Module 5D
Tool Marks & Impressions

Forensic Science Teacher Professional Development
Unit 8
The Collection and Preservation of Tool Marks, Tire, and Shoe Impressions
Definition of a Tool Mark

- A tool mark is a pattern resulting from a harder marking device (tool) being forced against a softer object.
- Tool marks are usually either striations (scratches) or impressions.
- Striations result from a sliding action, whereas impressions are a result of forcing the tool into the surface.
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Figure 18 shows an example of striations. Striations from a screwdriver scraping against a surface is a typical example of this type of tool mark. Figure 19 shows an example of an impressed tool mark. A firing pin pattern is a typical example of this type of tool mark.

Figure 18
A striation tool mark on lead produced by slicing the surface with a screwdriver tip

Figure 19
Firing pin pattern on a fired cartridge case
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Types of Tool Marks

- Indented marks occur when the tool is pushed into the surface.
- Striated marks occur when the tool slides across the surface.
- Combination marks occur when the tool is pushed in and then slides across the surface.
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Collection of Tool Marks

- A tool mark on a movable object should be protected and sent to the lab.
- A tool mark on a fixed item should be thoroughly photographed and then cast using silicone rubber.
- Proper evidence collection by the field investigator would include taking a photograph and cast of the marks, if necessary.
- Objects bearing tool marks should be submitted intact to the crime lab or a cast should be made of the tool mark.
- A suspect tool should never be placed into the tool mark, as there is a potential to damage the mark and compromise the value of any residue on the tool surface.
Collection and Preservation of Tool Mark Using Silicon Casting

Figure 2: Photograph of the tool mark with scale. Figure 3: Misting the outlined tool mark area with silicone emulsion spray. Figure 4: Injecting polyvinylsiloxane into the tool mark. Figure 5: Fingerprint card placed over the impression material and adhered to the orthodontic wax. Figure 6: Labeled fingerprint card. Figure 7: Final impression.

Figure 20  (Note figure 1 of the diagram was intentionally left out)

Steps of collection and preservation of tool mark using silicon rubber
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Tire and Shoe Impressions

- Similar to tool mark patterns, tires and shoes can produce impressions and striations.
- Not all tires and shoes will leave impressions when coming in contact with a surface.
- If the surface is soft, such as mud, dirt, or snow, the tire or shoe will leave an imprint under the weight of the vehicle or the individual.
- If the surface is hard, such as road pavement, the tire or shoe might still leave a trace if dirt or dust was present.
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Figure 21
Example of a tire impression
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Figure 22
Collection of standard and/or reference tire track pattern
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Shoe and tire marks impressed into soft earth can be best preserved by photographing and casting with dental stone.

Figure 23
Examples of shoe impressions
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Tire and shoe impressions can be preserved by photography or casting. The steps of shoe impression photography and casting with dental stone are discussed on the following slides. You may also view the following website for the same information.

Step 1

- Photographic documentation should be undertaken prior to any casting.
- A tripod with an invertible column is ideal.
- In a rare case of improper dental stone mixing, pouring or retrieval, this photograph could provide sufficient detail to make a comparison.
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Step 2

- A photographic scale is always used to provide reference to size and proper parallax.
- A photograph should be taken with and without a photographic scale.
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Step 3

- The camera frame should be completely filled with as much of the impression as possible. This provides the maximum amount of detail for comparison purposes.
- The use of oblique lighting with a flash from various directions can increase the chance of successful comparisons of the impression.
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Step 4
- After photographic documentation is complete, a casting frame should be carefully placed around the impression in order to contain the dental stone.

Step 5
- Use 3 pounds (1.36 kg) of dental stone for shoe impressions, 4 pounds (1.81 kg) or more for tire impressions (depending upon total impression area).
- Add 6 ounces (177.5 ml) of water to every pound of dry dental stone.
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Step 6
- Thoroughly mix the dental stone in a large resealable plastic bag.

Step 7
- Immediately after mixing, carefully pour the dental stone mixture into the impression.
- Allow the mixture to slowly spread from one end to the other, completely filling the casting frame.
Step 8
- Allow the cast to cure (dry) for 30-45 minutes.
- When curing is complete, a gentle tap on the back of the cast should resonate with a high pitched sound; an uncured cast will emit a dull sound.
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Step 9

- Dependent upon agency or laboratory policy, the attached soil may be left on the cast until time of examination.
- The attached soil should be left in place and only removed by a trained examiner.
Step 10

- Detailed cleaning by a qualified examiner can reveal sufficient uniqueness for positive individualization.
- Conclusive comparisons with known footwear or tire treads are possible if proper casting techniques have been followed.
Electrostatic lifting device

Dust shoe prints found at a crime scene can be lifted using an electrostatic lifting device.

Figure 24

An electrostatic lifting device includes the following.

• Power pack with rechargeable sealed lead-acid batteries
• AC battery charger
• Lift film 25 sheets
• 22 x 40 cm (9” x 16”) probe
• Flashlight
• Ground wire with clip
• Set of Bureau photographic scales
• Roller
• Transparent scale

More detailed information can be viewed at the website below.

Unit 9
Class and Individual Characteristics of Tool Marks, Tire, and Shoe Impressions
Unit 9 Class and Individual Characteristics of Tool Marks, Tire, and Shoe Impressions

Class and Individual Characteristics

- Tool marks can have either class or individual characteristics and sometimes both.
- The basic size and shape of the tool mark is a class characteristic and can tell something about the kind of tool that made the tool mark.
- The individual characteristics of tool marks are the striations and small particularities exhibited by the tool that are unique to that tool.
Unit 9 Class and Individual Characteristics of Tool Marks, Tire, and Shoe Impressions

Residue from a Softer Object on a Tool

- The tool should be first examined for residue using a stereomicroscope.
- If the residue on the evidence tool is shown to be consistent with the surface that was scratched, the association of the tool with the surface is greatly strengthened.
- Material characteristics of the tool may also be left in the tool mark.
Examination and Comparison of Tool Marks

Because trace evidence may be present either on the tool face or in the mark, it is important to collect control samples from an area near the mark.

The examiner can then attempt to reproduce the tool mark by making test impressions in similar material.

The tool mark and test impressions are then examined using a comparison microscope.
Unit 9 Class and Individual Characteristics of Tool Marks, Tire, and Shoe Impressions

Examination and Comparison of Tool Marks

- The examiner may conclude that
  - the tool mark was made by that tool and no other tool;
  - the marks are consistent in class characteristics and show a number of other similarities (the tool could have made the mark);
  - the marks are clearly different (elimination); or
  - the marks are not sufficiently clear (inconclusive).
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To summarize, tool mark examinations may provide the following information:

- The type of tool that was used to make a mark
- The action that made the mark
- The presence of residue consistent with the damaged surface
- The particular tool that was responsible for the tool mark
The class characteristics of tire and shoe impressions allow the forensic scientists to establish a database for the purpose of comparisons.

For example, an automated shoe print identification system has been developed in England called Shoeprint Image Capture And Retrieval (SICAR).

SICAR incorporates multiple databases to search known and unknown footwear files for comparison against footwear specimens.
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Tire and Shoe Impressions

- Shoe print images can be entered into SICAR by either a scanner or a digital camera.
- SICAR has a comprehensive shoe sole database, Solemate™, that includes more than 17,000 footwear entries, representing more than 700 shoe brands.
- This database provides the investigators with a means for linking a crime scene footwear impression to a particular shoe manufacturer, or linking footwear impressions collected from different crime scenes.
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Tire and Shoe Impressions

- The evidential value of tire or shoe impressions is determined by the number of class and individual characteristics that the examiner can recognize.
- Size, shape, and design patterns are class characteristics of the impressions.
- Wear, cuts, and damage on tires and shoes can possibly produce recognizable individual characteristics.
- A sufficient number or the uniqueness of such points of comparison may support a finding that both the evidence and test impressions originated from only one source.
Figure 25 shows a side-by-side comparison of a crime scene shoe impression with the suspect’s boot, together with a test print produced from that boot.

**Figure 25**

An example of shoe impression comparison
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Watch the video at the link below to understand more about the reliability of forensic evidence.
http://www.youtube.com/watch?v=TGfoszmKmfY
References


http://www.firearmсид.com/


http://www.forensictechnology.com/
End of Module 5

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