LOS ANGELES POLICE DEPARTMENT
Traffic Collision Investigation Enhanced
1850-33611
Expanded Course Outline

Instructional Goal: To provide sworn personnel with effective tools to use to be more efficient and effective when investigating a traffic crash.

Performance Objectives: Using learning activities, facilitated discussion and practical application scenarios, the student will:

- Gain understanding of occupant kinematics, impact biomechanics, bicycle and pedestrian dynamics, and motorcycle crash dynamics.
- Learn new techniques to diagram a crash scene and conduct a field practical on these techniques.
- Gain an understanding on vehicle damage analysis and conduct a vehicle inspection.
- Gain a better understanding on tire marks, legal updates and human interviewing techniques.

References: Instructors, facilitators and training supervisors shall ensure that current references are utilized

Day-1

I. INTRODUCTION AND COURSE OVERVIEW 0700-0800 (60 Min)

A. Topic 1.0 - Introduction and Orientation
   1. Instructors introduce themselves
   2. Review POST attendance criteria
   3. Orient students to facility

B. Course goals and objectives
   1. Build upon and "enhance" the skills of traffic crash investigation learned in the Basic Crash Investigation Course
      a. Provide the student with a more in-depth look at the traffic crash investigation process as a whole
      b. Provide the skills necessary for completion of a scale diagrams at complex intersections
      c. Introduce the student to the complexities of vehicle dynamics, occupant behavior, injury causation, pedestrian, motorcycle and bicycle crashes

C. Required materials
   1. Review what is needed to bring to class
      a. Calculator with square root function
      b. Blue Blitz ruler
      c. Compass
      d. Clipboard, pencil and eraser

D. Student responsibilities
   1. Dress attire
   2. Court
   3. Sign in sheet

E. Core values

1. Quality through continuous improvement
2. Integrity in all we say and do

II. VEHICLE DYNAMICS OVERVIEW (150 Min)

A. Topic 2.0 Introduction
   1. Understanding how vehicles behave in a crash is an important step in crash investigation
B. Elements of a crash
   1. First contact - the beginning of a crash
   2. Maximum Engagement
      a. The point where the objects can no longer crush
      b. For an instant, the parts of the objects in contact reach a common velocity of zero
   3. Separation – the point where the force between the objects becomes zero
C. Two kinds of impacts
   1. Full impact:
      a. Some parts of the colliding vehicles attain the same velocity during the impact phase.
      b. If the vehicles remain in contact when motion ceases, the impact is full because the parts in contact reach a common speed
      c. Motion between the parts in contact will cease momentarily
      d. **Does not** mean that either of the vehicles in the crash stopped completely during impact
   2. Partial impact:
      a. No substantial parts of colliding surfaces attain a common velocity during the crash sequence
D. Sir Isaac Newton
   1. 1st Law – An object at rest or in uniform motion will remain in that state unless acted upon by an outside force

   2. 2nd Law – motion changes from applied force
      a. Describes how an object changes its motion when a force is applied to it.
      b. The change in motion depends on the magnitude (amount) of the force applied, and on the weight (mass) of the object.
      c. Momentum is force times acceleration
   3. 3rd Law – For every action there is an equal and opposite reaction
   4. Thrust or Principal Direction of Force (PDOF)
E. Results in the collapse of vehicle parts
   1. Extent depends on amount of force applied and the strength of the vehicle's structure
   2. Has a direction through the vehicle?
F. Center of Mass – defined
G. Rotation

1. If the force is applied directly through the vehicle's Center of Mass (COM), vehicle will not rotate (Centered Crash)
    a. In these types of crash injuries are generally more severe because all of the force is absorbed by the vehicle, and in turn,, imparted on the passengers
    b. Centered crashes are fairly rare in the real world

2. Eccentric forces

    a. When the PDOF does not pass through the struck vehicle's COM, eccentric forces have been applied
    b. This is much more common in real world crashes
    c. Eccentric forces create rotation around the vehicle's Center of Mass
    d. The amount of rotation varies, depending on:
        1) The amount of force applied
        2) Where the force is applied

H. Vehicle damage
1. In order to determine the thrust angle or PDOF, the type of damage looked at is important. There are two types of damage:
    a. Contact damage – The damage that occurs where the vehicles, or vehicle and fixed object, were in actual contact
    b. Induced damage – The damage incurred by the vehicle in areas that were not in contact with the other object
2. Once we know the PDOF, we can estimate how the vehicle must have moved from first contact to its at-rest position

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K. "Understanding Car Crashes" Video
1. Play video and discuss dynamics of the crash in the video
2. Answer any questions

L. Summary

1. Thrust or PDOF may make the vehicle spin

III. OCCUPANT BEHAVIOR IN CRASHES (60 Min)

A. Topic 3.0 Introduction
1. Occupant Behavior in Crashes is also referred to as "Occupant Kinematics"
2. Deals with motion of bodies without consideration of the forces involved required to produce or maintain the motion

B. Occupant Kinematics is used to determine
1. Who was driving
2. Position of occupants at the time of impact
3. Injury mechanisms
4. Effects of restraint systems

C. Steps involved
1. Vehicle inspection
2. Understand the vehicle dynamics involved
3. Determine occupant kinematics
4. Match injuries to vehicle interior contact points
   a. Windshield
   b. Knee bolsters
   c. Steering wheel
   d. Seat belts
5. Compare kinematics, injuries, & vehicle interior
   a. Blood on interior parts
   b. Damage to vehicle interior from body contact
6. What effects did restraint system have?

D. Vehicle inspections
1. Should be done to determine the PDOF
2. Should be done to determine how occupants would have moved relative to the vehicle
   a. Best if done at scene
3. What parts to inspect
   a. Steering wheel
   b. Bent forward on each side where hands were
   c. Forced forward by driver's chest

d. Teeth marks
e. Moved to one side
f. Seat backs
    1) Bent
    2) Broken
g. Door panels
    1) Bowed
    2) Broken
h. Vehicle glass
    1) Broken outward
    2) Head star
    3) Hair or tissue embedded
i. Rearview mirror
    1) Broken
    2) Bent to one side
j. Dashboard indentations
k. Headliner indentations
l. Pillars indentations

E. Vehicle and occupant interaction
  1. Newton's 1st law applies. Crashes are that "outside force"
    a. Crash impact
      1) Acceleration
      2) Deceleration
      3) Rotation
    b. Occupants will move ***opposite*** and ***parallel*** to the PDOF

B. Understanding vehicle and occupant behavior in crashes
  1. Centered frontal crash.
  2. Side impact crashes
  3. Rear end crashes
  4. Non-centered crashes

C. Summary
  1. Understanding how vehicles moved (Dynamics)
  2. Is key to understanding occupant motion (Kinematics)
  3. Vehicle inspection is imperative

IV. IMPACT BIOMECHANICS OF TRAFFIC CRASHES (60 Min)

A. Topic 4.0 Introduction
  1. Impact biomechanics deals with the relationship between physical forces and injury

B. Vehicle crashes are three crashes in one:
  1. Vehicle vs vehicle
  2. Occupant vs vehicle interior
    a. Steering wheel
    b. Dashboard

C. Internal organs vs. skeletal structure

D. Impact biomechanics enables us to match injury patterns to the injury mechanisms. This comparison can be used to address certain issues

1. Who was driving the car at the time of impact
    a. Seat belt marks
    b. Steering wheel injuries
2. Occupant seating positions
    a. Dashboard impact injuries
    b. Knee bolster injuries
3. Seat belt usage and the effects of the restraint system
    a. Seat belt marks
    b. Air bag injuries

E. Validate or refute statements; statements do / don't match injuries

1. "Impact Biomechanics of Traffic Crashes"

F. Restraint system effects

1. Vehicles and occupants experience the same change in speed during a crash
2. Restraints help to decelerate occupants while the vehicle is decelerating
    a. **Ride down** is the slowing of the occupant that occurs while the vehicle is being crushed on impact
    b. The longer the ride down, the less chance of injury because deceleration is not as abrupt
    c. Restraints help to prevent ejection and reduce the severity of the secondary impact between occupant and vehicle interior

G. Types of seat belts

1. Lap belt
2. Combination lap and shoulder – also known as "3-point belt"
3. Separate lap and shoulder – must be latched independently
4. Passive type – puts itself on as you enter the vehicle
5. Active type – must be put on by occupant
6. Pre-tensioner type – charge fires on impact which tightens belt to take up the slack
7. Vehicle sensitive – enough G force activates the locking mechanism
8. Webbing sensitive – as webbing spools out too fast it locks the spool

H. Seat belt inspection

1. Latch plate or tongue – examine for signs of deformation
2. "D" ring – examine for signs of abrasion or melting
3. Webbing – examine for signs of stretching or pillowing. Was belt cut by rescue unit?
4. Buckle – check for abrasions in the area of the "D" ring. Was the buckle latched or unlatched?
5. Retractor – check function. Is it jammed in retracted position or jammed in its "in use" position

I. Air bags (Supplemental Restraint System or "SRS")

1. Nylon construction
2. Packed in corn starch so it won't stick to itself

3. Deployed by gas
    a. Gas is released from a solid propellant called the Automatic Ignition Module
    b. Solid propellant burns at 275 degrees
    c. Systems are equipped with a capacitor which will allow the bags to deploy **up to 20 minutes** after the battery has been disconnected

J. Induced injuries (restrained occupant)
1. Bruising – occurs at points where webbing exerts pressure against the body
2. Fractures – occur along the path of the belt on the outside (anterior) ribs on the side adjoining the seat belt (inboard side)

K. Air bag injuries
1. Abrasions
    a. Forearm
    b. Face
2. Burns
    a. Hands
    b. Arms
3. Flailing injuries – from contact due to air bag deployment. Hands on the steering wheel can be thrown back into the face of the driver
4. Fractures
    a. Firearm
    b. Face
    c. Thumb

L. Unrestrained injuries
1. Driver
    a. Facial injuries
    b. Upper torso contusions
    c. Knee contusions
    d. Head injuries
    e. Lower extremity injuries
        1) "Impact Biomechanics of Traffic Crashes"
2. Passenger (front seat)
    a. Facial lacerations
    b. Upper torso contusions
    c. Contusions to knees
    d. Head injuries

M. Vehicle damage (from occupants)
1. Interior parts to inspect and document
    a. Steering wheel
    b. Seat backs
    c. Door panels
    d. Windshield
    e. Rear view mirror
    f. Dashboard and knee bolster
    g. Gearshift

h. Headliner
i. Pillars
j. Restraint system
k.

V. BICYCLE /PEDESTRIAN CRASH INVESTIGATIONS (60 Min)

A. Topic 5.0 Introduction
   1. Pedestrian and bicycle traffic crashes can be the most challenging types of investigations we face. Hard evidence can be difficult to find, and in many cases very subtle in nature
B. Determining the Area of Impact
   1. Tire marks
      a. May show slight over deflection of a front tire at maximum engagement if the pedestrian's or rider's weight is added to the vehicle hood in the area immediately over one of the front wheels
      b. Variances in tire marks will be dependent upon
         1) The relative weights of the vehicle and pedestrian
         2) The heights of the center of mass of the vehicle and pedestrian
         3) The location of the application of downward force during the crash phase

      c. Bicycle tires may leave crash scrub marks at the area of impact
   2. Marks from the pedestrian or rider
      a. Shoe marks (heel or sole scuffs, polish transfer) on roadway or vehicle
      b. Clothing marks on road surface or on vehicle
      c. Blood stains, pooling around "at rest" position; or spattering upon impact
   3. Metal scars – scrapes or scratches from post-impact movement of a bicycle, skateboard, stroller, etc.
   4. Debris
      a. Debris cone will usually lead back toward the area of impact
      b. Debris may adhere to underbody of striking vehicle
      c. Lighter articles such as hats and glasses may remain at the area of impact if no direct contact is made between the article and the striking vehicle
C. Crash sequence overview
   1. Understanding the interaction between the vehicle and pedestrian during the crash phase of the nine-cell matrix may help the investigator understand the sequence of events which led up to the crash, establish an area of impact and determine what actions the pedestrian or driver may have taken prior to the impact. Consideration must be given to:
      a. **How** and **where** did the pedestrian enter the roadway (pre-crash phase of the nine-cell matrix

b. The **location** of the impact and the **angular relationship** between the vehicle and the pedestrian at first contact (crash phase of the nine-cell matrix

2. Understanding the impact alignment between the vehicle and the pedestrian involved in the crash usually relates back to **where** and **how** the pedestrian entered the roadway and the **location** the impact occurred. It also dictates to some degree where the pedestrian's body will move after its last contact with the vehicle. This also applies to both **where** and **how** the body will move on the striking vehicle as well as back onto the roadway (post-crash phase of the nine-cell matrix
3. The four steps
    a. First contact
    b. Acceleration of the pedestrian's body
    c. Movement upon the vehicle
    d. Movement onto and upon the ground

D. Pedestrian impact classifications
1. Wrap trajectory
    a. Pedestrian is "ladled" or "scooped" onto the vehicle hood
    b. As the vehicle begins to decelerate, the pedestrian slides off the hood and is overrun by the vehicle
    c. Usually lower profile vehicles
    d. Most common type of trajectory

E. Fender vault
1. The momentum of the pedestrian is a factor
2. The pedestrian moves diagonally across the hood of the vehicle
3. Impact force is applied below the pedestrian's center of mass

F. Forward projection
1. Usually involves high profile vehicles
2. Pedestrian is immediately accelerated upon impact
3. Impact force applied through the pedestrian's center of mass
4. Most common trajectory for children

G. Somersault trajectory
1. Striking vehicle is usually braking
2. Impact force applied below the pedestrian's center of mass
3. Least common trajectory

H. Roof vault
1. Striking vehicle accelerating through impact with post impact braking
2. Impact force applied below the pedestrian's center of mass

I. Physical Evidence
1. From the scene
    a. Tire marks, including pre- ***and post-impact***
    b. Blood stains, pooling and splattering
    c. The measured distance from the initial contact to the pedestrian's "at rest" position
    d. If the initial AOI cannot be determined, the measured distance from first contact with the ground to the pedestrian's "at rest" position

e. Debris cone or items of clothing at or near the area of impact, including any packages, shopping bags, hats, or glasses
f. The approximate location where the pedestrian entered the roadway
g. Document and photograph the evidence!

2. From the vehicle
    a. The height (above ground level) of the leading edge of the vehicle
    b. The highest major contact point (above ground level) between the pedestrian and the vehicle
    c. The height (above ground level) of the front bumper
    d. Clothing and tissue from undercarriage
    e. Clothing imprints in paint
    f. Hair or clothing embedded in glass
    g. ***Document and Photograph the evidence!***
3. From the pedestrian
    a. The height of the pedestrian, or the height to the center of the abdomen if possible
    b. Detailed documentation of the injuries
    c. Paint or oil and grease transfer to clothing

VI. MOTORCYCLE CRASHES (90 Min)

A. Topic 6.0 Introduction
1. Though motorcycle crashes produce many of the same types of physical evidence as motor vehicle crashes, the characteristics as seen on the roadway are unique. These differences are due to tire construction and the fact that a motorcycle is an articulated vehicle. An articulated vehicle is a vehicle that is “hinged”, such as an eighteen-wheeler

2. Gyroscopic effect
    a. High side – Occurs as, while skidding, the rear of the motorcycle comes around toward the front and the rider releases the brakes. The motorcycle tires regain traction in the way of rolling friction which causes the motorcycle to upright itself quickly, vaulting the rider off the motorcycle in the original direction of the skid. This is a **very** violent event
    b. Low side – Occurs when the rider locks the rear wheel with braking. The rear of the motorcycle starts to come around towards the front of the motorcycle and the rider lays the motorcycle over with a slight steering input. The motorcycle is “laid over” or “laid down” on its side opposite the direction of travel. This is a gentle event

B. Pre-crash physical evidence
1. Rear tire hooked skid - When the rear of the motorcycle comes around as a result of over-application of the rear brake
    a. The motorcycle rider has failed to keep the motorcycle going straight due to a combination of steering and leaning

   b. When the wheel stops rotating, the tire has 100% slip relative to the road surface. At this point, the rear tire of the motorcycle loses stability
   c. If the rear of the motorcycle comes around substantially, and the motorcycle is still in motion, the motorcycle will straighten up so rapidly that the operator will be thrown off the motorcycle, high-siding
   d. After “high-siding”, the motorcycle is overturned onto the pavement with sufficient force to cause gouges in the surface. These gouges will usually be seen at some distance from the end of the tire mark. The distance will vary depending on the speed of the motorcycle

2. Rear tire weaved skid – When the rear tire has locked, and the motorcycle has continued in a relatively straight line; the rear tire “weaves” from side to side, but never substantially comes around
   a. The tires track on more or less same line, even though only the rear tire is locked and marking the pavement
   b. The motorcycle operator has kept the motorcycle going relatively straight, even though the combination of steering and lean inputs is present
3. Straight skid – A straight, fairly long skid where the rear tire tracks in a straight line in relation to the front tire
4. Front tire skid – Normally a short mark due to an over application of the front brake
   a. A front tire skid will be darker than a rear tire skid, due to the fact that the motorcycle’s weight transfer during braking puts more load on the front tire
   b. The mark will also be straight and limited in length because the motorcycle will usually end up falling down
   c. The mark may also get wider near the end as the handlebars turn to one side and motorcycle is about to fall

C. Post-crash physical evidence
1. Gouges may be seen in the road surface
   a. Foot pegs
   b. Floor boards
   c. Handlebars
   d. Crash bars
2. Distinctive abrasion marks from steel, aluminum, rubber, plastic, and fiberglass parts can result from a motorcycle falling onto the pavement and sliding to its final area of rest
3. During the post-crash sequence, the motorcycle has the ability to slide rotationally around its Center of Mass (usually located approximately at the end of the crankshaft of the engine). This can cause the gouges and abrasion marks to arc or curve
4. During the impact phase, parts of the motorcycle may be broken or crushed, allowing fluids to escape and leave a path to the motorcycle’s area of rest
   a. Engine oil

  b. Transmission fluid
  c. Coolant

B. Physical evidence on the motorcycle
  1. Tire evidence
    a. Locked wheel tire evidence
    b. Rotating wheel
  2. Rim evidence
    a. A spoked rim will bend and conform to the shape of the object struck
    b. Side impacts to the wheels will result in the bending of the rim inward on the side that sustained the most force
    c. The edge of the rim may have scrapes indicating that it rotated against a curb. The sidewall of the tire will also have abrasions with a fine powder residue or dust if the curbing was built of concrete
  3. Front fork evidence
    a. In direct frontal impacts, the front forks will be evenly collapsed against the frame and/or exhaust pipes, depending on the crash speed
    b. In angled crashes, one fork tube will sustain more damage than the other as the tubes twist in the direction of force from the path of the opposing vehicle
  4. Handlebar evidence
    a. As the motorcycle handgrip or foot peg slides across the roadway, rubber is worn away on leading edge and built up on trailing edge
    b. Deformation of handlebars so that they continue to point in the direction of travel at impact, even though front wheel is deflected, may indicate that the rider was holding on as he was vaulted forward
  5. Fuel tank evidence
    a. A blunt appearing dent forward of the seat is usually caused by the groin of the rider as an impact takes place and momentum carries the rider forward
    b. There may also be blunt dents on the sides of the fuel tank from the rider's knees. Often a fabric impression or cloth transfer is found in these areas. A handlebar bent on one side may trap the rider's leg between itself and the fuel tank
    c. If one or both handlebars rotate back and contact the tank, the dent(s) will be much sharper, and deep scratching of the paint will occur from contact with the handgrip "Controls
  6. Engine and frame evidence
    a. Side casings made of softer metal will usually break away upon contact with the ground
    b. Engine guards designed to protect these parts will sustain scrapes and bend
    c. Crash bars, depending on the material thickness and number of fastening areas to the frame, may bend or collapse, or if rigid enough, bend the frame at their mounting points. These bars may also be the

cause of injury to the rider by trapping the foot or leg of the rider at impact

7. Rear swing arm assembly evidence
    a. Inspect the interior portion for rub marks which may indicate a loose rear wheel or oversize tire'
    b. There should be no lateral play in the bearings where the swing arm mounts to the frame
8. Rear shock absorbers, fender, and wheel evidence
    a. Rear shock absorbers will bend opposite to the direction of force. A gradual bend is usually caused by the rider's legs, while a sharper bend with scrapes on the shocks or springs indicated contact with a vehicle as the cause
    b. The rear wheel and swing arm assembly is very stiff and is not easily bent in rear end crashes
9. Lighting evidence
    a. Headlamp
    b. Brake and taillights

Day-2

VII. QUIZ (60 Min)

A. Quiz on Topic "I" to "VI" material

VIII. ANTI-LOCK BRAKING SYSTEM (ABS) (90 Min)

A. Topic 13.0 Introduction
    1. The purpose of this block of instruction is to assist the scene investigator in determining if there was a pre-existing mechanical problem with the braking system which may have contributed to the crash

B. ABS Information
    1. Anti-lock brakes are designed to allow threshold or maximum braking while maintaining steering control. This **does not** always result in the shortest stopping distance
    2. In testing completed by the Michigan State Police Traffic Crash Reconstruction Unit and the International Association of Accident Reconstruction Specialists, vehicles equipped with ABS were placed in hard cornering maneuvers while braking, and the results were not as expected
        a. The vehicles' stopping distances were between nineteen and seventy percent greater than those equipped with standard brakes
        b. In these instances, the increase in tire / roadway friction was allocated to cornering. This left little for the anti-lock sensors to detect to allow higher braking pressures without locking the wheels and losing steering control (skidding). Skidding front tires do not steer very well

C. ABS Terminology
   1. Microprocessor, also known as
      a. Computer
      b. ABS Module
      c. EBCM (Electronic Brake Control Module)
      d. CAB (Controller, Anti-Lock Brake)
      e. ECM (Electronic Control Module
   2. Wheel Speed Sensor; also known as
      a. Sensor
      b. ABS Brake Sensor
      c. Speed Sensor
      d. VSS (Vehicle Speed Sensor – located in the transmission
      e. WSS (Wheel Speed Sensor)
   3. Hydraulic Unit; also known as
      a. BPMV (Brake Pressure Modulator Valve)
      b. Control Valve
      c. EHCU (Electro-Hydraulic Control Unit
   4. ABS Warning Light
      a. Amber
      b. Should illuminate for approximately 10 seconds when the ignition switch turned switch is turned to the “run” position
      c. If the amber ABS light **is still illuminated after ten seconds, or is flashing, *<u>there is a malfunction in the ABS</u>*** system. Have the vehicle checked immediately
   5. Brake Warning Light
      a. Red
      b. Should illuminate for approximately 10 seconds when the ignition switch is turned to the “run” position
      c. Will also illuminates under various conditions

D. How ABS functions
   1. On any brake application
      a. The brake lamp switch awakens the ABS computer, telling it to be ready in case ABS control is needed
      b. As the brake pedal is pushed to the floor, the speed sensors are monitoring the rotation of the wheels
   2. If ABS is needed
      a. As the wheels approach lock-up, the brake pedal will sink slightly and vibrate or pulsate
      b. The hydraulic unit pumps the brakes between seven and twenty times per second to keep the wheels from locking in order to maintain steering control

E. If the system is incorrectly used or malfunctions
   1. Pumping the brakes takes up time and roadway, thus extending stopping distance. If the ABS is activated, the system is already pumping the brakes

        a. Manually pumping the brakes confuses the controller, and it may turn off the ABS
        b. The controller is designed to fail to a safe non-ABS mode (normal brakes). In this momentary condition, the amber ABS light may turn on and then reset
    2. If the ABS malfunctions, it is designed to fail safe to non-ABS mode (normal braking)

F. Driver complaints about vehicles with ABS and possible solutions. The most frequent alleged malfunction at T/C systems is "My brakes failed"
    1. "The brakes didn't lock up" – This is correct for an ABS equipped vehicle. Ask if the brake pedal pulsated or vibrated
    2. "The brake pedal went to the floor" – check it. Does it go to the floor? If so:
        a. Check the master cylinder
        b. Is the amber ABS light on?
        c. Is the red brake warning light on?
    3. "My brakes locked" – check if the amber ABS light is on. If it is, then the vehicle has normal service brakes
    4. "My car skidded"
        a. What is the roadway surface?
        b. Was the vehicle turning to avoid an impact?
        c. Did the driver try to turn at too high a speed and slide in a yaw configuration?
        d. ABS vehicles ***are not*** immune to the laws of physics
    5. "My truck (or van) locked the front brakes"
        a. Check the type of ABS system. Is it 2 or 4-wheel
        b. The vehicle could have either one
    6. "My brakes didn't respond"
        a. How fast was the vehicle going?
        b. Did the ABS come on?
        c. Is the amber ABS lamp on?
        d. Were the brakes overheated?

G. Brake Inspection Requests
    1. If there is a mechanical complaint or if verification of proper working order of a vehicle is needed, request a "Safety Inspection" through Motor Transport Division. The phone number is (213) 485-3495, and they are located at Piper Tech garage. They will forward the request to the proper garage for inspection
    2. Items the inspector will need are
        a. DR number
        b. A copy of the crash report
        c. Motor Transport Division Safety Inspection Request"

H. Other alleged malfunctions – the second most frequent alleged vehicle malfunction is "The car jumped out of 'Park'" and rolled into an object
    1. A vehicle must be traveling at less than one mile per hour to have the parking pawl lock the vehicle into "Park"

2. If a vehicle is in “Reverse” and the transmission is slammed into “Park” while still moving, the gear on the outer case of the transmission will break

IX. ADVANCED DIAGRAMMING (330 Min)

1230-1330 Lunch

A. Topic 7.0 Introduction
   1. Intersections are often not all comprised of 90-degree angled streets. Therefore, learning how to diagram these complex intersections is critical for the crash investigator

B. Intercept angles
   1. At any other than 90-degree intersection, there are a series of measurements which must be obtained to draw the intersection on a scale diagram
      a. Remember, the measurements taken at the intersection must be taken from the intercept points **to any distance the investigator chooses**, as long as they are **outside the break points** (where the straight and curved portions of the corners meet
      b. The measurements which must be obtained are: (see diagram)

Note: for this illustration, we’ll use:
A – B = 36’
A – C = 36’
B – C = 50’

1) A – B

2) A – C

3) B – C

      c. The A – B and A – C measurements **are controlled by the investigator in the field** and can be **any measurement as long as they extend past the break points**
      d. The B – C measurement cannot be controlled by the investigator, and is dependent on the angle of the intersection
   2. To draw this intercept angle to scale, follow this simple process: (see diagram)
      a. Draw a horizontal line
      b. Mark an “A” on the line
      c. With a compass, place the pivot on “A”. Scribe the 36’ arc, establishing the “B” and the approximate location of “C”
      d. Beginning at point “B”, strike a 50’ arc that intersects with the first arc. This establishes point “C”
      e. Using the template, draw a line from point “A” through point “C”
   3. This process works for **any** angles that may be encountered in the field

C. Practical application
   1. Using a sidewalk or street curb conduct a live demonstration of this method

D. Radius of a corner
   1. Definitions
      a. Radius – The distance from the center to the outside of a circle
      b. Chord – A straight line joining two points on a circle

c. Middle ordinate (aka "mid-ordinate") – The **perpendicular** distance between an arc and its chord, measured from the **middle** of the chord

2. Each corner of an intersection is a part of a circle. In order to obtain the radius of any corner, do the following: (see diagram)
   a. Strike a chord across the curved portion of the corner, **in between the break points**. For ease of calculation, use an even measurement for the chord, i.e., 10', 12' 15', etc.
   b. Obtain a mid-ordinate by measuring from the middle of the chord to the outer edge of the curb, at a 90^o angle
   c. Record both the chord length and the mid-ordinate distance
3. By using the following formula, calculate the radius of the curve

$$R = \frac{C^2}{8m} + \frac{m}{2}$$

Where:
R = Radius
C = Chord
m = mid-ordinate
8 = a constant value
2 = a constant value

NOTE: Both the chord and mid-ordinate **must** be in the same units (feet). In order to convert inches to feet, divide the number of inches by 12

Example: C = 20' and m = 24"

24" / 12 = 2'

$$R = \frac{C^2}{8m} + \frac{m}{2}$$

$$R = \frac{20^2}{8(2)} + \frac{2}{2}$$

$$R = \frac{400}{16} + \frac{2}{2}$$

$$R = 25 + 1$$

$$R = 26'$$

E. Practice problems
1. Given: C = 20' and m = 25"
2. Given: C = 20' and m = 46"

3. Given: C = 20’ and m = 17”
    a. Allow students to work the math problems, then review with them.
    b. Use Dry erase board to write out math

F. How to locate the pivot point to draw the radius to scale
1. Calculate the radius based on the chord and mid-ordinate
2. When using a template
    a. Draw a horizontal line parallel to and inside the curb line, at a distance from the curb equal to the radius in feet
    b. Repeat step #1 and draw a vertical line parallel to the other curb line
    c. Place the pivot point of the template where the two lines intersect
    d. Find the distance in feet of the radius and scribe the radius
3. When using a compass
    a. After calculating the radius, adjust the compass to the correct scale distance (of the radius in feet) using the template
    b. Using the template as a straightedge along the curb line, place the pivot of the compass along the template edge and scribe a line parallel to the curb line
    c. Repeat step #2 along the other curb line
    d. Place the pivot of the compass at the intercept of the two lines and scribe in the arc of the corner

G. Practical Application
1. Hand out blank paper
2. Walk through with students how to begin the diagram
3. Complete diagram on dry erase board as students completes it on blank paper

H. Using the two diagrams already completed for the approach angle portion of the class (the previous practical application), practice finding the pivot point for the compass using the radii calculated in the practice problems

I. Triangulation
1. Many crashes occur on roadways that do not continue directly across from each other, or include the offset of a third street, intercepting at an angle

2. In order to draw these types of roadways on a scale diagram, triangulation must be used in order to place the streets in their proper configuration to each other
    a. <u>Triangulation</u> – a geometric function for finding a position or location from two fixed points which are a known distance apart.
    b. With the use of a series of triangles, we can place the position of an intercept point of one of the corners at an offset and angle the intersection properly. The best place to start is <u>**always**</u> on one of the corners that intercept at 90 degrees!

    Note: See diagram

    c. With these measurements and the use of a compass, after establishing the south side of the intersection (the easiest, because it intercepts at 90 degrees), we scribe two arcs to establish the northwest intercept point

d. This intercept point can now be used to begin drawing the angle of the street with the A – B, A – C, and B – C measurements taken in the field. After the angle is created, the rest of the north leg can be drawn using the width of the street.

Note: The street width **<u>must be measured at 90 degrees</u>** to the curb lines

e. The last step is to draw in the radii of the curbs using the chord and mid-ordinate measurements taken at the scene

f. This method of triangulation will work at **<u>any</u>** complex intersection, no matter how many streets are intersecting

J. Practical Application
   1. Using student manual complete the triangulation exercise

K. Triangulation of curved roadways (see diagram)
   1. Triangulation can also be used to draw a curved roadway where the radius is not constant
   2. A series of triangles is used to establish points along the curvature which can be duplicated on paper and connected with the use of flex curves or a French Curve
   3. The process begins with identifying the intercept points at the intersection
   4. Using a tape measure 25’ from the breakpoint on the <u>curb line with the smaller radius</u>. From there, measure in increments of 50’ around the curve. These measurements **<u>must not follow the curvature</u>** of the roadway. Mark these points with chalk on the curb face.
   5. On the other side of the street, measure in increments of 50’ around the curve. Skip the 25’ first step to create the offset needed. Mark these points on the curb face as well
   6. The first measurement taken across the street is the street width between the intercept points at the intersection. We will call these points “A” and “B”. These points will create the base for the first two (and the two most important, because all the other measurements will be taken from these; remember “snowball effect”), establishing points “C” and “D”
   7. Once these two initial triangles have been measured, continue up the street diagonally, measuring between each point; e.g. “D” to “E”, “E” to “F”, “F” to “G”, etc

      NOTE: Some find it easier to call one side of the street “A” and the other side “B”; and then the points going up the “A” side are designated "A_0","A_1","A_2", etc. The same is then done with the “B” side

L. In order to take the scene measurements and use them to draw the curved roadway on a scale diagram, follow this process: (see diagrams)

1. Establish the base curb line of the intersection and establish points “A” and “B” on it. **It’s important to look at the configuration of the curvature in order to place the base to where the curvature will fit on the paper**
2. With a compass, establish point “C” by placing the pivot on point “A” and scribing an arc 25’ from it. Open the compass to the B – C measurement. Place the pivot point on point “B” and scribe a second arc where it crosses the first. This establishes the exact location of point “C”
3. To establish point “D”, place the pivot of the compass on point “B” and draw an arc 50’ from it in the approximate location of point “D”. Open the compass to the A – D measurement. Place the pivot on point “A” and scribe a second arc where it crosses the first
4. Once the two base triangles have been established, the process continues diagonally until all the points have been plotted
5. Using a French Curve or flex ruler, connect the points, completing the curb lines
6. With the curb lines drawn, calculate the radii of the corners and draw them in to scale to complete the diagram

M. Practical Application
   1. Complete triangulation exercise in student manual
   2. Hand out field sketch (See student manual), and have the class work through the steps to place the curved street to scale

N. Triangulation can also be used to document evidence or other items located at a crash scene
   1. The use of reference points (RP) established by fixed objects at the scene or the intercept points of the prolongation of curb lines is recommended.
   2. At complex scenes such as those on curved roadways, the use of reference point triangulation can simplify the evidence documentation process
   3. The integral part of this process is properly locating the reference points so that when the evidence is plotted on a scale diagram, it will be in its true location
   4. In the above example (see lesson plan), the AOI would be documented as: 50’ N/E of RP #1 and 48’ S/E of RP #2
   5. To plot this AOI on the scale diagram, use a compass and draw two arcs, the scale distance from each reference point. Where the two arcs cross is the AOI
   6. This method can be continued to document anything involved in the crash scene; including the start and end points of tire marks, gouges, scrapes, blood pools, etc

O. Practical Application
   1. Hand out the “Triangulation for Documentation of Evidence” project to the class and have them plot each point on the diagram

P. Baselines and offsets
   1. The use of baselines and offsets has many applications when completing scale diagrams

a. When establishing the baseline, in essence we are creating a coordinate system with "X" and a "Y" axis. This is especially helpful when using a Computer Aided Drafting (CAD) program to complete the diagram
b. The system may also be used to document and draw curved or irregular portions of a roadway. This application will be briefly discussed here

2. When establishing the baseline, an origin point must be chosen. Place the origin at the intercept point of one of the corners of the intersection. Run the baseline at 90^o to the base curb line (see diagram)
3. After the baseline is established, measure at 90^o from the baseline to the curb face. The increments chosen to be measured will be determined by the curvature of the roadway. **For accuracy, the sharper the curve, the smaller the increments.**
4. With these measurements, the process to draw the curve on a scale diagram is as follows:
    a. Establish the base curb line that the baseline will originate from at 90^o
    b. Begin to plot the offset points by measuring the offset distance at 90^o to the baseline. When all the points are established, use a French Curve or a flex ruler to draw in the curvature of the curb line
    c. With the curb lines drawn, calculate the radius of the corners and draw them in to scale on the diagram

B. Practical Application
1. Hand out the field sketch and have the class work through the steps to place the irregular roadway to scale
2. Review with class

Day-3

X. DIAGRAMMING FIELD EXERCISE (480 Min)

A. Field exercise on advanced Diagramming
1. Safety Permit obtained for field exercise
2. Practical exercise involving:
    a. Base line
    b. Offsets
    c. Triangulation

B. Students will complete two scale diagrams of two complex intersections
1. Each diagram will be submitted and reviewed by instructor cadre

Day-4

XI. TIRE COMPONENTS AND TERMINOLOGY (60 Min)

A. Topic 8.0.1 Introduction
   1. Tire inspection, in many cases, can be the most complicated task that the traffic crash investigator must complete

B. Tire components
   1. Bead
      a. That portion of the tire that contacts the wheel (rim)
      b. The bead also seals the air inside a tubeless tire

   2. Sidewall
      a. That portion of the tire which is in between the bead and the shoulder
      b. The sidewall supports the weight of the vehicle
   3. Shoulder
      a. That portion of the tire which is in between the sidewall and the tread
   4. Tread
      a. That portion of the tire which makes contact with the roadway surface
      b. The tread has three parts:
         1) Pattern grooves
         2) Pattern ribs
         3) Sipes

C. Tire failures
   1. Cuts and penetrations
      a. Two of the three most common tire failures
      b. Often caused by bodywork slicing into the tire
      c. Can arise from contact with objects left in the roadway
   2. Concussion damage
      a. Third of the three most common tire failures
      b. Typified by an **X** or **Y** shape or a single diagonal split
      c. This type of damage is caused with an inflated tire
      d. A deflated tire will cause bruising or cutting of the sidewall
   3. Deflation damage
      a. Commonly encountered in crashes
      b. Separation of tread and sidewall is due to overheating from deflated running
      c. Modern tubeless tires are very tolerant of under inflation
   4. Tow damage
      a. An understandable feature of a recovered vehicle
      b. Tire pinned by crash damage
      c. Axle locked by damaged transmission

   5. Dislodgement – may be caused by:
      a. Very high side forces
      b. Moderate side forces with under inflation

        c. Partial loss of pressure is characteristic of tubeless tires during a crash
    6. Lumps and bulges
        a. A bulge in the tread region will cause a patch of uneven wear
        b. A lump in the sidewall region will cause chafing and frayed plies
    7. Bead breakage – a tire mounting problem
        a. 185HR 14 tire mounted on a 15" wheel
        b. A lack of adequate lubricant when mounting a tire
    8. Valves
        a. Valve core can leak for two reasons:
            1) Rubber seal indents and air seeps
            2) Small grit embedded in seal
    9. Fitment
        a. Tires are too large and contact body work
        b. Tires are too small and are overloaded
        c. Wrong tire for environmental application
    10. Aquaplaning
        a. A condition where the tire loses all contact with the road surface due to the formation of a wedge of water which forces itself between the tire and the road
        b. Conditions needed:
            1) Heavy rain
            2) Smooth tires
            3) Badly drained road
            4) Speed of 50+ mph
        c. Results of aquaplaning:
            1) Inability to negotiate a curve
            2) Loss of control during an overtaking maneuver
        d. The application of brakes can cause loss of contact with the road surface
        e. Control is not regained until a low speed is reached
D. Skidding
    1. A common occurrence that takes place under most conditions when the tire remains in contact with the road
    2. A skidding tire will leave a telltale mark on the road, but an aquaplaning tire will **not** leave a mark
E. Tire inspection
    1. Make at-scene notes of the tire & wheel assemblies when the following are observed:
        a. The tire is flat
        b. There is a visible hole in the tire
        c. Either bead is unseated from the rim
        d. A rim is bent
        e. The wheel / tire is pinned by damage
        f. Note the affected tire's position on the vehicle

2. If all tires are inflated after the crash, no further inspection is required
3. A need for additional at-scene investigation related to tires:
    a. A wheel is detached from the vehicle
    b. Pieces of a tire or wheel have come off
    c. An allegation of a tire causing loss of control

F. Tire and wheel removal
1. If a tire is to be examined later, have the tow operator remove the tire & wheel assembly **before** towing the vehicle
2. Towing the vehicle can further destroy the tire & wheel as evidence
3. Documentation of tire & wheel removal
    a. Who removed the tire & wheel from the vehicle
    b. Who booked them as evidence
    c. Where they were booked
    d. Who inspected them
    e. Do **NOT** perform any destructive testing
    f. Get a written record of any inspection, prepared by an expert

XII. EVIDENCE FROM VEHICLES (270 Min)

A. Topic 8.0 Introduction
1. The second portion of the nine-cell matrix involves
    a. factors relating to vehicles involved in the crash. Evidence
    b. gathering at the scene of a crash is an enormous task. The
    c. scene investigator must make a determination as to which
    d. evidence to collect immediately, and which evidence will remain
    e. uncontaminated, enabling it to be collected at a later date.

B. Vehicle factors
1. Pre-crash
    a. Braking and steering performance
    b. Vision obstructions
    c. Angle of approach
2. Crash
    a. Initial contact point
    b. Angle at impact
    c. Damage
3. Post-crash
    a. Angle of departure
    b. Secondary impact
    c. Additional crashes with objects, pedestrians, or vehicles
    d. Final rest positions
        1) Controlled
        2) Uncontrolled

C. Preliminary Vehicle Damage Inspection Log
1. It is suggested to conduct a general vehicle inspection in the field at the time of the initial investigation

a. Areas to inspect:
    1) Damage areas
    2) Tires
    3) Restraint system
    4) Vehicle interior

D. Evidence from vehicles
1. Exterior evidence
    a. Contact damage area
    b. Induced damage area
    c. Glass examination
    d. Lamp examination
    e. Paint analysis
    f. Pedestrian crash evidence
2. Interior evidence
    a. Restraint devices
    b. Seats
    c. Speedometer readings
3. Brakes
    a. ***<u>DO NOT step on brake pedal!</u>***
    b. If brake failure is alleged, document in “Remarks”
    c. For major T/Cs, hold for Motor Transport Division
4. Other evidence
    a. Correlate damage to injuries
    b. Light switch position
    c. Radio volume level
    d. Tinted windows
    e. Alcoholic beverage containers

E. Induced damage area
1. Damage to the vehicle other that the damage within the contact damage area
2. This is caused by the shock of the crash
3. Substantiate the Primary Crash Factor

F. Types of glass/plastic
1. Headlight
2. Directional
3. Tail light
4. Windshield

    a. Glass is laminated to prevent shattering
    b. Windshields may contain evidence
        1) Blood
        2) Hair
        3) Skin
5. Side window

G. Lamp Examination
1. Examination will help the investigator establish whether lamps were on or off at the time of impact

2. Basic Lamp Structure
    a. Base and posts
    b. Filament support posts
    c. Filament
        1) Coiled tungsten
        2) Brittle when cold
        3) Pliable when heated
    d. Envelope
    e. Oxygen is removed and replaced with inert gas (nitrogen)
3. The normal lamp
    a. Clear and uncracked envelope
    b. Filament shiny with uniform spacing coils
4. Burnout under normal conditions
    a. Occurs a thin point on filament at 6100 degrees F
    b. Darkened envelope
5. Burnout under impact conditions
    a. The lamp must be in or near the contact damage
    b. Hot Shock
        1) Newtons first law of motion causes filament to stretch due to being heated and pliable
        2) When envelope breaks, small pieces of glass will melt onto the filament and a white powders substance called Tungsten Oxide will be present due to the introduction of oxygen.
    c. Cold Shock
        1) Filament breaks due to rigid qualities of the cold metal
6. Areas of caution
    a. DO NOT step on break pedal to test lamps
        1) If the lenses is cracked, the introduction of oxygen will destroy the evidence
    b. Age sag
        1) Filament will sag due to use
        2) The coil will remain uniform

H. Paint Analysis
1. Paint chemistry
    a. Paint contains unique properties and characteristics
2. What analysis of paint samples yields
    a. Physical microscopic features
    b. Gross color (surface color)
    c. Surface characteristics
    d. Layers
3. Identification of unknow vehicle by paint analysis
    a. The National Bureau of Standards maintains a color reference guide of automobile finishes.
    b. This guide was first published in 1974 and it updated annually

I. Exterior evidence from pedestrian crashes
1. Evidence may be subtle

2. Documentation is essential
    a. Displacement of dust/dirt
    b. The angle of the displacement
3. Fabric imprints
4. Blood, hair, tissue may be present on the vehicle

J. Interior evidence
1. Restraint devices
    a. Seatbelts
        1) Document if seat retractor is locked or not
    b. Airbags
        1) Document the deployment of them
        2) Use caution around airbags that did not deploy
2. Seats
    a. Seat position
3. Speedometer reading
    a. If analog speedometer, needle may be stuck at speed prior to crash
4. Brakes
    a. If brake failure is alleged, document this in the “remarks” section of the report
    b. If involved in a City Property Involved crash, severe or fatal crash, impound vehicle and hold for Motor Transport Division for an inspection
5. Steering wheel
    a. Deformed
    b. Airbag evidence
6. Other things to consider
    a. Volume of radio
    b. Window tint, possible vision obstruction
    c. Evidence of alcoholic beverages or drug paraphernalia

K. Practical exercise
1. Hand out “Preliminary Vehicle Damage Inspection Log”

XIII. VEHICLE INSPECTION FIELD EXERCISE (150 Min)

A. Field exercise at tow/impound yard
1. Safety Permit obtained for field exercise
2. Practical exercise involving:
    a. Damage analysis
    b. Seatbelt analysis
    c. Airbag analysis
    d. Headlamp and taillamp light assembly analysis
    e. Tire analysis

B. Review of inspection report

C. Students will complete two inspections of two vehicles

1. Each inspection will be submitted and reviewed by instructor cadre

Day-5

XIV. HUMAN FACTORS AND INTERVIEWING (60 Min)

A. Topic 10.0 Introduction
   1. The "Human Factors" portion of the nine-cell matric is the most complicated and possibly the most important part of any thorough investigation
B. Human Factors are the most neglected and overlooked portion of an investigation
   1. The human elements that should be examined are
      a. Pre – crash
         1) Perception / Reaction time
         2) Perception / Reaction distance
         3) Driver's, witness', or passenger's physical and mental condition
      b. Crash
         1) Occupant kinematics
         2) Injuries sustained during impact
      c. Post – crash
         1) Additional injuries
         2) Controlled final rest position may show no loss of mental faculties due to crash
   2. Perception / Reaction
      a. May be influenced by various factors
         1) Age
         2) Physical condition
         3) Strength of stimulus
         4) Habits
      b. Processing and acting upon information
         1) The majority of information is received visually
         2) Most believe that visual information processing consists of two-steps:
            a) Detection
            b) Response
      c. This is too simplistic
         1) "Detection" implies nothing more than conscious awareness that something is present
         2) A driver needs more information to reach a decision about an appropriate response

      d. The nature of information processing is more accurately described as a four-step model first written by Alexander and Lunenfield in 1975[1]:

[1] Gerson J. Alexander and Harold Lunenfeld. (1975) *Positive Guidance in Traffic Control.* US Department of Transportation

1) Detection
2) Identification
3) Decision
4) Response

e. Confusion factors between the “simplistic” approach and the four-step model
   1) People use “detection” to mean “detection – identification”
   2) They’re not the same. Identification cannot occur without detection, but it is entirely possible to detect but fail to identify properly. The latter can have catastrophic consequences

f. An appropriate decision depends on proper identification of the stimulus

g. There are four types of reactions:
   1) Reflex
   2) Simple
   3) Complex
   4) Discriminative

4. Physical and mental condition
   a. Natural abilities are the foundation that driving capabilities are built upon. Deficient natural abilities may be the cause of traffic crashes in some cases. Some of those deficiencies are
   b. Physical conditions
   c. Mental conditions

B. Interviewing

Why should the crash investigator get statements?

a. Statements create a more complete account of the occurrence for reporting purposes
b. Many wits can only recount a part of the event, but by combining these a more complete picture may be obtained
c. The lack of knowledge of a participant is important to document to prevent addition of information at a later date

5. How should statements be recorded?
   a. The written record is of the observations of the individual on the date of the crash. It will be difficult for any changes to occur in the future
   b. The document may be used as a means of recall for the individual at a later time (e.g.; in court)
   c. The document may be used in the evaluation of the person or the case
   d. The document may be used against a defendant, especially a signed statement
   e. Use Body Worn Video and upload to evidence.com

6. What kind of statements?

   a. In a report requiring a sketch, paraphrased statements are acceptable

b. In a report requiring a scale diagram, verbatim statements are required

7. Who should be interviewed?
   a. Drivers
   b. Passengers
   c. Witnesses
8. Principles of getting information
   a. Be objective
   b. Be positive
   c. Be specific
   d. Don't suggest answers
      1) Ask open ended questions
   e. Avoid conflict
   f. Be adaptable
   g. Verify statements
   h. Be diplomatic and understanding
   i. Don't embarrass people
9. Interview order
   a. Witnesses
   b. Parties
   c. Passengers
10. Interview vs Interrogation
    a. Interviewing is information gathering, and is non-accusatory
    b. Interrogation is accusatory questioning and is used to obtain admissions
11. What should the interview include?
    a. A series of questions designed to help the investigator complete a thorough interview and an all-encompassing investigation
    b. Don't tip off the interviewee that he/she may have made an important statement
12. The behavioral profile of a liar

    a. Behavioral patterns exist, but must be recognized
    b. The evaluation must be based on an overall pattern displayed, not just a single observation of activity
    c. Significant posture changes and gestures
    d. Eye contact
    e. Verbal behavior

XV. VEHICLE CODE AND LAW UPDATE (90 Min)

A. Topic 11.0 Introduction

1. The crash investigator must have a working knowledge of the crimes that he / she may encounter in the field. This class identifies the major crimes seen at

traffic crashes, and will assist the investigator with the information that he / she needs to gather at the scene for successful prosecution

B. Murder / manslaughter

1. Definition of manslaughter
2. Types of manslaughter

    a. Voluntary
    b. Involuntary
    c. Vehicular manslaughter with gross negligence – no alcohol or drugs
    d. Gross vehicular manslaughter while intoxicated
    e. Felony ("Watson") Murder

3. Definition of ordinary negligence

4. Definition of gross negligence

5. The "Basic Speed Law" as it relates to manslaughter

6. "Prima facie" speed limits as they relate to manslaughter

C. Murder and manslaughter distinguished

1. Primary cases
    a. Mercer vs DMV, 53 Cal.3d 753 (1991)
    b. People vs Garcia, 214 Cal.App.3d Supp. 1,5

D. Other case law

1. People vs Hernandez, 219 Cal.App.3d.1177

2. People vs Wilson, 176 Cal.App.3d Supp 1

3. Henslee vs DMV, 168 Cal.App.3d 455

4. Music vs DMV, 221 Cal.App.3d 841

5. People vs Engleman, 116 Cal.App.3d Supp. 14

6. People vs Thompson, 43 Cal.Rptr.3d 750

E. Intoxication

1. Felony DUI

2. Felony driving with .08% BAC

3. Inference of intoxication

4. Commercial drivers

5. Alcoholic beverage defined

6. Felony prosecution for .08% BAC

7. Misdemeanor DUI

8. Refusal to take SFST

9. Law regarding choice of chemical tests

10. Forced blood samples

F. Hit and run

1. Felony hit and run

   a. Elements
   b. Providing proof of financial responsibility

2. Failure to stop

   a. Driver disabled or rendered unconscious
   b. Driver's duty not affected by blame for crash
   c. "Immediately stop" defined
   d. Duties the same whoever injured
   e. Duties of non-driving owner

3. Misdemeanor hit and run
   a. Elements

G. Search and seizure

1. Search and seizure as it applies to the traffic function

2. Types of searches

   a. Plain view doctrine
   b. Automobile exception

c. Inventory search
d. Consent search
   1) Written vs Verbal

XVI. TIRE MARK IDENTIFICATION REVIEW (120 Min)

A. Topic 12.0 Introduction

1. Tire mark identification may be the most important skill a crash investigator must poses. Tire marks tell the tale of the sequence of events leading up to, during, and after the crash sequence

B. Types of tire marks

1. Locked wheel (includes impending skids)

   a. Pre – impact
   b. Post – impact

2. Scrub

   a. Always post – impact
   b. From a tire being pushed sideways

3. Prints / Imprints

   a. From moving tires in soft stuff
   b. Usually will throw soft material to the sides with directionality

4. Yaw marks

   a. Also known as centrifugal tire marks
   b. Always pre – impact

5. ABS marks

   a. Look like impending skid marks
   b. Caused by computer “pumping” brakes

6. Acceleration marks

C. Uses of tire marks:

1. Indicate the movement of the tire on the road before, during, and after impact
2. Fix a vehicle’s location at the time of impact
3. Obtain approach and departure angles for reconstructing the crash

4. In some cases, calculate a minimum speed for the vehicle

D. Causes of tire marks

1. When a tire is no longer free to roll, heat builds up between the roadway and the tire's surface

    a. On asphalt roadways this causes tar to come to the surface

2. Tire marks are harder to see on old, well-traveled roadways or on surfaces such as Portland cement. Marks on these are rubber from the tire. They tend to be much lighter and dissipate quickly

E. Characteristics of tire marks

1. Locked wheel tire marks are caused when a tire is no longer free to roll, either due to braking or damage, and the tire is sliding across the roadway surface

    a. The contrast between the right side and left side tires is generally equal in darkness
    b. The start of the tire marks is light and may include impending marks. The right and left sides end abruptly and directly across from one another
    c. The striations are ***parallel*** to the edges of the mark
    d. Front vs rear
    e. The width of the tire mark will be the same as the width of the tire

2. Scrub marks are caused when a tire is sliding sideways across the roadway surface due to the impact

    a. The width and darkness of the mark can vary
    b. Generally, there will be no striations

3. Prints can be left in various ways

    a. As a tire rolls through loose material, it will leave its tread print in the material
    b. As it rolls through loose material, material adheres to the tire face and fills the treads. As it rolls back onto a roadway, the material is deposited on the roadway and leaves a "print" of the tread

4. Yaw marks are caused as a rotating tire is side slipping across the surface of a roadway due to a high-speed turning movement

    a. The mark will have a dark and uniform outside edge, while the inside varies in width and darkness

b. The striations will be ***<u>near perpendicular</u>*** to the outside edge of the mark
c. Evidence that the rear tire is tracking to the outside of the front tire ***<u>must</u>*** be present

5. ABS marks are caused by the ABS computer effectively “pumping” the brakes many times per second

   a. The marks are very light and may be hard to see in dim lighting
   b. The striations are ***<u>parallel</u>*** to the outside edges of the mark
   c. The marks may resemble “gap skids”
   d. The marks may dissipate very quickly due to weather and traffic conditions
   e. When there is steering input by the driver, the tire marks left by ABS are unique insofar as they may be different types of marks. On an ABS vehicle, each wheel has an individual sensor. This may cause one tire to leave a locked wheel mark while another leaves a mark exhibiting the characteristics of a yaw mark

6. Acceleration marks are caused by a driver feeding more power to a wheel than it can apply to motion; the tire slips against the roadway

   a. The marks may be from one or both drive wheels, depending on the drive system the vehicle has
   b. The marks will begin abruptly
   c. The tire may dig some roadway material up and leave it at the beginning of the mark
   d. The marks will fade out as the tires gain traction

XVII. FORENSIC SCIENCE AND TECHNICAL DIVISION (FSD) (60 Min)

A. Topic 9.0 Introduction

1. Criminalistic Laboratory is comprised of eight specialized units that provide support services to investigative personnel in the Department

   a. Questioned Documents Unit
   b. Field Investigation Unit
   c. Firearm Analysis Unit
   d. Narcotics Analysis Unit
   e. Serology/DNA Unit
   f. Toxicology Unit
   g. Trace Analysis Unit
   h. Quality Assurance Unit

B. The Crime Lab can assist the traffic officer by performing various duties that include, but are not limited to:

1. Physical and DNA comparisons of hair and fiber samples collected at the scene to exemplars collected from suspects, victims, passengers, etc.
2. Matching vehicle parts collected at scene to a vehicle
3. Identification of hit and run vehicle year range, make and
4. Determination whether vehicle lamps were in use at the time of a crash
5. Matching paint samples collected at scene to a vehicle through comparison analysis of paint type
6. Fingerprint lifting and identification
7. Crime scene photography, including aerial shots

C. Evidence to collect for FSD

1. Vehicle parts

    a. For physical match
    b. Part identification

2. Vehicle lamps

    a. Hot shock
    b. Cold shock

3. Fabric transfers

    a. Interior upholstery
    b. Exterior upholstery
    c. Seat belts – determination if in use at time of T/C
    d. Airbags

4. Paint chips

    a. From explosion on impact
    b. Physical match back to a suspect vehicle
    c. Paint transfers

5. Transfers onto clothing

    a. Paint
    b. Tire marks
    c. Debris (glass, oil, grease, etc)

6. Blood, hair, tissue

a. Interior of vehicle
b. Exterior of vehicle

7. Fingerprints / body prints

   a. Photo documentation
   b. Request for lifting / enhancement of prints

8. Request physical match of clothing from victim's clothing torn off and attached suspect's vehicle

D. Technical Investigation Division (TID)

1. Photography

   a. Request for any Fatal or Severe Injury T/C
   b. TID Photos can use special photographic techniques such as detail enhancement and use of flash angles
      1) Also able to take video and 360degree pictures

E. Conclusion

1. Know what resources are available

XVIII. COURSE REVIEW AND CLOSING REMARKS (150 Min)

A. Return field exercises and vehicle inspections to students

1. Review field exercise
2. Review vehicle inspections

B. Review of class material

C. Administer Final Exam

D. Class critiques to be filled out by students