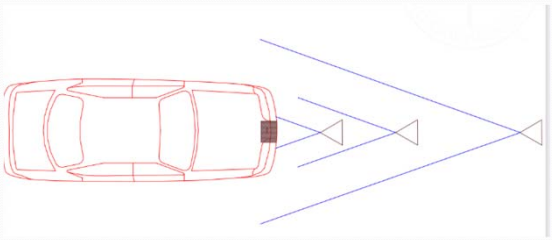




For Vehicle Damage



Relationship Photos



Vehicle Photographs

- Inside
  - Overall drivers side
  - Drivers floor (including pedals)
  - Dashboard
    - including light switch, infotainment system, guages

Vehicle Photographs

- Inside
  - Air bags
  - Windshield
  - Evidence (alcohol, drugs, etc.)
  - Seatbelt Use
  - Seat positions (measurements?)

Tire Marks

- Skid mark (ABS)
- Yaw mark
- Crook
- Flat tire mark
- Imprint

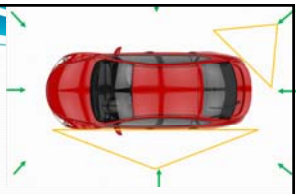
Document

- Roadway
  - Cement / asphalt
  - Speed limits
  - Road conditions
  - Traffic controls / signals / devices
  - Lighting
- Weather
  - Temperature
  - Visibility
  - Sunset/sunrise times
- In-car / body cameras

The Effects of a Collision

- Road Scars
- Debris
- First contact locations
- After impact movement
- Off the ground (airborne)
- Final positions
- Tire marks (f/32 great depth of field)

Quick Recap



- VIN plate (door jam)
- Tire Specification label
- Basic 8 Photos plus tires
- Damage areas with relationship photos
- Damage areas with measuring measurements
- Showing pre-impact, maximum engagement, post-impact
- PDOF / Paint transfer / rub-off / patterns (i.e. scrapes)
- Occupant contact marks / cell phones
- Seatbelts / Airbags
- Anything unique to the crash

Serious and Fatal Crash Investigation for Evidence Technicians

Nighttime Photography

What Do You Photograph?

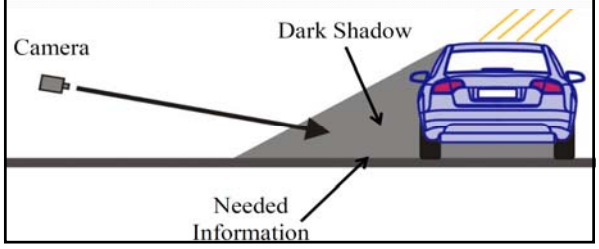
- IF you take your photos with the idea that someone will be able to look through your photos and quickly understand the crash in terms of direction, orientation and movement of each vehicle involved you will take better, more meaningful photos.

Protective Filter Polarized Len

- Using a polarizing filter to cuts off the glare and allows one to see beyond a surface
- Cuts off reflections from glass, metals or shiny surfaces

Flash: an important piece

Fill Flash Photography



Sync Cable: Side Lighting

Sync cable usage

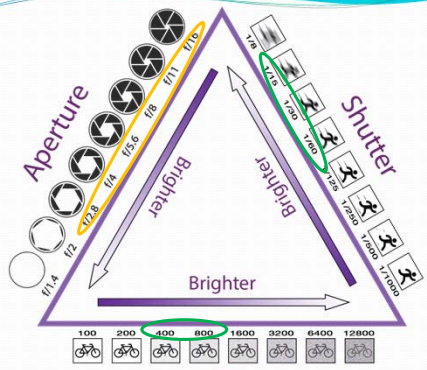
Handheld

Monopod mount

Focus on object the length of the pole, turn off auto focus, set picture for 10 seconds, take photo.

Program (Day) or Manual (Night)

- The camera automatically adjusts shutter speed and aperture for optimal exposure in most situations. Can only adjust ISO.

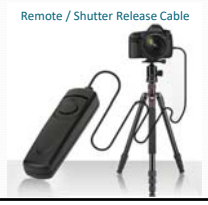


#1 Boost Up ISO

- ISO measures the sensitivity of the image sensor. The higher the number (more sensitive to light) the more graining the image can be (lower resolution).

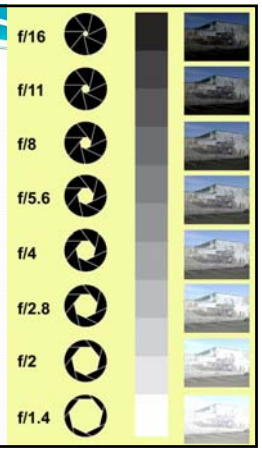
#2 Shutter Speed

- Determines how long the aperture is open
- Affects how motion is captures
- Longer open, more light comes in
- Longer open, more noise is made
- After 1/60 you need a tripod



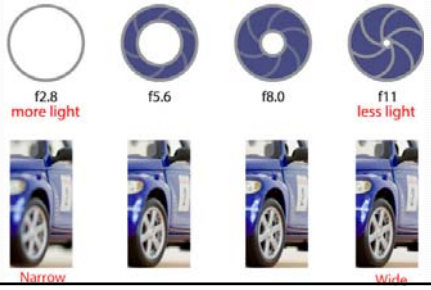
#3 Adjust the Aperture

- Called a f-stop
- Affects depth of field in a photograph. How much of the photo is in focus behind and in front of the point of focus
- "f" indicated the amount of light the lens lets through in proportion to its focal length



The "f" System / Depth of Field

- Each stop becomes smaller, half as much light is let in
- f/16 lets in less light than f/5.6
- f/11 is twice as bright as f/16, but only half as bright as f/8



Normal Field of View

- The camera can distort distance causing things to look close or farther away as you zoom the lens in and out.
- DX Format for DSLRs use 35 mm
- FX Format for DSLRs use 50 mm
- Must read manual!

Exposure Compensation

- Most daytime photographs can be taken on the Program setting and the TTL flash.
- Use to purposely over or underexpose a photograph without changing any other setting on the camera

Painting With Light

- Must use a long exposure
- Drawbacks
  - Artificial lights may discolor the photo (white balancing)
  - Squad lights, headlamps, fire equipment, reflective signs can wash out areas of the photograph.

Long Exposure Procedures

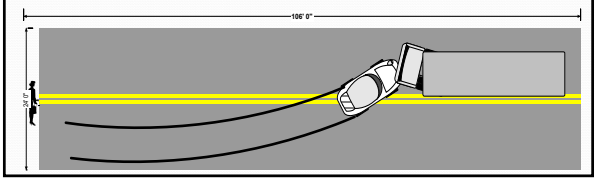
- Use a tripod
- Set the camera to manual
- ISO 1600+
- Shutter Speed to Bulb OR
- Set shutter speed based on light metering
- Aperture of F8 or lower
- Bracket photographs until the desired exposure is obtained

Painting With Light

- Technique used for illuminating large areas where without ambient light and outside the range of normal flash photography.
  - Large fields
  - Parking lots
  - Roadways
- Light sources
  - Electronic Flash
  - Flashlight

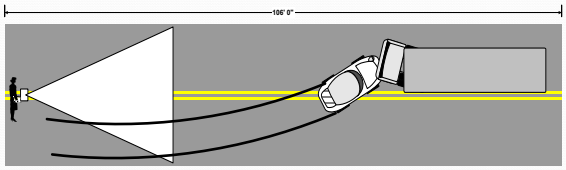
Painting With Light

- Nighttime Crash Scene
  - No street lights
  - over 100 feet
  - Skid/Yaw marks on roadway



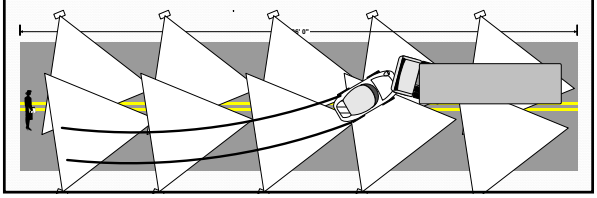
Painting With Light

- Using flash on camera assuming guide no. 80
  - This is as much of the scene you could hope to illuminate



Painting With Light

- In order to obtain a photograph of the entire scene using a flash.
  - Multiple firing of the flash from different locations down from the camera is necessary.



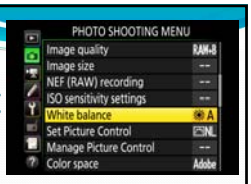
Painting With Light

- To accomplish this task you will need to follow these procedures:
- Best performed with 2 people
  - Set camera up on tripod.
  - Determine flash to subject distance
    - in this case about 15 feet
      - 100/15 = 5.3 or f5.6
  - Set Camera on Bulb setting
    - Need a locking cable release
    - Have a black card to hold in front of the lens

Painting With Light

- Make sure there are no light sources shining back at the camera.
- Open shutter with cable release and lock open.
  - Use a dark or black card to hold in front of lens
- Remove card from lens and have helper fire flash
  - Keep flash pointed away from camera
  - Cover lens
- Move down and repeat process until entire scene has been covered by flash.

Painting With Light



- White Balancing

Artificial lights give off different colors.

White balancing setting on camera tells the camera what type of light is in the area and allows the camera to adjust.

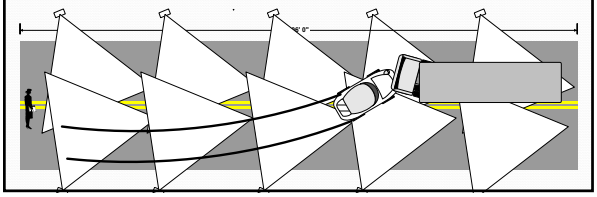
Auto setting works very well.

Painting With Light

- In the absence of a flash unit,
  - other light sources may be used, such as flashlights, spotlights, or floodlights.
  - Aperture will depend on output of light used and distance to object.
    - Power will usually be much less than flash.
    - Good to try different f-stops
- With shutter opened and locked slowly move the light over the object "painting the area with the light

Painting With Light

- In order to obtain a photograph of the entire scene using a flash.
  - Multiple firing of the flash from different locations down from the camera is necessary.



Visual Perception Photos

Ambient light photos to document what could have seen given available light.

Difficult due to variances in viewer's visual acuity.

- DO NOT state that photo is "what subject saw" (or could have seen)
- Utilize visual targets or markers within scene
- Bracket photos heavily (± 3-5 full stops)

Available Illumination

Visual Perception Photos

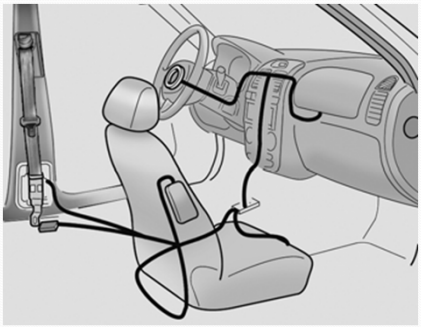
Basic Photographer Techniques

- For bright sunny days, apertures of f/11 or f/16
- For night photography, apertures of f/4 or f/5.6
- For bright sunny days, use ISO 100
- For night photography, use ISO 400
- PRACTICE

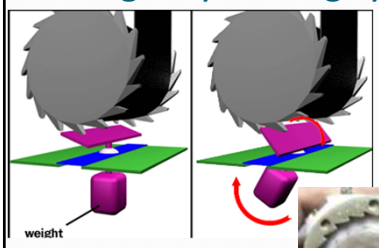
Serious and Fatal Crash Investigation for Evidence Technicians

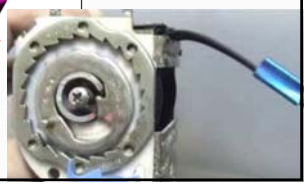
Evidence Collection
Vehicle Inspections
Investigation

Pretensioner



Emergency locking system





Child Safety Seat Restraints

215 ILCS 5/143.32

Lamps

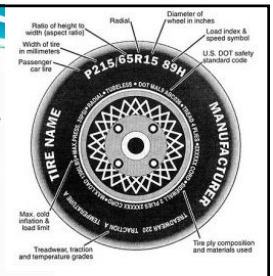
- On or off
- Broken or unbroken
- Position of light switch

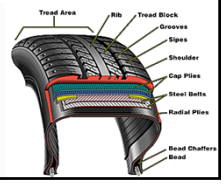
Lamp Examination

- Filaments are made from tungsten wire
- Incandescent at 4000 degrees Fahrenheit
- Results on, off, indeterminate
- Must be within contact damage area
- Hot Shock: filament deformation after collision, filaments inertia
- Fractured Filament: sharp/jagged ends when broken
- Broken Bulb: filament may be snagged by an external object

Tires & Drag Factor

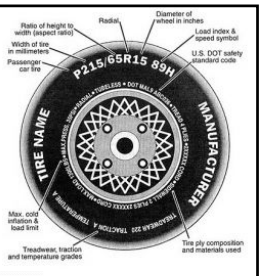
- Flat
- Hole
- Tire bead unseated
- Wheel flange bent
- Wheel stuck and not free to rotate
- Tread depth
- Tire pressure
- Tire weight rating

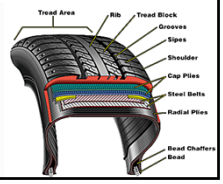




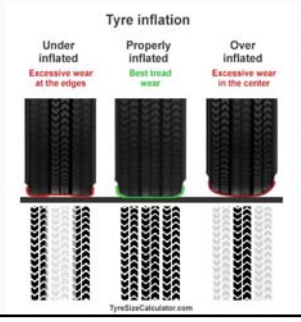
Tires & Drag Factor

- Tire resistance (post-collision)
- Tire bead unseated
- Wheel flange bent
- Tire pressure
- Tread depth
- Tire size
- Tire weight rating





Overinflated / Underinflated



Tire Exam

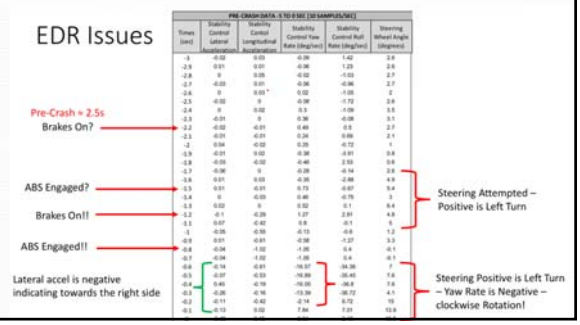
- Size, Failure, Pressure,

Tires & Wheels

L	Front	R	L	Rear	R
Make	Make		Make	Make	
Model	Model		Model	Model	
Size	Size		Size	Size	
Y N	Flat	Y N	Y N	Flat	Y N
Y N	Unseated bead	Y N	Y N	Unseated bead	Y N
Y N	Bent flange	Y N	Y N	Bent flange	Y N
Y N	Slightly Jammed (some restriction)	Y N	Y N	Slightly Jammed (some restriction)	Y N
Y N	Moderately Jammed (heavy restriction)	Y N	Y N	Moderately Jammed (heavy restriction)	Y N
Y N	Fully Jammed (unable to rotate)	Y N	Y N	Fully Jammed (unable to rotate)	Y N
Y N	Beyond Wear Indicator	Y N	Y N	Beyond Wear Indicator	Y N
	Tread Depth (/32)			Tread Depth (/32)	

EDR and Tires

- Speed based on tire revolutions
- Tires match electronic evidence (i.e. braking, steering)

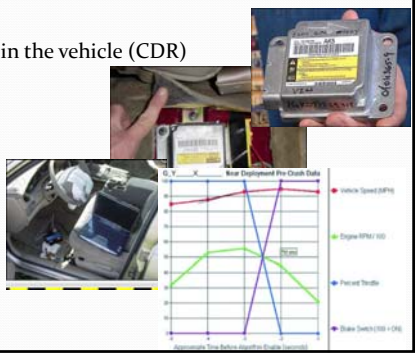


Air Bags & Event Data Recorders

- 1. EDR's improve reconstruction accuracy & get to causation – **data is *additional evidence*** – *use* with all other available scene evidence.
- 2. The EDR strength is to give us DRIVER BEHAVIOR.
- 3. Must have good scene measurements and photographs of the physical evidence to analyze.

Final Area to Inspect

- Data module in the vehicle (CDR)
- Seat belt
- Speed
- Braking
- Acceleration



Eliminating all possible causes

- NHTSA recall list http://www-odi.nhtsa.dot.gov/recalls/
- CARFAX report http://www.carfaxonline.com/
  - Application
- Vehicle Data Specs
  - Manufactures Website
- Weather Report http://www.wunderground.com/
- IDOT Traffic Signal Plan Sheet
  - Includes signal sequencing
- Suncalc.net

Eliminating all possible causes

- Crash Data Recorder http://www.cdr-system.com/
- Mechanics Information http://www.alldata.com/
- ISO ClaimSearch (NICB)
- CLEAR (Thomson Reuters)
- Vigilant / Flock
- Berla (Vehicle Forensics)
- Collision Avoidance Systems (Cameras)

Investigation (24 Hour Timeline)

- Able to place subject in vehicle?
- Able to identify driver?
- Video (private and public) / LPRs
- Get video's quickly, many cycle through after 24 hours
- Cell phones & social media
- Any impairment (video evidence?)
- Driver KSA's

Autopsy

- Photos: external and internal injuries
- How body moved in crash (bring photos)
- Match injures to vehicle movements
- Alcohol, drugs, prescriptions
- What caused death?
- Collection of clothing and shoes
- Collect: tissue sample, blood sample, hair root sample, hair sample and fingerprints