Traffic Collision Skidmark Analysis

Expanded Outline

I. Course Introduction, Overview and Objectives
   A. Introduction
      1. Overview of facility
   B. Overview
      1. Mathematics Review
      2. Collision Investigation Review
   C. Objectives
      1. To understand and document collision related skid mark evidence
      2. Familiarize students with the formulas available to collision investigators
      3. To understand the role of the coroner in collision investigations
      4. Students will learn how to determine the speed of a vehicle based on skidmarks
      5. Students will gain a better understanding of the Laws of Motions as they relate to collisions

II. Calculator/ Mathematics Review
   A. Calculator Review
      1. Common calculations
      2. Scientific calculators
   B. Mathematics Review
      1. Number line
      2. Fractions
      3. Statement of Equality
      4. Squaring/Squareroots
      5. Conversion factors
         a. miles per hour (mph) → feet per second (fps)
         b. fps → mph
      6. Percentages
      7. Variables

III. Skid Marks Identification
   A. Definitions and characteristics
      1. Skid marks
      2. The 3 basic methods of leaving visible tire skid marks
   B. Types of skidmarks/tiremarks
      1. Impending
      2. Locked wheel
      3. Side skid
      4. Critical speed scuffs
      5. Skip
      6. Gap
      7. Acceleration
      8. Collision Scrub
      9. Tire marks
   C. Characteristics and identification of skids

1. Locked wheel skid
2. Impending skid
3. Side skid
4. Critical speed scuff

D. Measuring devices/techniques
1. Pace
2. Rolotape
3. Tape measures

E. Drag Factor/Coefficient of friction
1. The measurement of resistance of an object sliding over a surface
2. Nomograph/Traffic templates
3. Recording and measuring
   a. Measure and record each skid separately
   b. Skid observation techniques

IV. Courtroom Testimony

A. Testimony
1. Demeanor
2. Preparation
3. Working with the deputy district attorney
4. Collision related criminal offense testimony

V. Role of the Coroner

A. Introduction to the Coroner
1. Instructor introduction
2. Overview of coroner responsibilities in general
3. Role of the coroner in the collision investigation
4. Scene protocol
5. Reporting
6. Examples of collision related deaths
7. Question and answer activity

VI. Speed versus Velocity

A. mph versus fps
1. mph = Speed
2. fps = Velocity
3. Convert speed to velocity
4. Convert velocity to speed

VII. Science Behind Collisions

A. Newton's Three Laws of Motion in relation to collisions
1. An object in motion, stays in motion unless acted upon by another force (speed and direction)
2. Change in velocity is proportional to force acting on it (acceleration)
3. If an object exerts force on another object, that second object exerts an equal and opposite force on the first (action, reaction)
4. Algebraic formulas and derivations for each law

B. Acceleration
1. What is acceleration?
2. How is acceleration measured?
3. Acceleration factors

4. Distance as a constant

VIII. Time and Distance within a Skid

A. Slide to Stop
   1. Basic slide to stop formula
      a. Solve to determine speed in mph
   2. Coefficient of friction
   3. Braking efficiency

B. Slide to Stop in Feet Per Second (velocity)
   1. Solve to determine velocity in fps
   2. Acceleration
   3. Distance
   4. Formula derivations

C. Combined Velocities
   1. Formulas
   2. Uses

D. Perception and Reaction Time
   1. What is perception and reaction time (P&R)?
   2. Why is it important?
   3. Relevance in traffic collision investigation

E. Radius of a curve
   1. Radius
   2. Chord
   3. Middle ordinate
   4. Determining speed from radius

F. Grade/Elevation
   1. Rise over run
   2. Application to friction value of the roadway

G. Combined Speed/Velocity
   1. Using the Pythagorean theorem
   2. Combined speed in mph
   3. Combined velocity in fps

H. Time and Distance and Stopping Equations
   1. Derivation to solve for distance to stop
   2. Formula to determine distance prior to collision

IX. Considerations in Investigating Collisions Involving Public Entities

A. Obtain detailed statements
   1. Where were drivers coming from or going to
   2. Estimated speeds
   3. What lanes drivers were in
   4. Familiarity with area

B. Identify all occupants and witnesses
   1. Note seating positions
   2. Seatbelt use (check for inconsistencies in seating position)
   3. Canvas the area

C. Liability
   1. Ramifications of incorrect information
   2. Inaccurate statements
   3. Errors in PCF

4. Civil liabilities

X. Initial and Ending Velocities
   A. Factors
      1. Distance (before and after)
      2. Braking percentage
      3. Friction
      4. Slide to stop formula
      5. Use for pre and post impact speeds
   B. Calculating Length of Time
      1. Relationship between time and distance
      2. Fps instead of mph

LEARNING ACTIVITY

Class will meet at EVOC facility from 1500-1800 on day three of the class. Class will utilize the formulas learned in the classroom in a practical environment. Students will observe, from a safe distance, one instructor driving a vehicle and applying the brakes to leave a skid mark on the ground. One instructor will remain with the students and ensure no one is near the area of the vehicle while it is in motion. Students will then measure the skid marks and calculate the following:
-Slide to stop in MPH
-Slide to stop in fps
-Distance to stop in feet
-Perception and reaction time
-Safe stopping distances
-Drag factor estimates (time permitting)
-Radius from speed

After demo, students will return to classroom to complete calculations. Instructors will provide correct answers and facilitate class discussion on demonstrations and observations.

XI. Launches and Vaults
   A. Defining Launches and Vaults
      1. Launch
      2. Vaults
   B. Determining Speed from Launches and Vaults
      1. Distance and fall
      2. Level takeoff
      3. Launches 6 degrees or less
      4. Launches 6 degrees or more

XII. Kinetic Energy (KE)
   A. What is Kinetic Energy
      1. Work, force and distance
   B. Potential Energy
      1. Gravitational and elastic energy
   C. Equations

1. Determining KE
2. Work (W)
3. Determining Mass and Weight

XIII. Course Review/Written Test/Evaluations

A. Course Review
   1. Review of the material covered in the course

B. Written Test
   1. Test will cover material including equations and mathematics covered in the class

C. Evaluations