TRAFFIC ACCIDENT STUDY GUIDE 2010

SECTION SEVEN

This study guide is designed to provide the law enforcement Explorer with basic principles. The guide is not all inclusive, and does not delineate specific techniques that must be used. The focus of this guide is to provide principals that are flexible and adaptable to various law enforcement situations.

Following the basic principals in this guide should allow the law enforcement Explorer to successfully handle various law enforcement training activities safely and professionally.

The study guide was developed through the cooperation of International Association of Chiefs of Police and the Federal Law Enforcement Training Center.

SECTION SEVEN

DIAGRAMMING

SYLLABUS

COURSE TITLE: TRAFFIC ACCIDENT DIAGRAMMING

LENGTH OF PRESENTATION:

LECTURE	LAB	PE	TOTAL	PROGRAM
3:00	1:00	3:00	7:00	

DESCRIPTION:

This course provides the students with the knowledge and skills to accurately measure and record the position of evidence found while processing a vehicle accident scene. These items of evidence may include tire marks, debris, victims, signs, markings, vehicles, etc. The students participate in a laboratory exercise to practice transferring measurements taken at an accident scene to a scaled drawing of the accident scene. Instructors will evaluate student performance during a conference competition involving all aspects of accident scene processing.

TERMINAL PERFORMANCE OBJECTIVE (TPO):

Given a staged vehicular accident, the student will describe and demonstrate the process of taking measurements at an accident scene, provide a diagram and supporting documentation with acceptable accuracy.

ENABLING PERFORMANCE OBJECTIVES (EPO):

EPO #1: Drawing a field sketch of a vehicular accident.

EPO #2: Describe and apply three types of reference points used in accident scene diagramming.

EPO #3: Define and apply the coordinate and triangulation methods of measurement.

EPO #4: Create a table of measurements from data collected at the accident scene.

EPO #5: Complete a final scale drawing of an accident scene and include supporting documentation (e.g., Identifying Information, Table of Measurements, and Legend).

STUDENT SPECIAL REQUIREMENTS:

1. The students will complete a final scaled drawing of the accident scene during the practical exercise.

Instructor Guide

METHODOLOGIES:

1. Lecture.
2. Demonstration.
3. Laboratory exercise.

TRAINING AIDS:

1. Instructor:
    a. Accident diagramming “tool kit” including:
        (1) Steel measuring tape.
        (2) Lumber crayon.
        (3) Traffic template.
        (4) Vehicles for the laboratory exercise and the conference competition.
        (5) Safety devices (e.g., flares, traffic cones, reflective triangles, etc.) sufficient to mark the accident scenes during the laboratory exercise and the conference competition.
2. Student:
    a. Clipboard.
    b. Unlined white paper.
    c. Pencil.
    d. Art gum eraser.
    e. Traffic template.
    f. Drafting compass.
    g. Radius nomograph.
    h. Portable radio.

i. Traffic accident “tool kit.”

SPECIAL REQUIREMENTS:

1. The instructor will stage a vehicular accident for demonstration in the laboratory exercise.

2. The instructor will stage a vehicular accident for evaluation of student performance during the conference competition.

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OUTLINE OF INSTRUCTION

I. INTRODUCTION

A. RAPPORT AND OPENING STATEMENT

1. Preparing an accurate, legible accident diagram is one of the most important tasks performed by traffic accident investigators.

    a. The accident diagram is a graphic representation of the accident scene.

    b. The accident diagram and the narrative accident report are records that insurance companies, courts, traffic engineers, and others may review.

    c. Accident diagrams serve to refresh the accident investigator's memory as well as accurately record what the investigator observed at the accident scene.

    d. Should the case ever be litigated, professionally drawn accident scene sketches and professionally written reports aid in establishing the credibility of the accident investigator.

2. This course will teach you how to produce accurate and legible accident diagrams to scale.

    a. We will go through the process including with field sketching, measuring, reconstructing arcs and angles, plotting the position of vehicles, bodies, or other items of evidence.

    b. We will demonstrate this process during a laboratory exercise.

NOTE: If there is not enough time, the instructor may omit the in-class laboratory exercise.

    c. Finally, you will demonstrate how to diagram a vehicular accident scene in a graded practical exercise.

B. TERMINAL PERFORMANCE OBJECTIVE (TPO):

Given a staged vehicular accident, the student will describe and demonstrate the process of taking measurements at an accident scene,

provide a diagram and supporting documentation with acceptable accuracy.

C. ENABLING PERFORMANCE OBJECTIVES (EPO):

1. EPO #1: Drawing a field sketch of a vehicular accident.

2. EPO #2: Describe and apply three types of reference points used in accident scene diagramming.

3. EPO #3: Define and apply the coordinate and triangulation methods of measurement.

4. EPO #4: Create a table of measurements from data collected at the accident scene.

5. EPO #5: Complete a final scale drawing of an accident scene and include supporting documentation (e.g., Identifying Information, Table of Measurements, and Legend).

II. PRESENTATION

A. EPO #1: Drawing a field sketch of a vehicular accident.

1. The field sketch is the first step in the process that will culminate in a formal diagram of the accident scene (either to scale or not to scale).

    a. The field sketch (also known as a “preliminary field sketch”) is a rough drawing that “maps” the accident scene as observed by the accident investigator on his or her arrival.

        (1) The purpose of the field sketch is to assist the investigator in recording measurements taken at the scene.

        (2) It should depict only features of the accident and road configuration features observed by the accident investigator.

        (3) It should not contain anything that the accident investigator would not be able to explain when testifying in court.

b. Like rough investigative notes, attorneys may review the field sketch should the accident result in litigation (an accident may result in either civil or criminal litigation).

(1) Therefore, even a field sketch should be neat, accurate, and complete.

(2) The accident investigator should retain the field sketch and rough investigation notes in the case file.

2. The investigator draws the field sketch by first recording the outline of the roadways and then drawing all things relevant to the accident in their relative positions.

3. The field sketch should include the following information which will appear in the final accident diagram:

a. Features of the roadway (e.g., fog lines, centerlines, etc.)

b. Positions of vehicles, bodies, debris, blood, etc.

c. Positions of traffic control devices, including advanced warning devices.

d. Environmental factor such as snow, ice, standing water, etc.

e. Any item or terrain feature that may have been a factor in the accident.

(1) It is better to sketch and make measurements of something that is later determined to be irrelevant than to overlook a potentially important piece of evidence.

(2) The rule of thumb is, if you have any doubt about whether something is relevant, include it.

f. Names of streets and addresses, if applicable.

g. Type of road surface or other surface information when the accident is off the road.

h. Anything that may have obstructed the driver's vision and contributed to the accident.

i. Types and locations of road lights if the accident occurred at night.

j. Skid marks or other relevant marks (e.g., tire prints in the snow or in mud) or gouges.

k. Debris related to the accident.

l. Road grade or super-elevation.

m. Lane and road widths.

n. Reference points.

4. Use numbers to identify the vehicles involved in the accident.

5. Use letters to identify reference points.

6. Orient the sketch so that north is at the top of the page.

7. Write all information on the sketch so that it is parallel with the top and bottom edges of the sketch.

   a. This makes the sketch look neater.

   b. It also makes reading the information of the sketch easier.

B. EPO #2: Describe and apply three types of reference points used in accident scene diagramming.

1. Reference points are positions on the terrain from which to take measurements.

   a. You should select reference points that can be easily located for future reference.

   b. Locate the reference points on the field sketch and the final diagram and describe them in the table of measurements.

2. In this course, you will use three types of reference points (i.e., tangible, semi-tangible, and intangible).

   a. **Tangible** – A tangible reference point is a landmark that is in place, will likely remain in place, or that can be relocated from a survey or blueprint if it is removed. Examples include:

(1) Fire hydrants.

(2) Parts of a bridge.

(3) Parts of a building.

(4) Power poles.

(5) Light poles.

(6) Manhole covers or drainage grates.

b. **Semi-tangible** – These reference points are marks that the accident investigator places at the scene and references to permanent landmarks (i.e., tangible reference points).

(1) Semi-tangible reference points can be a mark made by the investigator or a pin the investigator drove into the ground directly opposite of a tangible reference point.

Figure 1: Semi-tangible reference point referenced to the corner of a tangible reference point.

(2) The investigator uses semi-tangible reference points to eliminate the need of making repeated measurements to a remote reference point.

c. **Intangible** – The investigator may place intangible reference points on the roadway where the edges of two roadways would meet if not connected by curves. Examples of the use of intangible reference points include:

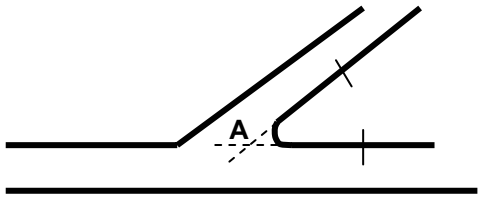


Figure 2: **A= An intangible RP**

Reconstructing an arc in an intersection.

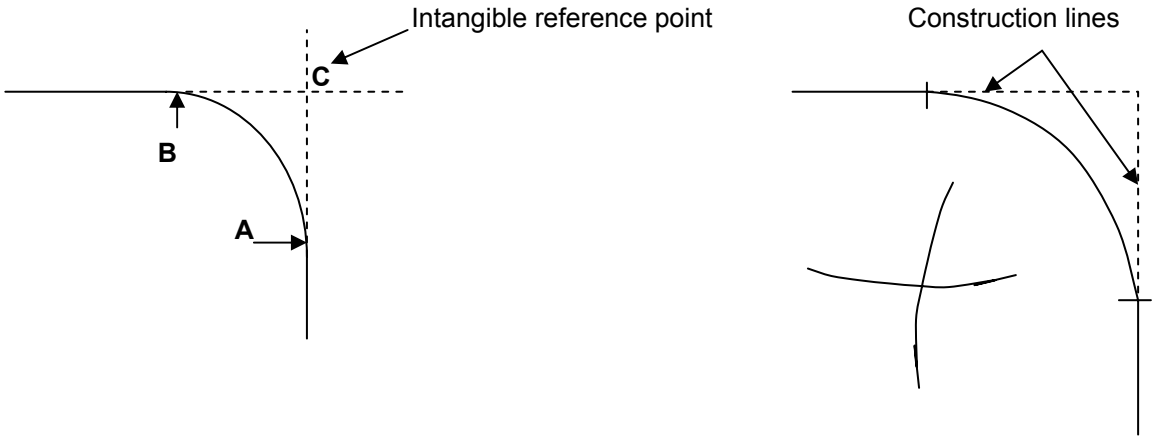
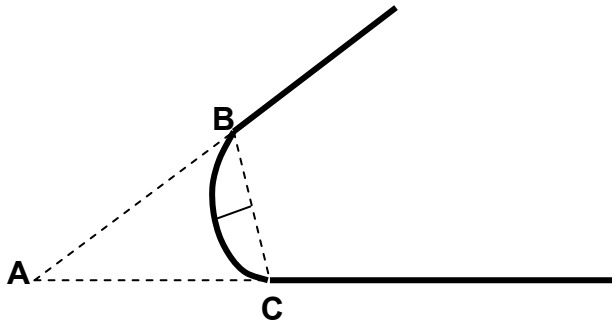


Figure 3: Reconstructing the arc of an intersection.

Note that in the example at the right the intersecting arcs locate the point where the compass must be anchored to draw in the curved to scale. First the radius is calculated and the compass opened to this value. Next the point of the compass is placed at A & B and arcs are drawn in lightly. Where these arcs cross locates the point where the compass point is placed to draw in the curve.

NOTE: This is not the only way to draw an intersection with a curved portion of road. The accident investigator can also use the coordinate method measuring from a baseline to points "A" and "B". However, establishing an intangible reference point at "C" may help take measurements to locate other objects relevant to the accident scene



A – B – C locates the angle of the intersection.

B – C & the middle ordinate locate the measurement for the radius.

Figure 4: Using an intangible reference point for angular reconstruction and to establish the radius of a curve.

In this example A could be used as an intangible reference point. A-B-C form a triangle, the dimensions of which can be used to reconstruct the angle of the intersection. In

addition, in this example the investigator has placed B & C at the points where the curve begins. B to C is now the cord measurement which can be used with the middle ordinate to calculate the radius. Although this will save time, the two processes do not have to be combined.

(1) Investigators can use intangible reference points to locate objects within the accident scene.

O

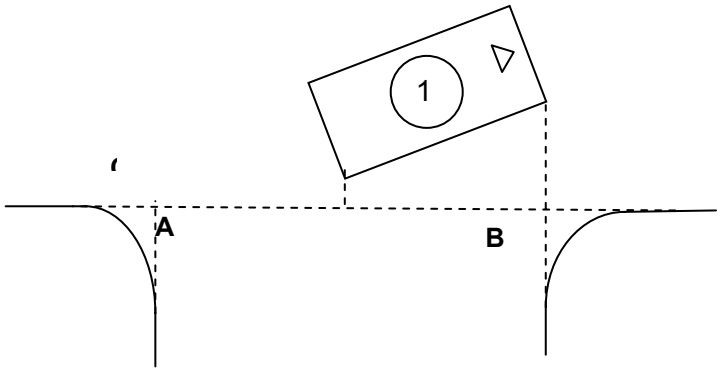


Figure 5: Using intangible reference points to locate objects.

Note that when intersecting lines are used to establish a reference point the designations RP 1, 2, etc. are normally used.

C. Define and apply the coordinate and triangulation methods of measurement.

1. **Coordinate method** – In this method of measurement the investigator takes all measurements as right angles (90 degrees) from a baseline. An object with a known 90 degree angle, such as a clipboard can be used to maintain a right angle off the baseline.

   a. An easy way to do this is to use one measuring tape as your baseline and a second measuring tape to make your measurements from the baseline.

   b. You can designate the distances measured being approximately in a northerly, southerly, easterly, or westerly direction from the baseline.

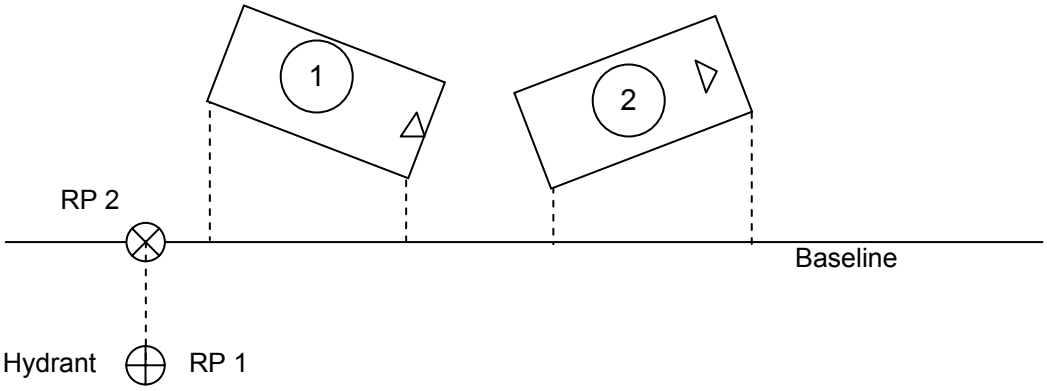


Figure 6: Coordinate method of measurement.

c. Investigators can use the coordinate method for a majority of accidents when:

(1) Taking measurements on a roadway with defined edges (e.g., curb, edge of pavement, etc.).

(2) Taking measurements on objects that are all within 30 feet of the baseline.

2. **Triangulation method** – In this method of measurement, the investigator locates the position of an object by using distances from two fixed points a known distance apart.

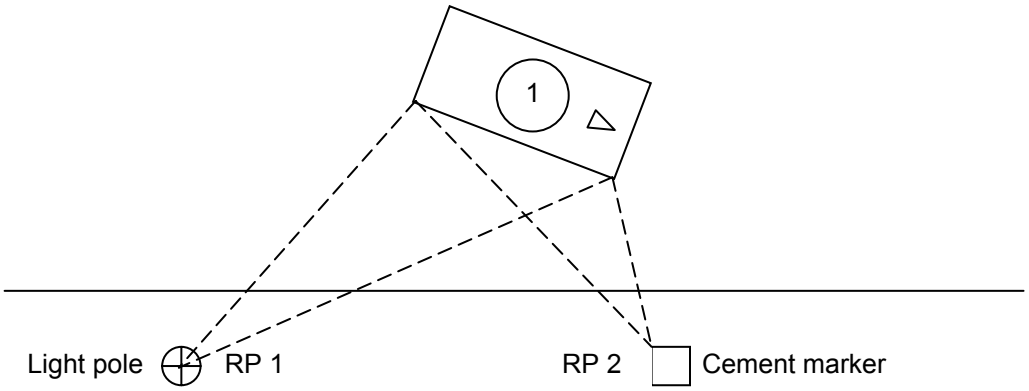


Figure 7: Triangulation method of measurement.

a. When using the triangulation method, the reference points should be at least 20 feet apart; avoid using long, narrow triangles.

b. Investigators may use the triangulation method when:

(1) The edge of the roadway is indistinct.

(2) Locating the position of objects that are more than 30 feet from a baseline.

(3) Taking measurements on traffic circles or other similar curved roadways.

3. Investigators may choose to use the coordinate method and the triangulation method together if terrain or other factors make using just one method impractical.

D. Create a table of measurements from data collected at the accident scene.

1. After completing the field sketch, the investigator must measure distances to objects and record these measurements on a table of measurements.

a. A table of measurements describes the reference points and spots measured by the investigator and lists in tabular form the actual distances and directions to or from these locations.

b. An investigator needs to make enough measurements at the accident scene to avoid conjecture about locations when drawing the final scaled drawing or testifying in court.

c. The investigator records these measurements as follows:

(1) When using feet and inches, write feet in large numerals and inches as smaller (superscript), underlined numerals to the right of the feet.

(2) This prevents misinterpreting the number “1” with the symbol for feet (‘) and the number “11” with the symbol for inches (“).

(3) An alternative is to record measurements as feet and tenths of a foot (e.g., 10.5) if you have a tape measure made for that purpose.

2. There are three methods of recording measurements.

a. The investigator may choose to record these measurements directly on the field sketch.

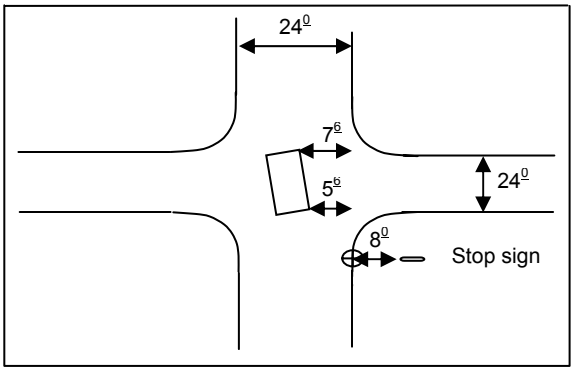


Figure 8: Recording measurements on a sketch.

NOTE: In this course, the students must produce a table of measurements using one of the following tabular formats.

b. Alternatively, the investigator may use a form that combines the field sketch with a table of measurements.

Description: RP #1 Description: RP #2				
Spot on Road	North	South	East	West
Vehicle #1 RF RP#1 RR				
Vehicle #2 LF RP #1 LR				
Vehicle #2 LF RP #2 LR				
Vehicle #1 Width:				
Vehicle # 2 Width:				
Spot A				
Spot B				
Chord	Middle Ordinate		Radius	
Stop Sign				
Road Conditions:			Road Width:	

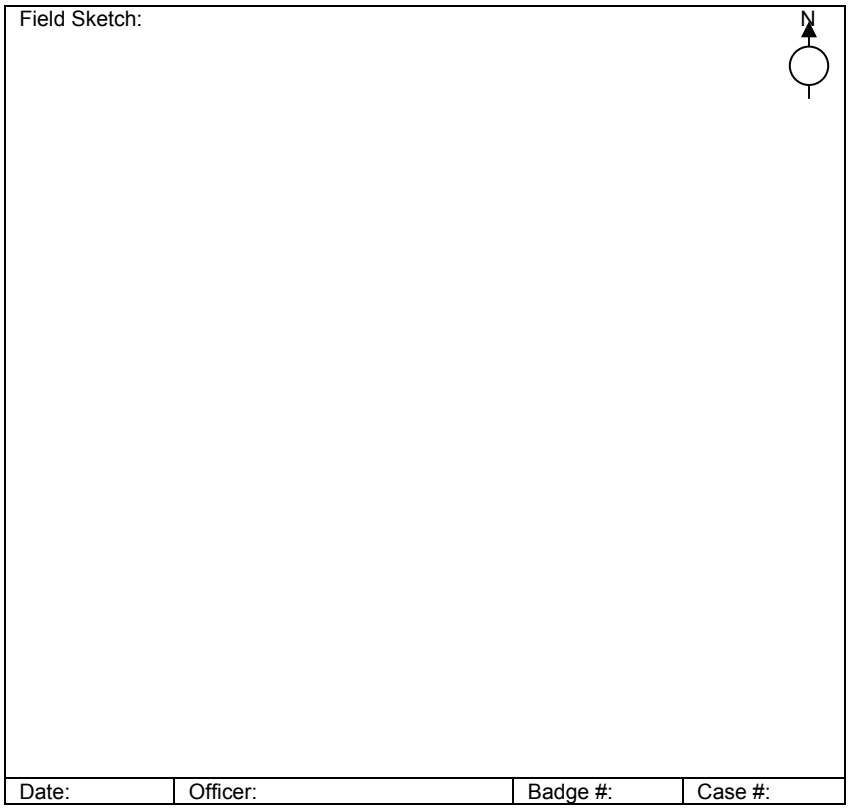


Figure 9: Example of a form that combines the table of measurements with an area for the traffic accident sketch.

c. A third alternative is to draw the field sketch on one piece of paper and record measurements on a separate table of measurements.

Table of Measurements				
Description of point(s) from which measurements were taken: **RP #1 is** **RP #2 is**				
Point or Item Measured	**North**	**South**	**East**	**West**
RECORD ITEMS NOT MEASURED FROM A REFERENCE POINT AS "A **TO** B."				
Officer:	Badge #:	Date:	Case #:	

Figure 10: Example of a table of measurements.

E. Complete a final scale drawing of an accident scene and include supporting documentation (e.g., Identifying information, Table of Measurements, and Legend).

1. The accident investigator should plan the final scaled drawing.

    a. Check the maximum north-south and east-west axes to determine the orientation of the paper on which you plan to make the drawing.

    b. Choose the scale of the drawing (e.g., 1” = 20 feet, 1” = 10 feet, etc.).

    c. An investigator can draw scale maps of most accident scenes using a traffic template.

2. Draw the streets first.

    a. The investigator can draw many intersections as pairs of parallel lines arranged in either a “┼” or “┬” configuration.

    b. The investigator can reconstruct angled intersections from measurements taken by extending the curb lines to form a triangle.

3. Next, add the reference point(s) to the drawing.

4. Finally, draw all other items in their relative positions.

5. During the practical exercise, you will produce a final scale drawing of a staged motor vehicle accident using the following criteria:

    a. Use the one inch equals 10 feet scale expressed as a ratio (i.e., 1:120).

    b. Draw all geographic and object locations within one scale foot of actual measurements.

    c. Mark clearly at the scene and plot all “spots” which are not tangible reference points, so that an instructor can verify all measurements.

d. Orient your drawing with approximate north at the top of the page and mark the drawing with the appropriate direction symbol and the word “Approximate.”

e. Present all measurements in a tabular form either on the accident scene diagram or on a separate sheet of paper.

f. The accident scene diagram will contain only numbers, letters, drawings, symbols, or other information needed to interpret the accident scene.

g. Put all other information in one of the following documents:

(1) Identifying Information detailing who, what, where, when, why, and how.

(2) Legend listing any non-standard symbols used in the diagram.

(3) Table of Measurements.

h. Label all vehicles with a circled number (e.g., (1))

i. Label all reference points with the letters “Rp” followed by a number (e.g., Rp1, Rp2, etc.).

j. Label all “spots” by uppercase letters (e.g., A, B, C, etc.).

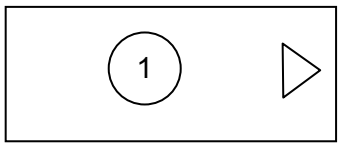
k. Do not draw freehand anything that you can draw using the traffic template.

l. Draw construction lines lightly so no obvious erasure marks appear on the final drawing.

m. Identify all streets and roads by name or number, composition of the road surface, grade, and super-elevation.

n. Write all numbers and letters on the drawing parallel to the bottom and top edges of the paper.

o. Indicate the front of each vehicle with a small triangle drawn with the traffic template as follows:



III. SUMMARY

A. REVIEW OF PERFORMANCE OBJECTIVES

1. EPO #1: Drawing a field sketch of a vehicular accident.

2. EPO #2: Describe and apply three types of reference points used in accident scene diagramming.

3. EPO #3: Define and apply the coordinate and triangulation methods of measurement.

4. EPO #4: Create a table of measurements from data collected at the accident scene.

5. EPO #5: Complete a final scale drawing of an accident scene and include supporting documentation (e.g., Identifying Information, Table of Measurements, and Legend).

B. REVIEW OF TEACHING POINTS

1. Drawing a preliminary accident diagram provides you with a picture of accident scene conditions when you arrived on the scene.

   a. It is the basis for the final accident diagram.

   b. It assists the investigator in making and recording measurements of the accident.

   c. Courts treat the preliminary sketch just like investigative notes.

2. There are three types of reference points used in accident diagramming.

   a. Tangible,

   b. Semi-tangible, and

   c. Intangible.

3. Accident investigators can take measurements using either the coordinate or triangulation methods.

   a. In the coordinate method, you take measurements at 90 degrees from a baseline.

b. In the triangulation method, you take measurements to two or more reference points (or landmarks) at least 20 feet apart.

4. As you take measurements, record them in a table of measurements.

5. When you draw the final accident diagram, orient it so north is at the top of the page.

   a. Use a traffic template to simplify the mapping process.

   b. Use the appropriate scale.

   c. Draw construction lines lightly so you can erase them easily.

See Section 10 for details of laboratories and Conference Competition.

REFERENCES

Rivers, R. W. Traffic Accident Investigators' Handbook. Illinois: Charles C. Thomas Publisher, 1980.

Traffic Institute. "How to Use the Traffic Template." Illinois: Northwestern University, 1984.

TRAFFIC ACCIDENT DIAGRAMMING

PRACTICAL EXERCISE STANDARDS

1. Complete the final diagram using the one inch equals 10 feet scale expressed as a ratio (i.e., 1:120).

2. Plot all geographic and object locations within one scale foot (i.e., one tenth of an inch).

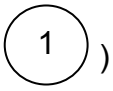
3. Plot and mark clearly at the scene all “spots” which are not tangible reference points.

4. Orient the drawing with north at the top of the page and include the proper direction symbol and the word “Approximate.”

5. Present all measurements in a tabular form either on the diagram or on a separate sheet of paper.

6. Include only those numbers, letters, or other information necessary to interpret the accident scene.

7. Include all other information in the identification section (investigator, time, date, case number, weather, surface conditions, etc.).

8. Identify all vehicles with a circled number (e.g., 

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9. Label all reference points with the letters “Rp” followed by a number (e.g., Rp1, Rp2, etc.).

10. Label all “spots” by uppercase letters (e.g., A, B, C, etc.).

11. Do not draw freehand anything that you can draw using the traffic template.

12. Draw construction lines lightly so no obvious erasure marks appear on the final drawing.

13. Identify all streets and roads by name or number, composition of the road surface, grade, and super-elevation.

14. Write all numbers and letters on the drawing parallel to the bottom and top edges of the paper.

15. Indicate the front of each vehicle with a small triangle drawn with the traffic template as follows: