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Tire Tread and Tire Track Evidence

LETN-160-0012

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I. SYNOPSIS

This lesson presents the various aspects of tire tread evidence and the deductions that can be made at the crime scene. Tire marks and impressions provide the investigator with a variety of information that is useful in determining the possible type of vehicle responsible as well as even allowing positive identification.

II. OBJECTIVES

Upon completion of this lesson, a law enforcement officer will be able to:

1. recognize the different types of information that may be left by tires.
2. utilize the proper techniques to determine the information that is available.
3. determine how to preserve tire evidence for off-scene evaluation.
4. reference various sources of information that will assist in providing additional information.

III. INTRODUCTION

Tire tread evidence is some of the most often ignored evidence at crime scenes. A big part of the reason for this is the lack of proper training in the recognition and preservation of this evidence and in its perceived value (i.e., the information that can be obtained from it).

IV. KEY POINTS

- Tires come in a wide variety of sizes and tread designs.
- Tread designs are exclusive to a particular manufacturer.
- The direction of travel can be ascertained from a tire mark or impression.
- Acceleration marks start out heavy and gradually get lighter as traction is acquired.
- Braking marks start off light and get darker as the rubber heats up and the vehicle slows down.

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Notes:

- Some tires actually have serial numbers on them (usually on large trucks).
- Tire stores typically maintain records of the sale of tires to customers.
- Mold marks left on brand-new tires during production may be present in impressions.
- Cuts, scrapes and wear can be found in tire impressions.
- It is not uncommon for criminals to have more than one brand of tire on their vehicle.
- Tire marks/impressions can reveal the turning radius of the vehicle that produced them.
- Vehicle turning radius varies for different type/size vehicles.
- Turning radius is the minimum distance that vehicle requires (curb to curb) to make a complete circle (360-degree turn).
- Vehicle stance can be ascertained from tire marks/impressions.
- Vehicle stance is the distance from center to center of the tires on the front axle or the rear axle.
- Front stance typically differs from rear stance.
- Wheel base can sometimes be determined from tire marks/impressions.
- Wheel base is the center-to-center or front-to-front distance between the front and rear wheels.


V. OUTLINE

The proper documentation of tire mark/impression evidence requires both photography and dental stone casting. Both of these techniques require special considerations, which we presented in a previous lesson. There is a significant amount of information that can be derived from tire marks/impressions.

A. General Documentation

1. The tread width should be measured and recorded for each impression (with different tread design).
2. The tread depth should be measured (wear-bar indicators, if present, provide a good point of reference for measurement).
3. Photographs (with scale present) are taken.
4. Selected areas (with the best visible detail) are cast with dental stone.

B. PowerPoint Presentation (The Essentials of Tire Evidence) pages 6–24



Forensic Tire Evidence

Tire Impressions and the
Information that can be Derived
from Them

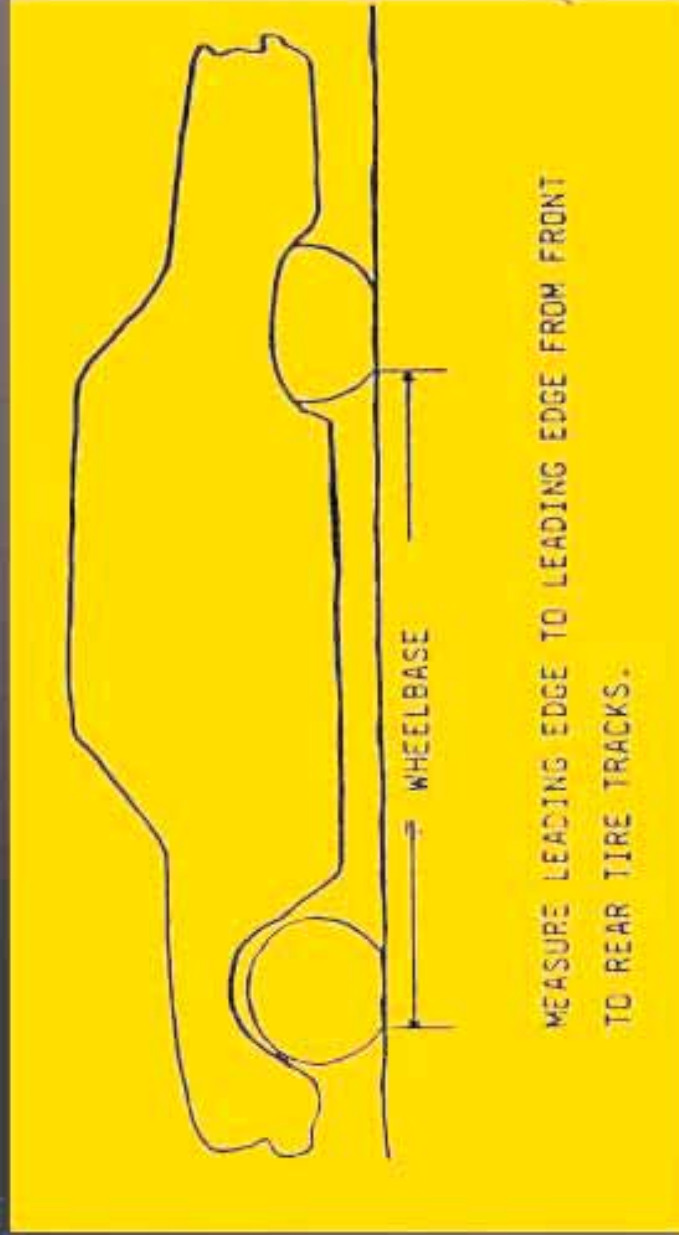
Vehicle Track

- Michigan State Police and RCMP operate data bases for American and foreign vehicle specifications
- Search is based on 3 measurements:
 - Wheelbase
 - Front track width (stance)
 - Rear track width (stance)

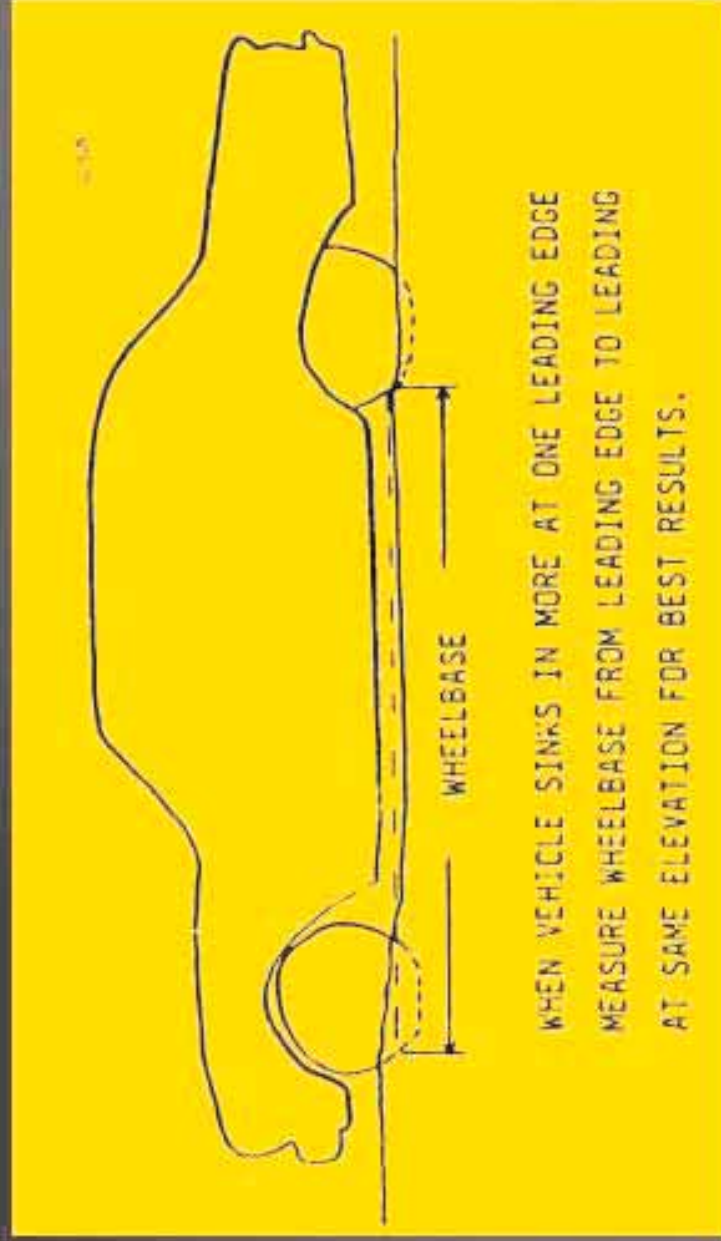
Additional Measurements

- At crime scenes some additional measurements may be obtained:
- Tread design width (arc width)
- Turning diameter
- Tread depth (skid depth)

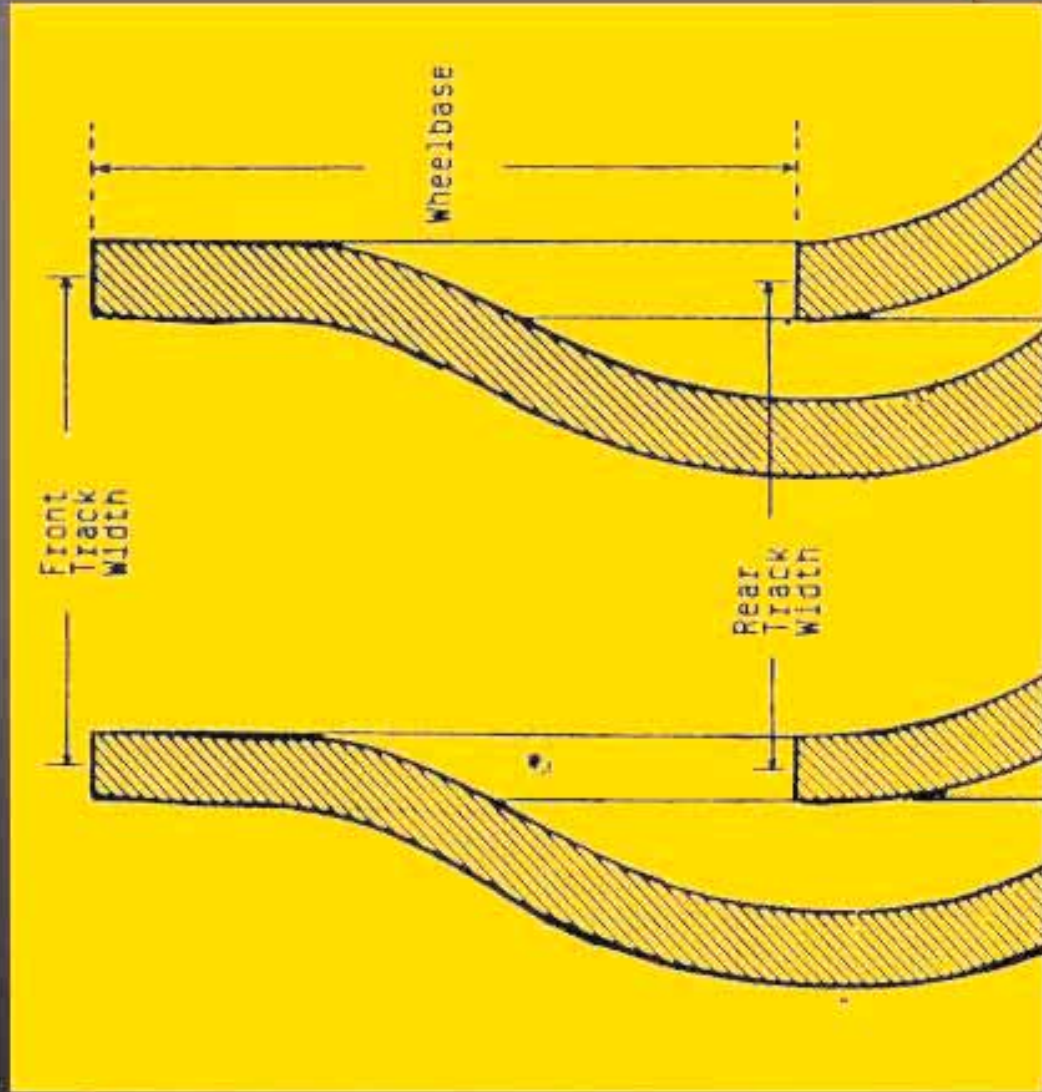
Measuring Wheel Base



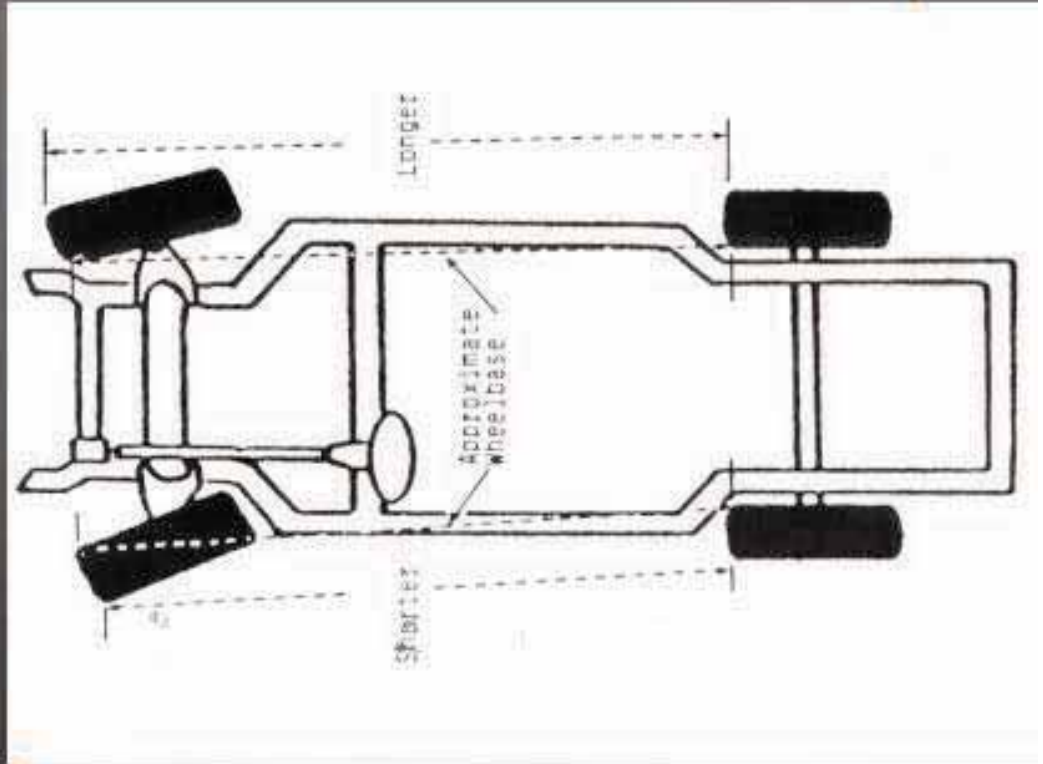
Measuring Wheelbase in Mud, Snow, etc.



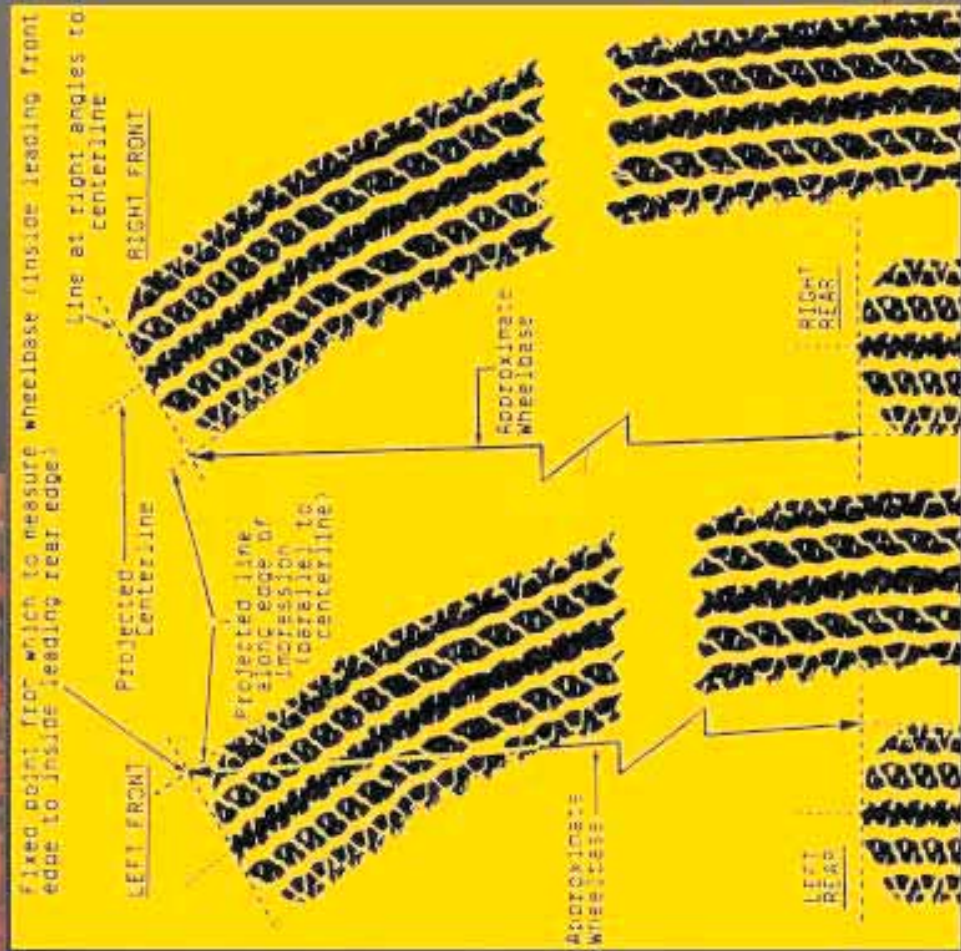
Wheelbase and Track Measurement



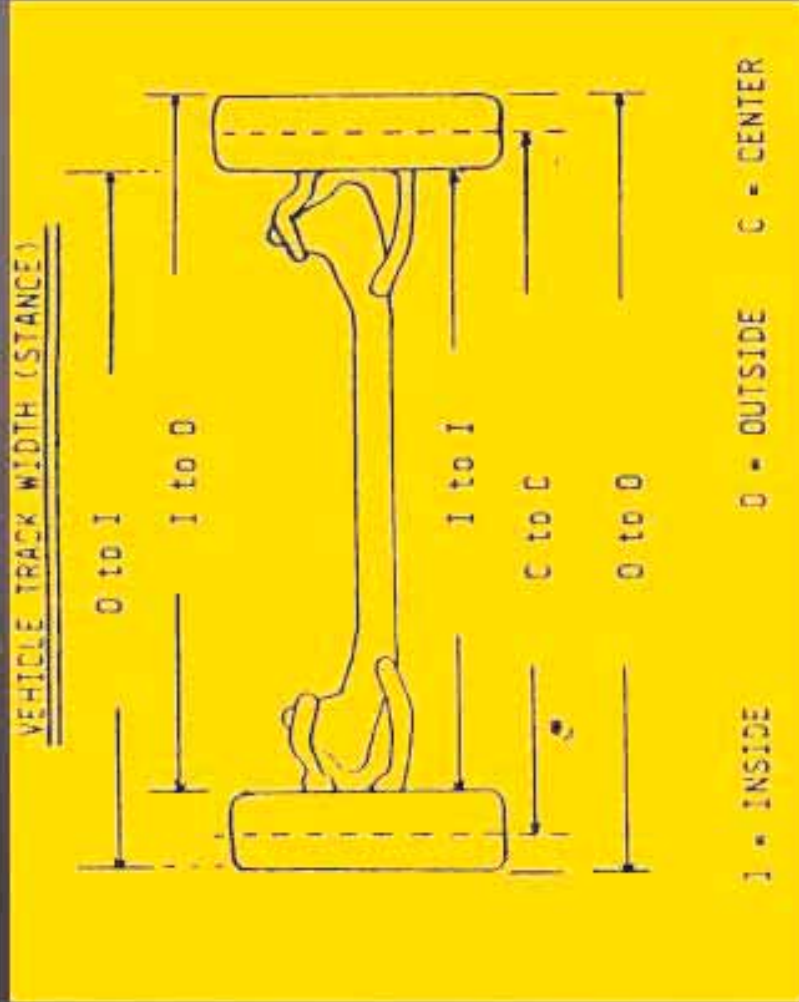
What if tires are Turned?



Measure Inside Leading Front Edge to Inside Leading Rear Edge



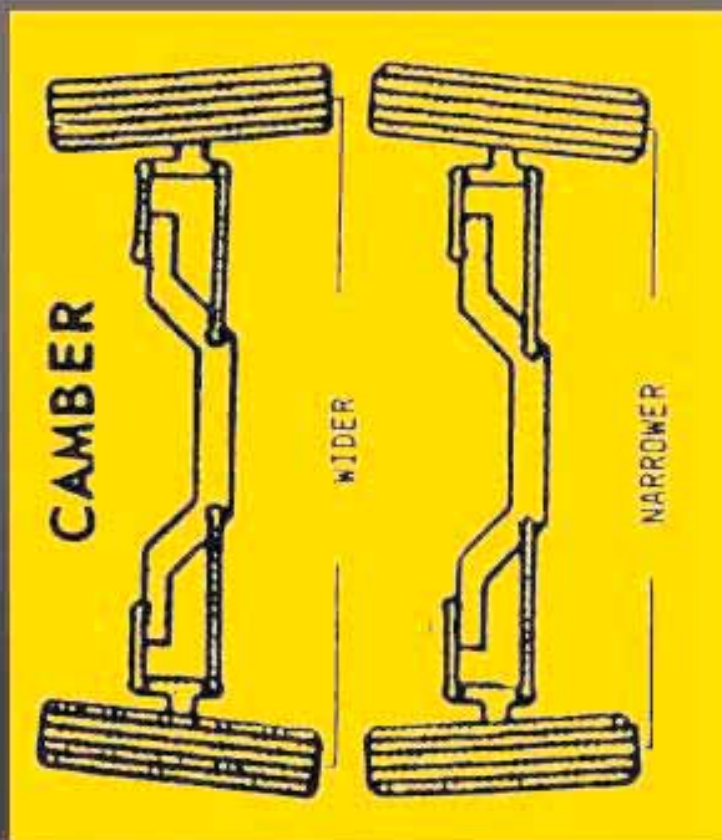
Vehicle Track Width (Stance)



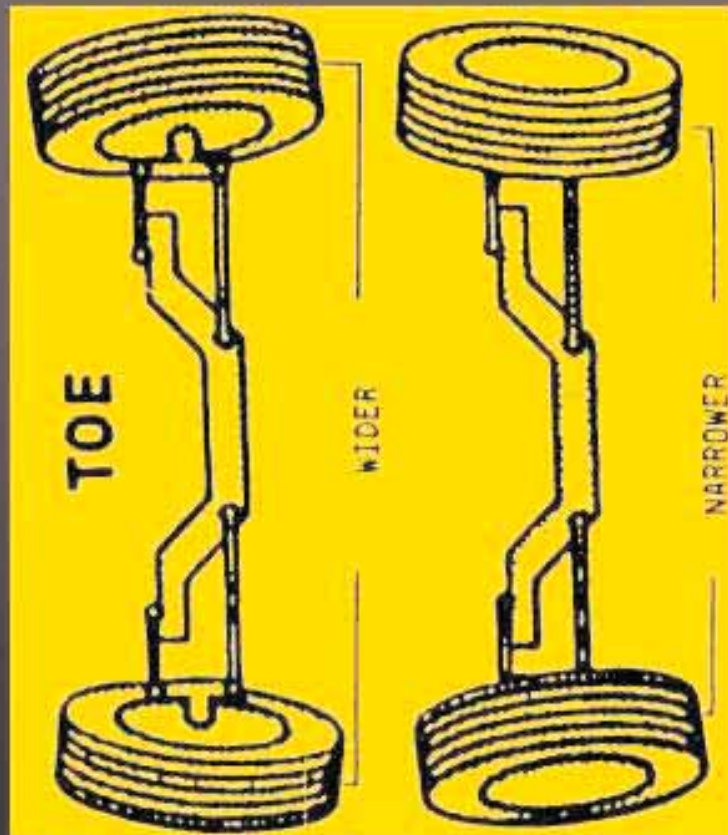
Factors Effecting Track Width

- Camber – Inward/outward slant of tire to compensate for load
- Toe in/out – difference between the width of the leading tire edges and trailing edges

Camber



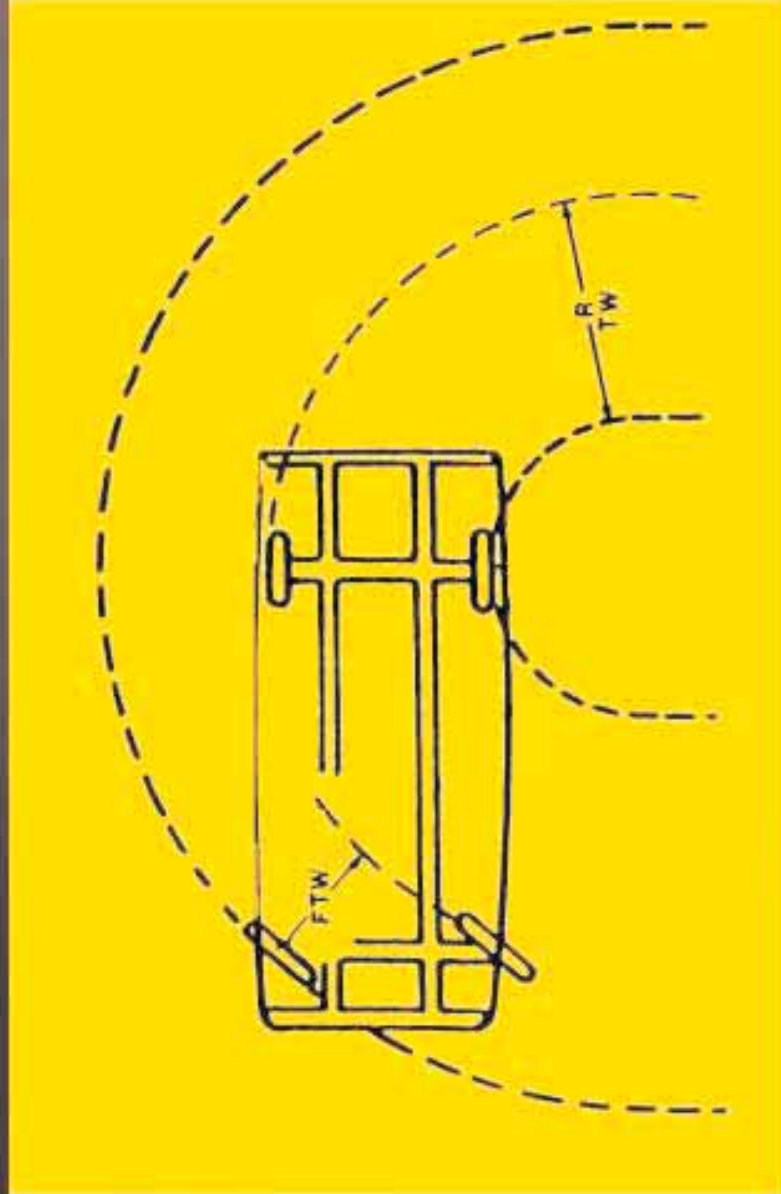
Toe In/Out



What about vehicles with 4WS?

- There are presently several vehicles that offer 4ws
- Examples include the Honda Prelude and Mazda 626
- At highway speeds the rear wheels turn as the front are turned but to a lesser degree
- At low speed the rear turn opposite the front to a maximum of 5 degrees

What happens to front track width on a turn?



Track width for dual axle vehicles

MEASUREMENT OF TRACK WIDTH

FOR DUAL AXLE VEHICLES

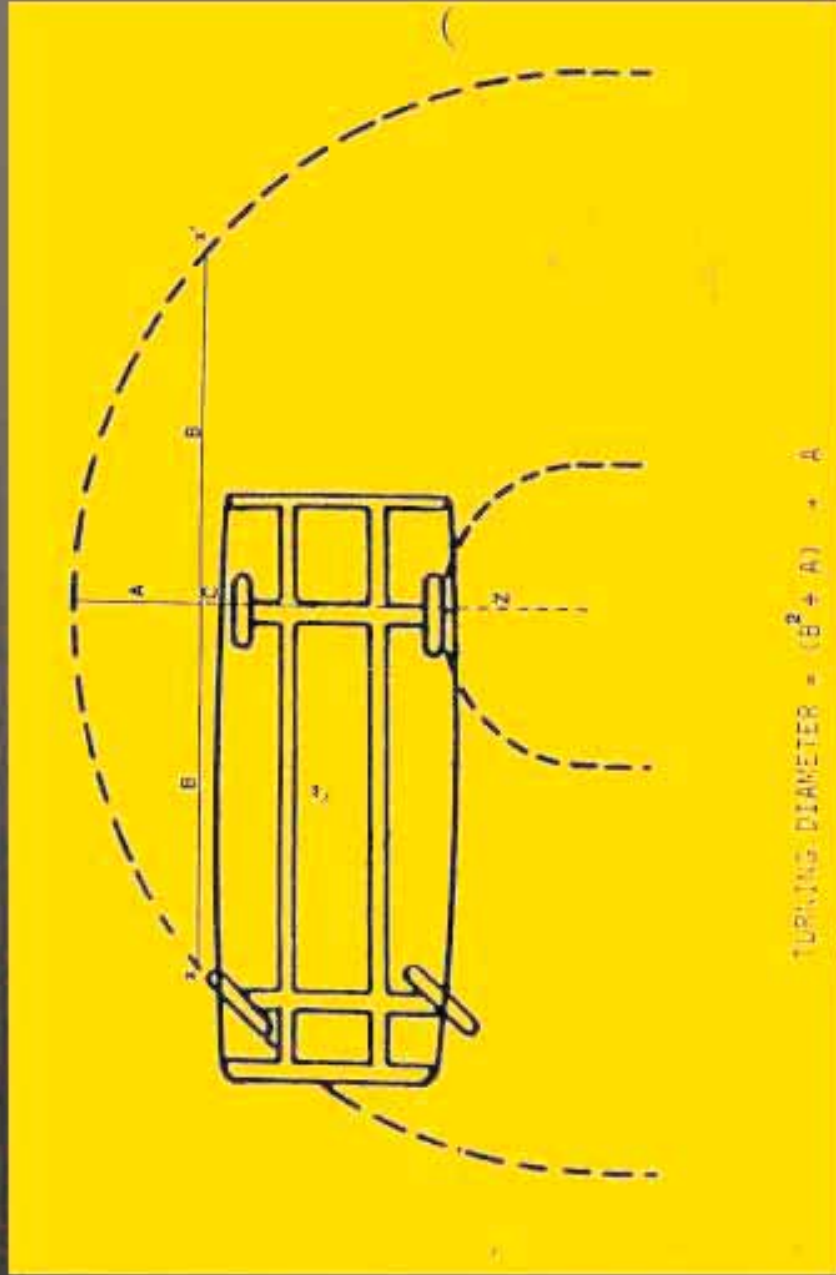
(STANCE)



TAKE MEASUREMENT FROM
CENTERPOINT BETWEEN THE

TWO TIRES

Measuring Turning Diameter



Tread Design Width (Arc Width)

- Measurement across tread from one edge to the other in the tread design
- Sometimes difficult to distinguish at scene
- If discernable, can lead to size, sidewall treatment and type of vehicle

Tread Design Depth (Non-Skid Depth)

- Depth gauge on calipers can be used to measure
- Most new tires are $11/32$ to $12/32$ of an inch
- Ex 1: scene = $8/32$ " , suspect tire = $10/32$ "
- Ex 2: scene = $10/32$ " , suspect tire = $8/32$ "

Identifying Tire Design

- Tread Design Guide – Boca Raton, Florida
- Who Makes It and Where? Directory – Boca Raton, Florida
- CD Rom – Boca Raton, Florida

VI. GLOSSARY

Dental stone – dry powder casting material used by dentists to make casts of dentition. A superior medium for casting impression evidence (3-D)

2-D Impression – one with no perceptible depth

3-D Impression – one with perceptible depth

Stance – center to center measurement between front or rear tires

Tire Impression Evidence – the result of a tire pressing against a surface

Turning radius – minimum diameter required to make a complete 360-degree turn

Wear bar – raised area in tire tread that indicates the minimum safe tread depth

Wheel base – distance between front and rear wheels

VII. REFERENCE LIST

McDonald, Peter; Tire Imprint Evidence; CRC Press, 1986.

Saferstein, Richard; Criminalistics: An Introduction to Forensic Science; Seventh Edition, Prentice Hall, 2001.

“Tire Tread Design Guide” and “Who Makes it and Where”, Tire Guides, Inc. Boca Raton, Florida.

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VIII. TEST QUESTIONS

1. Tire mark/impression evidence may be:
 - a. either 3-dimensional (3-D) or 2-dimensional (2-D).
 - b. either photographed or cast.
 - c. either short or long.
 - d. either left or right.
2. Tire impressions on pavement:
 - a. are useless.
 - b. cannot be photographed.
 - c. are 2-D impressions.
 - d. are only made by worn tires.
3. Tire impressions in soft soil or mud are called:
 - a. 3-D impressions.
 - b. positives.
 - c. remnants.
 - d. resources.
4. Tire stance is the _____ distance between the front or rear tires.
 - a. center to center
 - b. inside to inside
 - c. outside to outside
 - d. side to side
5. Wheel base is the _____ distance.
 - a. left to right front
 - b. left to right rear
 - c. rear to front (center to center)
 - d. right front to left rear
6. Wheel base measurements from impressions assume a:
 - a. compact car.
 - b. large vehicle.
 - c. locked steering wheel (wheels fully to right or left).
 - d. steering wheel at the mid-point (straight ahead).
7. Tire stance is typically:
 - a. the same in front and rear.
 - b. different in front and rear.

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8. The formula $TD = 2 (c_/8m + m/2)$ is used to calculate:
 - a. turn direction.
 - b. total distance of skid.
 - c. turning diameter.
 - d. time of drag.

9. A database for determining a possible vehicle from measurements of tire impressions is maintained by the:
 - a. FBI.
 - b. Michigan State Police.
 - c. DEA.
 - d. ATF.

10. Two measurements of particular importance in documenting 3-D tire impressions are:
 - a. length and width.
 - b. length and depth.
 - c. width and depth.
 - d. point of origin and point of termination.

11. Tire impression evidence:
 - a. should be both photographed and cast.
 - b. may be either photographed or cast.
 - c. is difficult to destroy.
 - d. is never identifiable to a particular tire but still needs to be collected.

12. Tire stores frequently:
 - a. maintain records of sales to individuals.
 - b. add serial numbers to tires.
 - c. make test impressions of tires for reference.
 - d. alter tire identifying marks.

13. Wear bars are:
 - a. found in the tread and show depth of tread remaining.
 - b. tools used to measure tire treads.
 - c. the tread elements in tires.
 - d. tools used to dismount tires.

14. Serial numbers are sometimes found on _____ tires.
 - a. large truck
 - b. tractor
 - c. small vehicle
 - d. passenger car

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15. A useful reference for determining brands from tread designs is:
- a. "Tires, Tires, and More Tires."
 - b. "It's Time to Retire."
 - c. "Tire Tread Design Guide."
 - d. "Tires from A to Z."