Traffic Collision Investigation Intermediate

COURSE DESCRIPTION

This course is focused on the basics of tire mark identification and analysis. Course content will include the following: definitions and terminology; documentation and measurements; identifying and naming various types of tire friction marks; determination of drag factors; calculating speeds from tire friction marks; “Laws of Motion”; time and distance analysis. This forty hour course will be instructed over a period of five days for eight hours each day.

COURSE OUTLINE

I. Definitions and Terminology 2 hours

A. Definitions

1. The three basic causes of producing visible tire friction marks
   a. Extreme deceleration
   b. Extreme change of direction
   c. Extreme acceleration
2. Types of tire friction marks
   a. Skid mark
   b. Scuff mark
   c. Tire imprint

B. Terminology

1. Impending skid mark
2. Locked wheel skid mark
3. Skip skid mark
4. Gap skid mark
5. Side skid mark
6. Spin skid mark

7. Scrub skid mark
8. Critical speed scuff mark
9. Acceleration scuff mark

I. Documentation and Measurements 3 hours

A. Tools for measurements
1. Total Station
2. Measuring wheel (Rolatape)
3. Tape measures
4. Pacing (inaccurate)
5. Visual estimation (inaccurate)

B. Documentation

1. Coordinate system

a. Establish a “x” and “y” axis

b. Measure at 90 degrees to each axis.

2. Triangulation

a. Establish two reference points

a. Measure from the two reference points to an evidence point forming a triangle.

3. Station line

a. Establish a station line the length if the collision scene.

b. Measure at 90 degrees to the left or right of the station line.

C. Photography

1. Collision scene photos-locating tire friction marks in relation to scene.
2. Vehicle photos- locating tire friction marks in relation to vehicles involved.
3. Special conditions
    a. Day time photos
    b. Night time photos

I. Identification of Tire and Skid Marks 2 hours

A. Types of tire friction marks
1. Impending skid mark
2. Locked skid mark
3. Skip skid mark
4. Gap skid mark
5. Side skid mark
6. Spin skid mark
7. Scrub skid mark
8. Critical speed scuff mark
9. Acceleration scuff mark

B. Other types of marks on roadway
1. Gouge marks
2. Scrape marks
3. Scratch marks
4. Vehicle fluids
5. Human tissue transfer
6. Fabric transfer

C. Mechanism of transfer
1. Friction and heat

2. Abrasion and tearing

3. Temperatures

4. Artificial or natural compounds

5. Sliding tire mark

6. Rotating tire mark

7. Weight transfer

8. Steering input

9. Intermittent tire marks

I. Newton's Laws of Motion 1 hour

A. Law 1-Every body at rest tends to remain at rest, while every body in motion tends to remain in motion, unless acted upon by an unbalanced external force.

B. Law 2- The acceleration of any body is directly proportional to the force acting on the body, while it is inversely proportional to the mass of the body.

C. Law 3-For every force exerted on a body by another, there is an equal but opposite force reacting on the first body by the second.

I. Math Review 1 hour

A. Basic principles

1. Addition
2. Subtraction
3. Multiplication
4. Division
5. Order of Operations

B. Calculations and Identification

1. Square

2. Square root

3. Decimals

4. Whole numbers

5. Unit conversions

6. Percentage conversions

7. Algebra review

C. Calculator

1. Functions

2. Operation

3. Mathematical problems

I. Drag Factor Computations 3 hours

A. Definitions

1. Drag Factor- a numerical value which represents the horizontal pulling force, in pounds, required to cause an object to move in the direction of force, uniformly, divided by the weight of the object being moved.

2. Coefficient of Friction-represents the resistance of one body to another when they are sliding or rubbing against each other, for example, a tire sliding over a level road surface.

B. Methods of Determining Drag Factors

1. Drag Sled

a. Weight of drag sled

b. Horizontal pulling force required to pull drag sled

c. Drag factor equals the horizontal pulling force divided by the weight of the drag sled.

2. Test Skids

a.

b. Use longest skid for skid distance.

c. Conduct a minimum of two tests.

d. Calculated drag factors must be within 5%.

3. Published Data

a. Northwestern University Traffic Institute

b. Institute of Police Technology and Management

4. Accelerometer (Vericom 3000)

C. Braking Efficiency

1. Braking Percentages for Different Types of Vehicles

a. Rear-wheel drive vehicles

b. Front-wheel drive vehicles

c. Tractor/Trailer combination vehicle

d. Motorcycles

2. Defective Brakes

D. Factors Affecting the Coefficient of Friction

1. Roadway surface

2. Tires

3. Grade/superelevation

4. Weather

E. Resultant/Adjusted Drag Factor

F. Other Drag Factors

1. Pedestrians

2. Sliding motorcycle

3. Rollovers

4. Locked vs. Rolling wheel

5. Wet grass

6. Dirt

I. Speed Computations 12 hours

A. Speed from skid marks

1.

2.

A. Combined Speed Formula

1.

2.

C. Critical Speed Scuff mark

1.

2.

VIII. Time and Distance Calculations 4 hours

A. Conversion Factors

1.

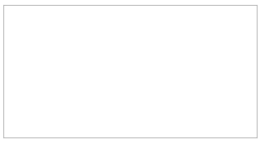
2.

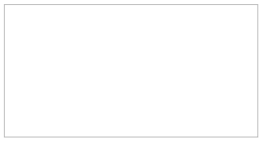
B. Time Calculations

1.

2.

3.



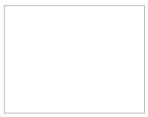


C. Distance Calculations

1.

2.

3.



I. Practical Exercises 10 hours

A. Demonstrations and Analysis

1. Low Speed Skids
2. High Speed Skids
3. Anti-lock Brake Skids (ABS)
4. Critical Speed Scuff Marks

A. Determining Drag Factor

1. Using drag sled
2. Conducting test skids
3. Using Vericom 3000

C. Problem Exercises and Analysis

1. Nine Problems are completed by groups of students
2. Student must determine the following:
   a. Collision skid or test skid
   b. Identify type of skid/scuff mark
   c. Measure tire marks

d. Determine drag factor

e. Calculate speeds

3. Groups compare results in classroom

4. Known results are shared with students

I. Final Exam

2 hours

A. Open book exam

B. Fifty comprehensive questions

C. Multiple choice and word problems

Total 40 hours