

---

## CASTING THREE-DIMENSIONAL IMPRESSIONS

---



### **OBJECTIVE:**

- Given written and video reference materials and the requisite supplies and equipment, at the end of the session the student will be knowledgeable of the methods of making casts of three-dimensional impressions to the extent that the student will be able to: explain the dangers of assessing the value of a three-dimensional impression at the scene without making a cast for later examination in the identification laboratory; describe the advantages of a cast vs photographs; explain the need for, and demonstrate the proper placement of, a measuring scale when photographing the impressions; describe the effect on the evidentiary value of an impression if the object is placed in the impression in an attempt to show that it fits; select the appropriate materials for casting a given list of three-dimensional impressions; describe or demonstrate casting impressions in soil or sand, wood and snow using the appropriate casting materials; describe or demonstrate the recommended method of cleaning a dental stone cast, as evaluated by the facilitator.

---

---

## RESOURCES

---

---

- A publication of the Ontario Police College, "Casting Three-Dimensional Impressions.
- Text "Footwear Impression Evidence" by William Bodziak
- Text " Tire Imprint Evidence" by Peter McDonald

Alternate reading "Footwear Identification" by Michael Cassidy. A Canadian (RCMP) book which is now a little out of date but which contains good descriptions of the processes.

---

---

## INTRODUCTION

---

---

### **In this module you will learn to:**

- locate and collect three-dimensional impressions
- select the appropriate materials for making casts in sand, soil, snow and wood or other similarly impressible materials,
- make casts of impressions in sand or soil, snow (weather permitting) and wood or other similarly impressible material
- cast an impression which is under water
- clean a dental stone cast so that the fine detail may be more readily observed

### **Preamble**

Three-dimensional impressions are found in soft materials such as sand, soil, mud, snow, and occasionally in wooden door and window frames. They may be found, in fact, in any substrate which moulds itself to fit an object which is pressed into it.

This Guide, and the two specialized texts to which you will be referred during the module, deal only with three types of impression evidence; footwear impressions, vehicle tire tracks and tool marks. At scenes of crime you are, of course, likely to find other types such as knee impressions, elbows or wrists, bare or stockinged feet, and many others. (Friction ridge impressions are dealt with in a separate module.)

All of the methods and materials about which you will learn are readily adaptable to casting any type of impression. Footwear, tire and tool impressions are merely the most commonly encountered.

This module is intended to provide you with the basic knowledge you will require to perform the ordinary impression collection functions at a crime scene.

It is up to you to use that knowledge, along with your own initiative and creativity, to solve the more unusual problems that you will undoubtedly face.

## **HOW TO WORK THROUGH THIS MODULE**

- read the objective to discover what you will attain for your efforts.
- gather the resources listed in this Guide.
- examine the Criterion Test at the back of this Guide.
- start reading this Guide and follow the instructions.

---

The material in the Guide and Activities booklets, although integral parts of this training package, are by no means adequate by themselves to ensure success. Study the resource material. The resources have carefully selected for their relevancy to the objective.

---

## **THINGS YOU WILL NEED**

- the two listed texts
- casting materials listed with each of the exercises in the Activity booklet

---

For your safety and for the safety of those working with you, before handling any chemical, ensure you understand the content of the product label and Material Safety Data Sheets (MSDS).

---

## **A. FOOTWEAR IMPRESSIONS AT THE CRIME SCENE**

**Turn to the text "Footwear Impression Evidence".**

**Read the Preface (pp. xv - xvii)**

This gives a short explanation of the position that footwear impression evidence has, until fairly recently, held in forensic science. As the author, William Bodziak, points out, this attitude has begun to change. Police Services, and in particular the investigating detectives, are now beginning to realize the importance of such evidence and are expecting identification personnel to make use of footwear impression evidence on a regular basis.

Several Ontario identification units are placing great emphasis on this evidence and one unit has reported making 45% of their total identifications on footwear impressions alone.

**When you have completed the above reading, answer the following questions:**

1. According to the author, which groups have, in the past, been given the responsibility of dealing with footwear impressions in the U.S.?

---

---

2. What has been the effect of this fragmentation of effort?

---

---

3. From your present knowledge, state which group or groups in Ontario have the responsibility for locating, collecting and interpreting footwear impressions.

---

---

**Now read Chapter 1 (pp. 1 - 24)**

This chapter provides an overview of the subject, discussing such topics as the importance of footwear impression evidence, the surfaces upon which you would expect to find them and how to find them. Finally, the text leads you through a hypothetical crime scene to provide you with a scenario in which footwear impressions may, or may not, be found.

When you have completed the above reading, answer the following questions:

4. If other persons have walked about at the crime scene, leaving their footwear impressions mixed with those of the suspect, could it still be possible to locate and collect those of the suspect? Explain your answer.

---

---

---

---

5. Describe the two types of characteristics used for comparison of an impression with the footwear.

---

---

---

---

6. With which type of characteristic is it possible to positively identify a specific shoe?

---

---

7. According to the author, what percentage of the population could be expected to be wearing the same size and design of shoe?

---

---

8. Why is walking gait measurement, on its own, not a useful means of identifying a subject?

---

---

9. Would static footwear impressions be more likely to be found in summer or winter in Ontario? Explain your answer.

---

---

10. Explain the difference between positive and negative two-dimensional impressions.

---

---

11. What lighting arrangement should be used to visualize dry residue impressions on a smooth floor?

**Note:** In the textbook, diagram 1.6(a) shows a footwear impression that has been dusted with black fingerprint powder but the accompanying text on p.15 describes it as being enhanced with silver powder. The diagram is correct, the text is in error.

---

12. Which of the reasons given for lack of success in finding footwear impressions at a crime scene could be avoided or prevented by proper crime scene management?

---

---

13. List the specific areas to which you should pay particular attention when looking for footwear impressions at a crime scene.

---

---

14. At a homicide scene, what area must you be sure not to overlook when searching for footwear impressions?

---

---

15. In this module you will learn various methods of collecting footwear impressions.

a) What is one way, pointed out by the author, that is not successful?

---

---

b) Explain why the method is not successful.

---

---

<p><b>Note:</b> You will be learning how to photograph footwear impressions in a photographic module. If you wish you may therefore defer reading Chapter 2 of the text for the time being and go to Chapter 3 "Casting Three Dimensional Impressions".</p>
---

**Return to the text and read Chapter 3 (pp. 63 - 75)**

This section of Chapter 3 briefly describes the importance of casting; why casts have some advantages over photographs and how impressions are formed in soft surfaces. It also discusses the reasons for the use of dental stone vs other types of casting materials when recording footwear impressions. (Keep in mind that this rationale also applies to other impressions such as tires, in the same substrates of mud, soil or sand.)

Note also, the illustrations on pp. 66 - 68 which depict the reasons why impressions, and therefore the photographs and casts made from them, are often not the same length as the footwear.

**When you have completed the above reading answer the following questions.**

16. List five reasons why casting is important.

---

---

---

---

---

17. How can an examiner obtain the maximum amount of information about an impression?

---

---

18. Explain two reasons why photographs may not accurately show size or detail.

---

---

19. Why is Plaster of Paris no longer considered suitable for casting three-dimensional impressions?

---

---

20. What qualities would you look for in a material which the manufacturer claims is a replacement for dental stone for casting three-dimensional impressions?

---

---

21. What are the approximate differences in the compression strengths of plasters and stones?

---

---

---

---

**Return to the text and read pages 75 - 84.**

<p><b>Note:</b> You will discover that there are differences between the procedures described in the text and in the Activities booklet. Your own identification unit may also have additional methods. As with most Identification applications, it is the result rather than the means which is important. The most important consideration is that the methods you use give results equal to those you learn here.</p>
---

**Turn to the Activities book and complete Activity One.**

### **Cleaning the Cast.**

Dental Stone casts do not reach their full strength until completely cured. For example after one hour stone has 1000-1500 lbs of crush strength and 5-6000 lbs after 24 hours.

For this reason we allow the cast to cure for 24 - 48 hours before attempting to clean it.

The method given on page 86 of the text suggests the use of a saturated solution of potassium sulphate to help loosen the dirt, but note that it does so by causing bubbles to be released from the cast. **This method is not recommended.**

The fear is that this will affect the cast over a period of time, such as during a long delay before trial, causing it to become chalky. At best this will make it messy to handle in court, at worst it could the fine detail to become rounded off or even weaken the cast thus making it more susceptible to damage.

### **Recommended method of cleaning the cast**

We have found that most of the residual dirt can be removed with a high pressure spray such as found in car wash bays. Because the process takes only 15 - 20 seconds the surface of the dental stone cast does not become softened and is therefore not damaged by the pressure of the spray. Note that this method cannot be used on Plaster of Paris casts which quickly dissolve away in water.

We do not recommend washing the cast under the tap or using a brush. Because of the length of time the cast remains wet under the tap it may soften and there will then be a tendency for the brush to abrade the surface of the cast and damage the fine detail.

You should not attempt to get the cast completely clean. With a cast made in clay or soft soil it may be possible to do so but with one made in sand many of the sharp-edged, irregular shaped grains will be firmly fixed in place and will not wash out without damaging the cast.

Remember that a cast will record detail only as fine as the medium in which the impression was made. For example; if you step on a gravel driveway you may see only the rough outline of the footwear with only enough detail to suggest that a person did step in that spot. If you then step in a flower bed immediately alongside you may see every thread of the stitching and every nick and cut in the shoe. The shoe and the wearer are no different, it is only the quality of the impression medium that has changed.

**Turn to the Activity Book and complete Activity Two.**

### **Strengthening an Impression prior to casting.**

If the sand or soil is extremely dry and powdery at the time the impression was made there may be no fine detail present because the substrate will not hold together to mould the shape of the object. On the other hand, one which was made in damp material may show extremely fine detail. If, however the second impression has since been dried out by the sun it may still show good detail but be very fragile. As you pour the heavy, wet dental stone mixture into an impression in this condition the impression is likely to be severely damaged if not completely destroyed.

To avoid this damage the impression should be strengthened before the dental stone is poured. As pointed out on p.81 of the text, various sprays such as lacquer or shellac have been tried. The author points out several disadvantages of using such 'fixatives'. While they can work quite well, they tend to leave a blotchy finish on the cast which makes later photography of the fine detail much more difficult.

A simpler way of strengthening the impression is simply to wet it with a very fine mist spray of water. The important factor to ensure success is only to use a sprayer which produces a very fine mist, not heavy water droplets.

Spray the impression from upwind at a distance of 30 - 45 cm (12 - 18") so that it is completely dampened, but not running, with water. This will wet the substrate to a depth of approximately 3-6mm ( $\frac{1}{8}$ "- $\frac{1}{4}$ "). This will bind the substrate together while the dental stone is poured.

### **CASTING IN WATER**

From time to time you will come across impressions that are full of water. Some of these will have been made in a shallow puddle, others will have been made in a dry substrate and have later filled with water.

If examined closely, impressions of this type will often be found to contain extremely fine detail. This is because of the mud in the puddle in which the impression was formed. Unfortunately this fine material is also the cause of some difficulty in collecting the impression. Any disturbance of the water may raise a cloud of silt, then, as the silt resettles, it obscures some of the fine detail.

Collecting such impressions must therefore be done in such a way as to cause the least possible disturbance in the water. The easiest, perhaps the only, way to do this is to cast the impression with dental stone.

Dental stone hardens because of an internal chemical reaction rather than drying because of the evaporation of water. It is therefore possible for the stone to cure when completely submerged.

The difficulty is to introduce the stone without disturbing the impression. In reality it is a fairly simple process.

**Read p. 85 in the Bodziak text, then read the suggestions outlined below.**

Once any floating debris has been removed from the impression simply sprinkle the dental stone over the surface of the water above the impression. Use a flour sifter to help sprinkle the stone evenly over the surface. This will help you to avoid dropping large amounts into the water at once. This action could cause waves and may damage the impression.

Build up a layer of stone over the impression until you have a layer 5 - 10 mm ( $\frac{1}{4}$ " -  $\frac{1}{2}$ ") thick. You can then place a retaining frame around it without the danger of disturbing the silt and thus damaging the impression.

Then you can mix up a batch of stone in the normal way making it a little thinner than normal. (*This instruction is another minor disagreement with the text in which it is suggested that the mixture should be thicker than normal.*) A thinner mix will make it easier to pour without large blobs falling into the impression. Pour it over a spatula held as close to the impression as possible, just as you would for a regular dry cast. In this case the spatula may be in the water. Three to four centimeters ( $1\frac{1}{2}$ ") of total thickness should be sufficient.

If the water is cold you may find that the cast takes longer than usual to cure. In this case leave it a minimum of one a half hour but preferably one hour, before you remove it

When you remove the cast from the water you will probably find that it is relatively clean but do not attempt to clean it any further until the full 24 hour period has elapsed. After that time it will have reached close to its full strength and, if necessary, can be cleaned with the pressure spray method, like any other dental stone cast, without danger of causing any damage.

**Turn to the Activities booklet and complete Activity Three.**

## CASTING IN SNOW

Because of its weight and the heat given off during the curing of a Dental Stone cast we cannot use this material directly for capturing impressions in snow. The heat simply melts the snow and the weight of the stone then destroys the impression.

Snow impressions can, however, be cast using one of two other methods, poured molten sulphur or sprayed wax with dental stone. These are discussed below.

*You will find that the opinions of the OPC Identification Training Unit and William Bodziak (author of the text) are diametrically opposed as to which of the methods is preferable.*

OPC has had greatest success with sulphur casting while Bodziak prefers Snow Print Wax ©. Interestingly, both sources speculate that it may be the particular snow conditions or ambient temperatures in the respective geographic regions that influences their preference. The best advice is that you read both sources, try both methods and then make your own decision. Keep an open mind until you have thoroughly tested both methods in your own climatic conditions. You may find that both methods are equally satisfactory in your own area.

**Read pp. 87 - 100 in the Bodziak text then compare with the information below.**

The type of snow which best allows casting is the type that makes the best snowballs, i.e., firm packing snow. You can easily test for this condition by picking up a handful of snow and squeezing it in your hand. If the snow stays together in the shape of your palm and fingers when you open your hand, it will also support good detail in an impression. Light, fluffy snow usually will not support an impression or will be destroyed when the casting material is applied. Crystalline snow which forms after a thaw-freeze cycle will not support the fine detail that we are looking for in an impression.

## CASTING WITH SULPHUR

Sulphur is used in molten form and any form of sulphur is suitable for the purpose including, flowers (unrefined waste product), prills (small beads or split beads used in industry), block (larger, brick sized pieces) or sublimated (highly refined). Since any form is satisfactory, the cheapest possible source is the best.

Because sulphur is a by-product of certain industrial operations, it is often available from those sources in lump or block form at very low prices. Check the industries in your area. The powdered form is often available from agricultural or horticultural suppliers. If purchasing from those sources, make sure it is pure sulphur, containing no additives.

Prill sulphur, mentioned in Cassidy's book<sup>9</sup> is no better than any other type of sulphur. Because it is not fine powder, however, it tends to be a little less messy to use, especially

outside in a breeze. Sublimated sulphur is available from laboratory chemical supply companies, but is very expensive since it is highly refined for pharmaceutical use. It is unnecessary to purchase this type.

### **Method**

While it may seem contradictory to use hot, molten sulphur to cast a snow impression, the process works very well in practice. The secret lies in the property of sulphur to revert to a solid from a liquid as a result of only a very slight drop in temperature.

When brought to the correct temperature, and poured into the cold impression, the sulphur instantly solidifies, capturing the fine detail before the snow has time to melt.

### **Preparation**

Since snow impressions are cast only in cold weather it is advisable to minimize the time spent at the actual site by making preparations well in advance.

Melting the sulphur from a stock supply takes time and can be messy when done outside in the wind. You can do the initial preparation in the laboratory and then set the sulphur aside until it is needed.

First, obtain two or three saucepans of about three to four litre capacity (visit the local rummage or garage sales). The best ones for the purpose are thick-walled cast aluminum or iron.

Fill a saucepan with sulphur, in whatever form you have available. Then heat it slowly at a moderate temperature (approx. 200°C or 400°F) until it has the appearance and consistency of corn syrup. Keep adding sulphur until the pan is full.

Do not try to speed up the process by increasing the heat. The sulphur will simply thicken to a toffee-like consistency and prevent you from easily adding more powder or stirring the mixture.

Once the pan is full of molten sulphur, remove it from the heat and allow it to cool. It will form a solid block in the pan which is a more convenient and clean way of carrying it to the crime scene.

### **Heating the sulphur in the field.**

For field use, a propane or naphtha camping stove will provide adequate heat and will be easy to control. Situate the stove in a sheltered area, out of the wind. Set the stove at medium heat. If you have it close by the impression you will be able to monitor its progress as you prepare the impression.

The melt will take thirty minutes or more, since low heat must be used. Outside in the cold it will be tempting to attempt to speed up the heating process. Remember that heating it to too high a temperature will only give you the toffee-like consistency. Be patient! If it does become overheated and thickens, place the pan in the snow to cool it and return it to the correct consistency.

### **Fumes**

**Melting** sulphur produces fumes that have a mild smell and are non-toxic. You may heat it indoors on a kitchen stove if it is convenient at the scene, the ordinary stove hood will remove the smell.

It is unlikely, when melting it as described above, that the sulphur will catch fire. You should, however, be aware that **burning** sulphur produces toxic sulphur dioxide which has a characteristic bad smell. Avoid breathing these fumes!

If it does catch fire when you are working outside in sunlight, the pale blue flames will be difficult to see but you will immediately recognize the odour. Move to the upwind side of the pan and then throw snow onto the surface of the sulphur to extinguish the flames.

If it ignites when you are using a stove indoors, immediately carry the pan outside so that the fumes will be quickly dispersed and you can then deal with it as above. Unlike a grease fire, the flames will be quite low and should not cause a problem when carrying the pan but do not breathe the fumes or spill the mixture.

### **Preparation of the Impression**

While the sulphur is being melted you can prepare the impression for casting. You will need to remove any debris or loose snow that has fallen or been blown into the impression after it was made.

As usual you will need to take photographs before you pour the cast. This is a challenge when the impressions are deeply embedded in the snow.

Pouring the hot sulphur directly onto the impression will cause damage at the point first struck by the relatively large volume of hot sulphur. To avoid this you must construct a pouring trough into which the molten sulphur will be poured..

The trough is simply a table-spoon sized, and shaped, area having three sides, the open side being adjacent to the edge of the impression. Form the trough next to the highest

portion of the impression so that the sulphur will flow from the trough out over the impression and down into the lower areas as you pour. You may first have to make a small pile of snow to place the trough slightly higher than the impression.

As you to pour, the sulphur initially flows over the impression in a thin layer, which sets immediately as it contacts the cold snow. As you continue to pour the thickness builds up to provide sufficient strength for removing the cast from the snow. Even if the heat then melts the snow the fine detail has already been captured.

In order to prevent the sulphur from escaping from a shallow impression, or to restrict the cast to just that part of the impression you wish to record, build a low containment wall of snow around the impression. Because snow impressions are often fairly deep this step will not always be necessary.

### **Pouring the sulphur**

When the sulphur is completely melted, take the pan to the impression and allow it to cool by setting it in the snow with the lid off. Keep stirring occasionally equalize the cooling throughout the whole pan.

As it cools, crystals, having an appearance similar to that of ice forming on water, will begin to appear on the surface of the molten sulphur. Each time you stir, the crystals will melt again as you bring hot sulphur up from the bottom of the pan. When you stop stirring the crystals will take some time to reform. As the sulphur batch cools this time will be reduced.

When the crystals form again immediately after you stop stirring, the sulphur has cooled to the proper temperature of about 46°C (115°F). In this state the sulphur will instantly solidify if the temperature is now dropped quickly by even one degree.

Give the molten sulphur a final stir and pour with a steady, moderately fast speed, into the pouring trough, continuing until the impression is full. As the sulphur hits the snow you will see it solidify and the following material will flow over the solid part until it too hits cold snow and solidifies.

You should pour until the cast has a thickness of at least 10 mm. Sulphur has little tensile strength and therefore is very brittle when set, so do not skimp on the thickness.

This is where a heavy-walled pan is better than the cheap thin-walled aluminum pans. With the thin type the heat is transferred so quickly that the sulphur solidifies in a layer 1-2 cm thick on the bottom and sides of the pan while it is still too hot in the centre to pour. This results in you having very much less molten sulphur available to form the cast. A heavy-walled pan, on the other hand, retains the heat better, allowing the sulphur to cool more evenly so that there is less stuck to the pan when the melt reaches the proper pouring temperature

Allow the cast to cool and solidify. This may take 5 to 15 minutes depending on air temperature. At this stage the cast will have a dark yellow translucent appearance rather than the opaque pale yellow of the cold sulphur with which you started

Be very careful to ensure that the sulphur has had time to set all the way through. It will first form a crust on the top and bottom because of the cold snow and air but will still be molten in the centre. The thicker you have made the cast, of course, the longer it will take to cool and set all the way through. Attempting to lift it before it is fully set will result in you breaking through the crust, destroying the cast and getting molten sulphur on your hands. Be patient!

Even when fully set the cast will be very brittle and easily broken although the surface is quite resistant to damage from rubbing. Ensure that it does not get dropped or bumped while you are transporting it back to your office.

### **Strengthening the sulphur cast.**

Once back at the office you can strengthen the cast by embedding it in a supporting pad of dental stone.

Mix up a batch of dental stone. Make it thicker than normal, about the consistency of peanut butter. This will prevent the sulphur cast from sinking into the stone mixture. To help the stone grip the cast, tack a few small lumps of sulphur to the back of the cast by heating one surface of the lump until it softens and then holding it in contact with the cast until it cools.

Pour the stone into a suitable container such as a cardboard box lid or a bed of sand. Then carefully place the cast onto the surface of the stone. Press it down to ensure that it is firmly embedded but not so far that the stone starts to overlap the impression side of the cast.

Alternatively, you can set the cast face down in a bed of sand. To ensure that the cast remains tightly embedded, with no space around the edges where the dental stone can get underneath, it helps if the sand is damp. Build a cardboard retaining wall and pour the dental stone over the cast to a thickness of about 15-20 mm. Again, lumps of sulphur stuck to the back of the cast will assist in ensuring good adhesion between the two materials.

Vandiver recommends adding fibreglass to the molten sulphur and claims that it will increase the strength by about fifty percent. He recommends adding about five percent by weight of 1/8" to 1/4" pieces of milled fibreglass.<sup>14</sup> The very small size of the milled fibres should not interfere with the ability of the sulphur to record the fine detail of the impression. This method should be considered as an alternative to the bed of stone. It will not be necessary to do both.

### **Health and Safety Considerations**

Sulphur is not highly toxic in powdered or lump form. As with any fine powder, however, you should wear a particle mask so that you are not breathing in the dust when you are first melting it.

Like many otherwise harmless powders, it can be explosive if the dust is dispersed finely in the air in the presence of flame. When using an open flame burner to melt the sulphur take care not to allow clouds of sulphur powder to be formed in the vicinity, especially when working outdoors in a breeze.

As noted earlier, if the sulphur catches fire and burns while melting, it gives off sulphur dioxide gas which, in sufficient concentration, is toxic. These fumes, if inhaled, will combine with the moisture in the respiratory system to form a weak sulphurous acid, which will be irritating to the mucous membranes. Stay upwind and, as noted earlier, put out the flames by covering with snow, if indoors, carry the pan outside.

If stored in a damp area, sulphur will combine with the moisture to form weak sulphurous acid. Store it in plastic and keep it dry.

Keeping in mind the above comments, sulphur, used properly, does not present any significant hazards.

## **SPRAY WAX METHOD**

An alternative way of recording impressions in snow is the spray wax method.

The spray wax used for this purpose is a commercial product supplied in aerosol cans. The idea originated in Sweden from experiments using spray-on imitation snow ordinarily used for Christmas decorating. Although the spray-on wax available in Sweden apparently worked well, a suitable brand was not found in Canada. Snow-Print Wax™ has solved that difficulty.

Snow-Print Wax™ is coloured red or orange for easier visibility on the snow surface.

The method requires that you spray the snow impression with the wax material to a thickness of two to three millimeters. This records the detail of the impression and acts as an insulator. Dental stone can then be poured inside the wax layer which insulates the snow from the exothermic reaction of the stone.

Some users have failed to realize that the impression is reproduced on the wax, not on the stone. The stone is only there as a support for the wax impression. Cleaning off the wax removes the evidence!

## **Procedure**

First spray a light coating onto the impression from about 25-30 cm (10-12") away on the upwind side. Do not get too close otherwise the force of the spray may damage the impression. Allow the spray to drift across the impression and watch as the detail in the impression stands out more clearly because of the contrasting colour of the wax. At that point photograph the impression again.

Let the first layer of wax set for 3-5 minutes. Then apply two or three more light, even layers at the same intervals. The aim is to ensure that the entire impression, including the sides, is covered with an even layer of wax. Any gaps or thin areas will permit the stone to pass through and damage the impression. Try to build a layer about 2 - 3 millimeters thick over the whole impression.

When the spray is not actually being used to coat the impression, keep it warm in a coat pocket, or your vehicle or other heated area to prevent the cold from decreasing the pressure. If this happens it will tend to come out of the container in "spits" which will cause uneven spraying. Clean off any build-up of material around the spray nozzle. Occasionally the orifice will plug up. The manufacturer has anticipated this problem and supplies several spray nozzles with each can of wax.

After the final layer of wax has set for five minutes or so, mix up and pour a thick, warm mixture of dental stone on top of the wax.. This can be mixed a little thicker than a normal stone cast since you are not recording fine detail on the stone, but simply supporting the wax. Take care to ensure that the stone does not overflow the wax coating into the snow and get between the wax and the impression.

Cover the impression with cardboard or a newspaper to retain some of the heat as the stone cures. Remove the cast as soon as the stone has hardened or it may freeze into the surrounding ice and snow. Trying to pry the cast loose will destroy the wax impression.

The wax surface is extremely fragile and you must take great care when handling and transporting the cast. Keep it in a cold, shady area if you are continuing to work at the scene. Transport it in the trunk of the vehicle where there will be the least amount of heat. (Check for warm areas caused by exhaust pipes under the trunk) Do not allow other items to touch the wax surface, including any protective wrapping. It is best transported in an open box.

Whenever possible photograph the cast with electronic flash since it will quickly melt if you place it close to studio lights.

The wax never hardens and we are not aware of any method to strengthen this surface. This causes problems when examining it to make comparisons and when presenting it as evidence in court.

## **Cost**

The wax is rather expensive and you will need a minimum of two cans so that one can be kept warm while you are using the first. A full footwear impression will require almost a full can of wax, tire impressions may require several cans.

### **EVALUATION OF THE TWO METHODS**

During classes at the College, casts have been made on numerous occasions utilizing both Snow-Print Wax™ and sulphur methods, side-by-side in the same snow.

Most of these casts were made in January or February, in temperatures ranging from just above freezing to about minus twenty degrees Celsius. Snow conditions varied from ice with a thin covering of powder snow, to good packing snow, to spring-like "corn snow".

In virtually every case the sulphur method produced finer detail. Note, however, that these results are diametrically opposed to those reported by William J. Bodziak in his book "Footwear Impression Evidence"<sup>15</sup>. It must also be pointed out that on many occasions neither method produced the fine individual detail necessary for individualizing the footwear.

Both methods have advantages and disadvantages. Because of the wide range of temperatures in Ontario, and the consequent varied snow consistencies, you would be best advised to try both methods in your own area. Then make your own comparisons and select the method that best suits the conditions at that particular time.