F. Collection & Preservation of Firearms Evidence

1. Firearms

#31

(A) most important - SAFETY - all precautions taken to make sure there is not an accidental discharge of a loaded weapon in transit.

- usually need to unload
  - 1ST record position of weapon's hammer & safety position & location of all fired & unfired ammo in the weapon.

#32

revolvers

(B) chamber position is indicated by a scratch mark on the cylinder when it aligns w/ the barrel. Each chamber gets a #. Useful in determining sequence of events.

(1) each round should be placed in a separate box/ envelope.

(2) if automatic, magazine is removed & checked for prints & then chamber is emptied.

(C) Evidence tag is attached to the trigger guard.

2. Ammunition

(A) primary concern - protection of class and individual markings on bullets & spent cartridges

(1) free bullets embedded in surfaces by carefully breaking away the surrounding material while avoiding direct contact w/ bullet.

(2) wrap bullet or casing in tissue paper to protect it before packaging it

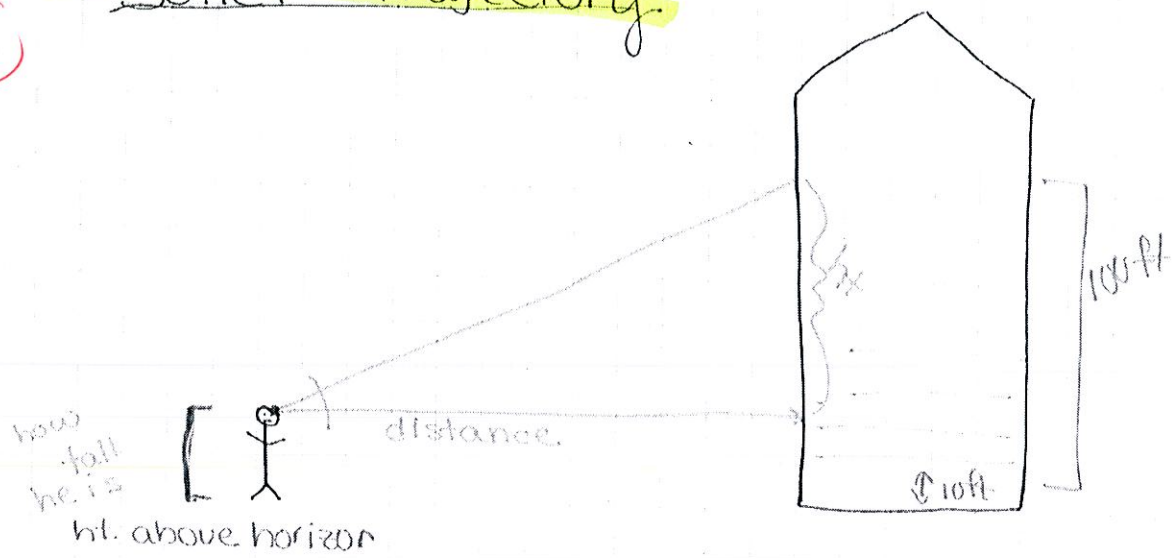
(3) Note the exact location

3. Gunpowder Deposits

(A) collect clothes of victim, each item in a separate paper bag.

#33

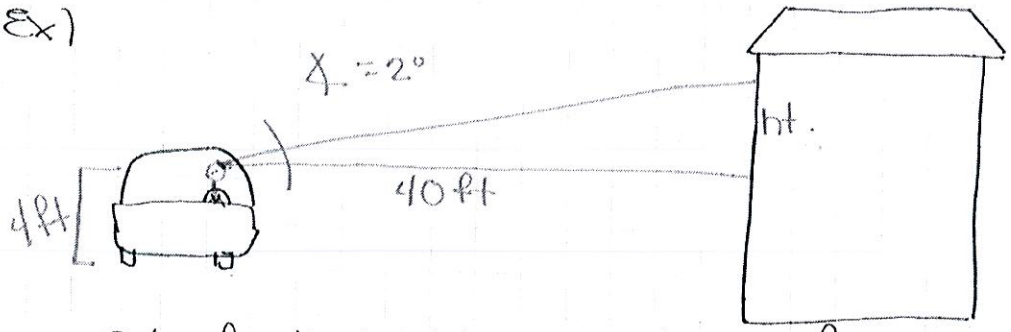
# Bullet Trajectory




$$\text{ht.} = \text{distance} \cdot \tan \measuredangle$$

$$\text{total ht} = \text{ht} + \text{ht. above horizon}$$

(Ex)




Solve for the height the bullet came from.

$$\text{ht} = 10\text{ft} \cdot \tan 2° = 1.4\text{ft}$$

$$\text{total ht} = 1.4\text{ft} + 4\text{ft} = \boxed{5.4\text{ft}}$$

D. Automated Firearms Search Systems

1. Early Systems (early 1990s)

competing systems

(A) FBI - DRUGFIRE: examined unique marks on spent cartridges on video

(B) ATF - IBIS - Integrated Ballistic Identification System - microscopic images of spent bullets & cartridges

(Bulletproof - bullets) & Brasscatcher (cartridges)

#34

2. NIBIN - National Integrated Ballistics Information Network

Now

(A) incorporates DRUGFIRE & IBIS

(B) run by the ATF, communications run by FBI

possible future

3. Ballistic Fingerprinting - capture & storage of markings on bullets & cartridges of all guns during test-fire BEFORE being sold.

(1) issues: who collects the data & who maintains data

#35

E. GSR - gunshot residue - if the gun muzzle of a fired gun is close enough to the victim, then GSR will be left around the bullet hole.

1. Distance determination

(A) Handguns & Rifles

- less than 1 inch from victim - heavy concentration of vaporous lead near the hole, scorch bullets, & stellate - star-shaped tear pattern around the bullet hole
- 12-18 inches away - halo of vaporous lead around the hole
- up to 25 inches away - presence of scattered specks of unburned or partially burned powder
- more than 3 ft. away - usually no residue, may only see a bullet wipe - dark ring around the hole

#36a & b

(B) Shotguns - muzzle to target distance is estimated by measuring the spread of the discharged shot

- close-range → 4-5 ft. spread
- usually 10 inches spread for every 1 yd (3 ft)
- factors affecting spread
  - barrell length, size of shot, # shot, quantity of gunpowder used, & choke
    degree of restriction placed on the end of the gun barrel

#37a

2. Powder Residue on Garments
   - can't always see GSR on clothings
   - use IR photography to see it
   - Greiss test - chemical test #38

3. Primer Residue on Hands - on thumb web & back on hand holding gun
   A. early days - dermal nitrate test
   B. now -
      (1) swabbing using a Q-tip dipped in 5% nitric acid solution & Q-tips sent to a lab to look for lead styphnate, barium nitrate, antimony sulfide (found in primer) 4 Qtips - 2/hand - 1 front & 1 back #37b
      (2) SEM test - apply adhesive to hand to remove to be found on a scanning electron microscope. #39 - more accurate & tons more expensive
      (3) other tests
         (a) neutron activation analysis - used in conjunction w/swabs - expensive
         (b) flameless atomic absorption spectrophotometry - fairly cheap

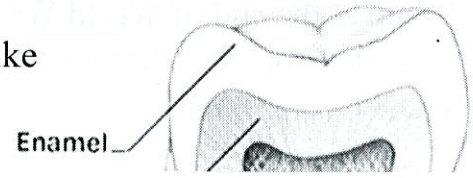
# Introduction

- **Odontology**—the study of the anatomy and growth of teeth and diseases associated with the teeth and gums
- Forensic Odontologists uses knowledge of the teeth to:
  - *Identify victims of mass disasters*
  - *Help police in criminal investigations*
  - *Verify signs of abuse*

#40

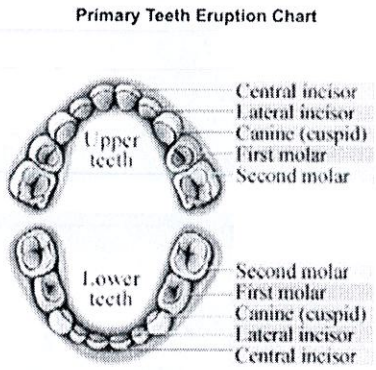
# Teeth & the Body

- Every human body ages in similar manner
  - Teeth follow semi-standardized pattern
- Each human has an individual set of teeth
- Teeth are made of **enamel**
  - Can withstand trauma – decomposition
- Thin outer covering of the tooth
- **Hardest tissue** in the human body
- Reason why teeth can withstand high stressors like extremely high temperature, water desiccation



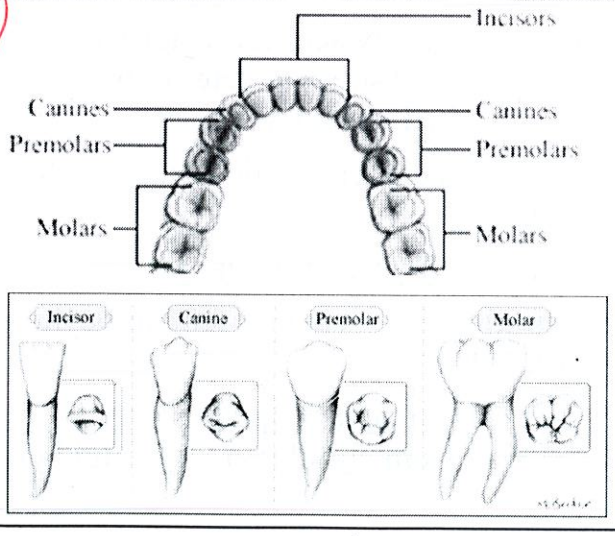
# Deciduous Teeth

- Primary teeth sprout from milk buds and are temporary
- Fall out to make room for permanent teeth
- Teeth begin to appear at 6 months of age and all should have emerged by age 3
- Humans have **20** deciduous (baby) teeth #41
- Between the ages of 7-21 years all of the deciduous teeth should have been replaced with permanent teeth



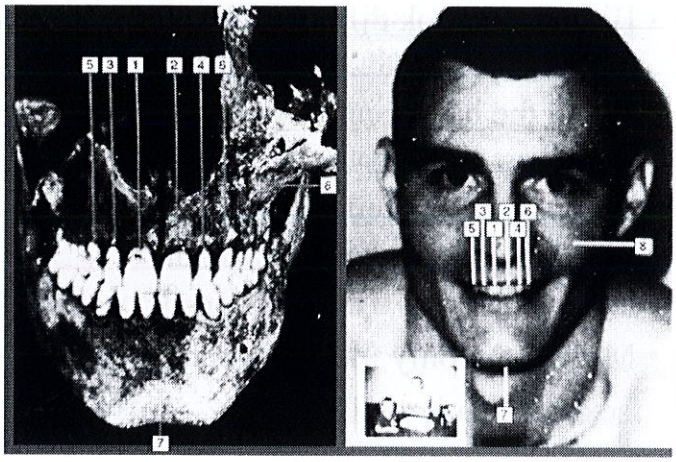

# Permanent Teeth

- Approximately **32** teeth in adult mouth #41
- 4 types:
  - ***Molars*** (chewing & grinding)
  - ***Premolars*** (chewing & grinding)
  - ***Canine*** (tearing)
  - ***Incisors*** (biting)
- Teeth differ in size, shape, and root type



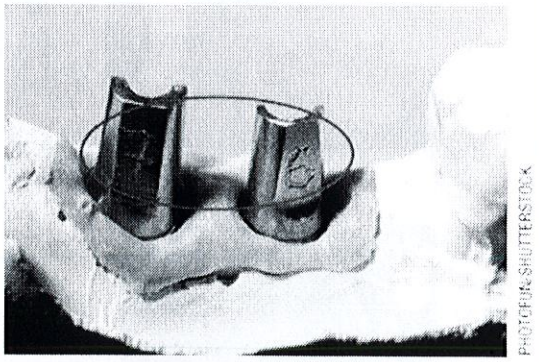
# Identifying Remains by Teeth

- A forensic odontologist compares dentals records with the victim's remains
- Dental alterations—*fillings, caps, bridgework, and dentures*
- Teeth—*size, shape, gaps, cracks, alignment, missing or extra one, wears, stains*
- **Dentition**— the pattern made by a particular set of teeth



# Dental Records

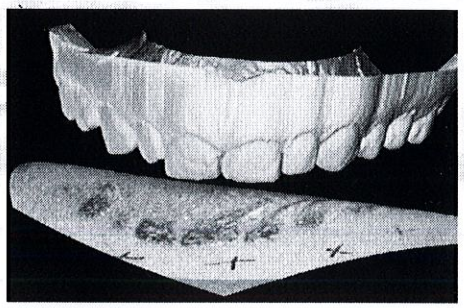
- Forensic Odontologist compares
  - The ***antemortem*** records (*take during life*)
  - The ***postmortem*** records (*recorded after death*)
- **The Universal System**
  - Teeth are given a specific number
    - Primary teeth are given specific capital letter
  - Any dental work done on surface is noted
  - Sheets kept on dental file forever - when person is missing, files are transferred to missing person office



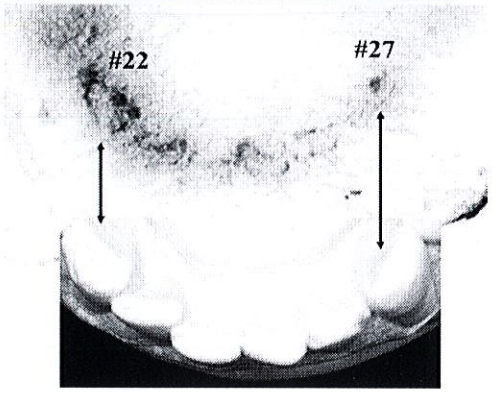
PHOTOFUN/SHUTTERSTOCK

***Figure 11-12.*** *The serial numbers of the dental implants are circled in red.*

# Analysis of Bite Marks



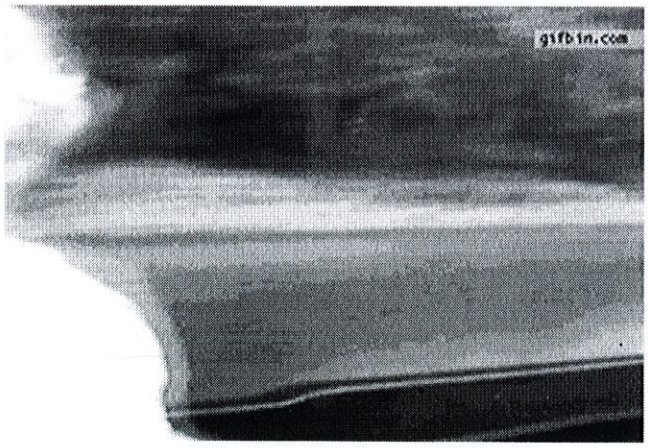
- In a bite mark comparison, you are looking for and matching **unique features** between the bite mark and exemplar castings
- These features may include:
  - *Gaps*
  - *Rotation (angle)*
  - *Size of teeth*
  - *Width from tooth to tooth*

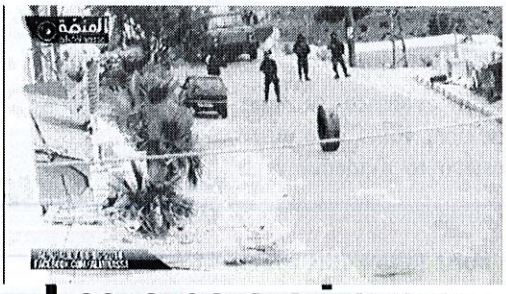


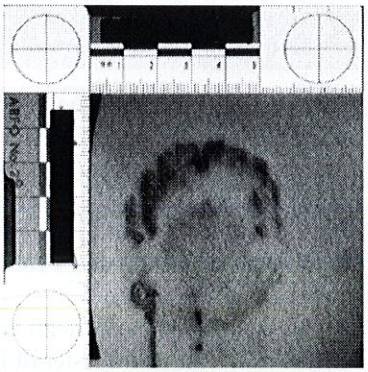

# How reliable is Forensic Odontologist?

#43

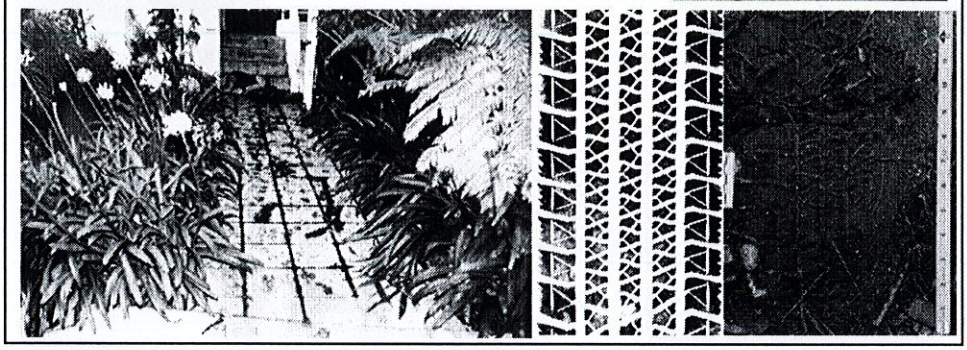
- **Not very accurate**
- Why? Soft tissue will swell or distort and two people can have similar teeth construction
- However, bite marks can exclude suspects





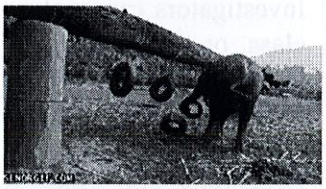


# Impressions

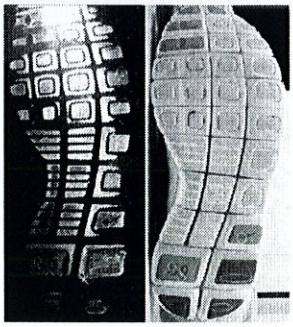


## Impressions

✓ Impression evidence can be defined as **objects** or **materials** that have retained the characteristics of other objects through direct **contact**.



✓ Impressions are created when one object is pressed against another material with enough **force** to leave an impression of the object.

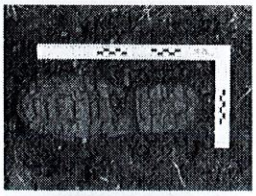


✓ **Shoeprints, tool marks, tire tracks, bite marks**, and **marks** on a **fired bullet** are several examples of impression evidence.

#44

Images: http://upload.wikimedia.org/wikipedia/commons/archive/6/61/20070917141644!Shoeprint_forensic.jpg and http://www.topmark.co.nz/images/content/tmpics01/gallery-s/SilipressionTeethMold.jpg

Investigators analyze the impression evidence to find unique **characteristics** to link shoes, tires, tools, and other objects found in a suspect's possession to evidence at a crime scene.



#45

**Collection of impression evidence must follow this exact procedure:**

1)Photograph and measure all impression evidence

2)Carefully cast with Plaster of Paris

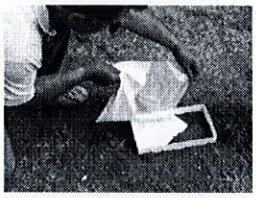
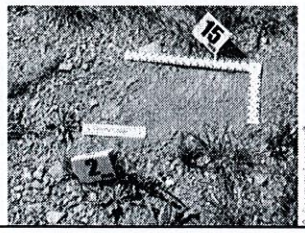
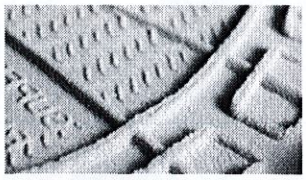
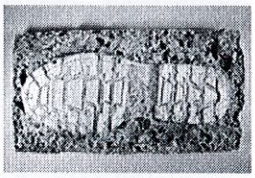


Figure 16-4 *Impression evidence is documented before any attempt is made at casting.*




Example of Shoe Print in Bio-Foam Impression Foam





Images: http://www.evidentcrimescene.com/cata/cast/dscasting.html

Investigators can analyze a shoe print to determine its **class**, or the type and brand of shoe. They will also look for **individual** characteristics, such as **wear patterns** and specific **damages** or **defects**.

Depending on the quality of the impression, investigators may be able to determine a person's **speed** (walking vs. running) as well as estimate the **size** of a person based on the impression's depth.

Figure 16-3 *This impression in snow reveals two things about the gait of the person who left it: he or she was walking, not running, and he or she walked with toes pointed outward.*

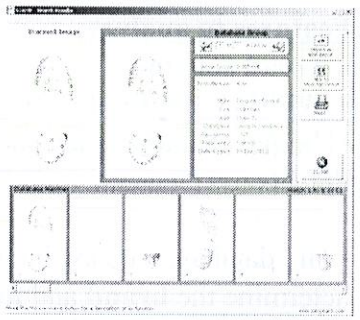
#46

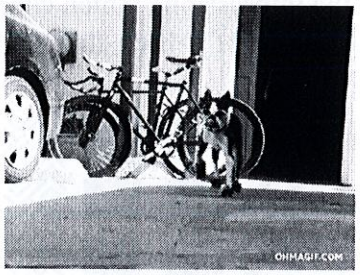
**Features to analyze:**

- **Tread** patterns, size, and depth
- **Wear** patterns caused by the way a person walks
- Material defects or **damage** (nicks, cuts, etc.)
- Other **trace** materials, such as soil, tar, rocks, and paint that would indicate where a person has been

Images: http://www.stampmatch.com/results.html and http://www.fosterfreeman.com/products/shoeprints/solemate/solemate.html

- Databases contain the names of specific manufacturers and tread patterns used to identify different types of shoes.
- Crime-scene investigators can search the databases to find:
  - The manufacturer that produced the sole pattern
  - The company that purchased the sole for the shoes
- If a large number of manufacturers use the same generic sole patterns, it complicates sole identification.



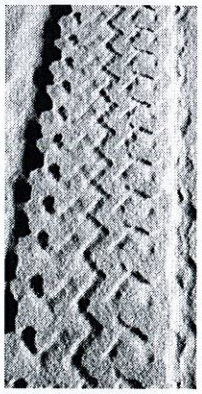


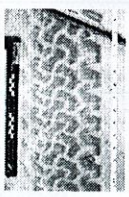

5

#47

#48

- Tire tracks are important in forensic investigations and are usually found in road **accident** scenes or in the access and **escape** routes of other crime scenes.
- Tracks help investigators identify the type of **vehicle** that left them.
- Investigators may make **ink prints** of a tire or **plaster casts** of a track.
- They will also take **photographs** that can later be used to prove a match.





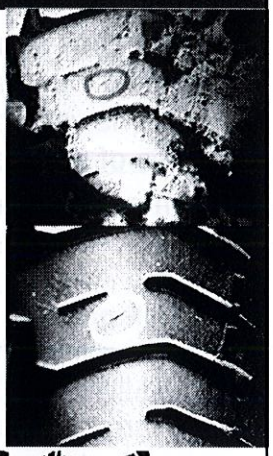
Images: http://www.suite101.com/view_image.cfm/454216, http://www.ronsmithandassociates.com/FWTTS.htm.

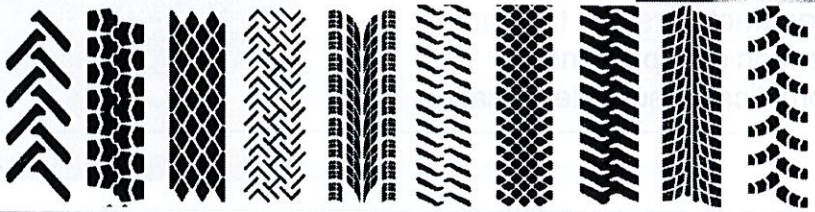
#49

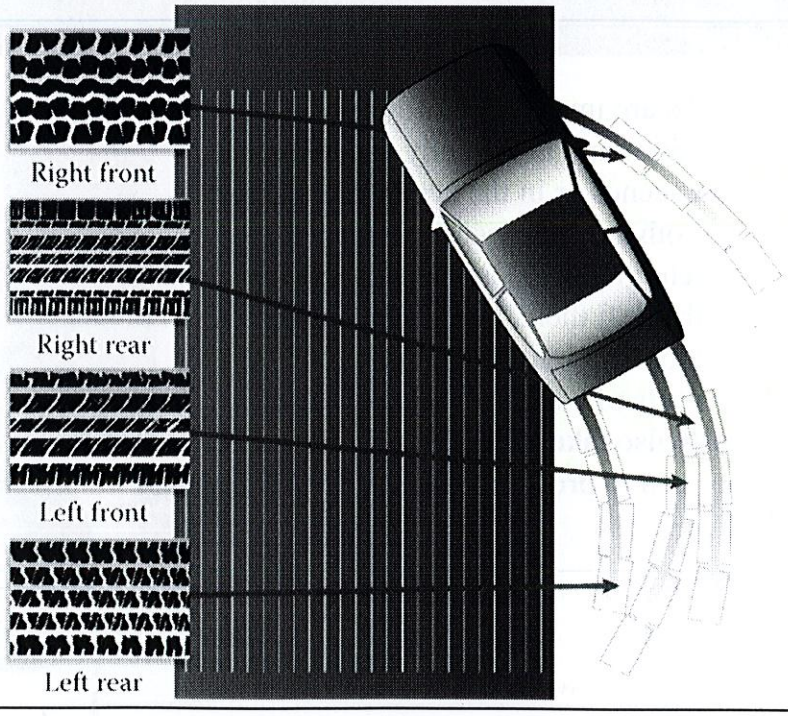
**Features to analyze**:

- **Tread** pattern
- **Width** & **depth** of the tread pattern
- Unique characteristics due to the **wear pattern** or **defects**

- Tire databases are available help investigators determine the **brand** and **model** of the tire that left the impression , which can be used to determine the type of **vehicle** that made the tracks.







- **Tread area-** the part of the tire that meets the road
- **Rib-** an individual ridge of tread around the tire
- **Groove-** a depression in the tread

#50

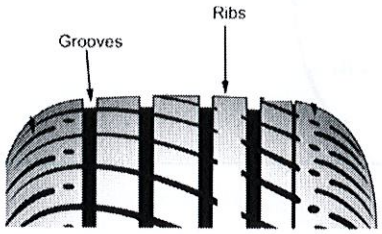



Figure 16-10 *A tire tread.*

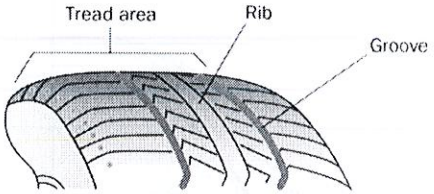
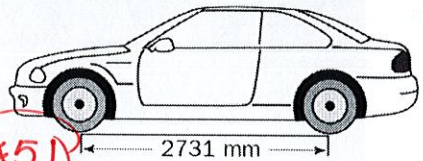
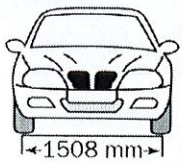



Figure 16-11 *Every make and model of vehicle has its own track width and wheelbase measurements.*




#51

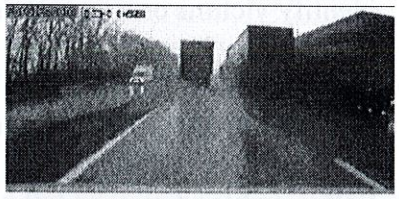
**Wheelbase**




**Front track width**


**Rear track width**

#52



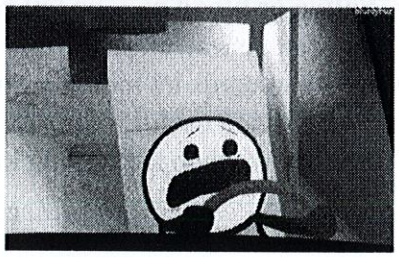
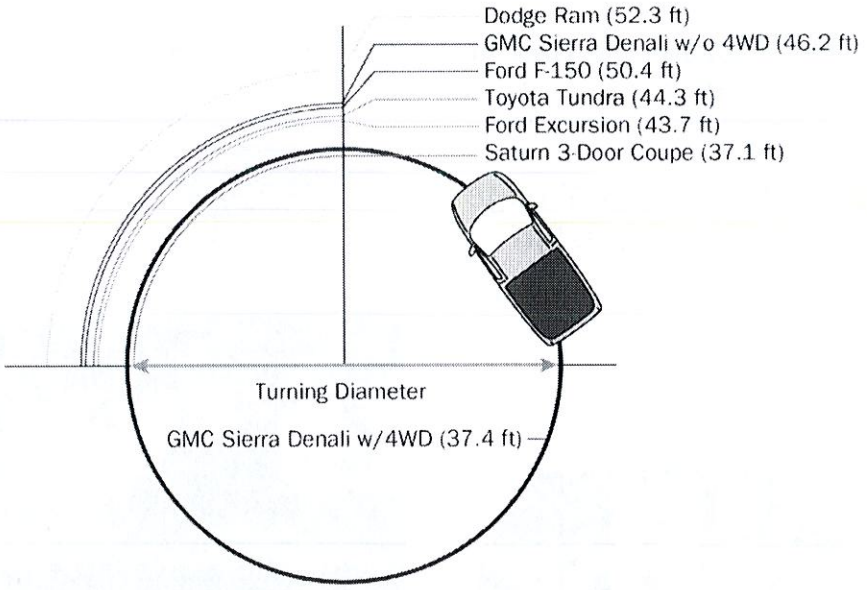


Figure 16-12 *Tread marks revealing turning diameter can help identify a vehicle. Which of these vehicles has the smallest turning diameter?*




- Investigators can analyze **bite marks** for characteristics to help them identify victims or suspects as well as to exclude others.
- Marks can be left on a victim's **skin** or other **objects**, such as Styrofoam cups, gum, or foods.
- **Saliva** or **blood** may be left behind that can be tested for **DNA**.
- Dental records including **x-rays** can also provide useful information, especially when attempting to identify a victim.

Images: http://www.forensicdentistryonline.org/Forensic_pages_1/currentopic1.htm, http://www.trestonedental.co.uk/images/0303.jpg

# Tire Impressions

- can be lifted from: dirt
  snow
  sand

- Impression lifted (collected) using: #48
  Plaster of Paris
  dental stone
  sulfur
  snow print wax

- Investigators look for unique characteristics: #49
  wear & tear
  pebbles embedded in grooves

- Suspect tire impression does 1 complete revolution of the tire.

- Identifying Characteristics:

  • track width (front & rear) #52
  - distance from center of 1 tire to the center of the 2nd tire

  • wheel base #51
  - the distance from the front axle to the center of the rear axle


  • turning diameter #53
  - the distance required for a car to make a U-turn (½ a circle)