Glass & Soil

(Unit 3)

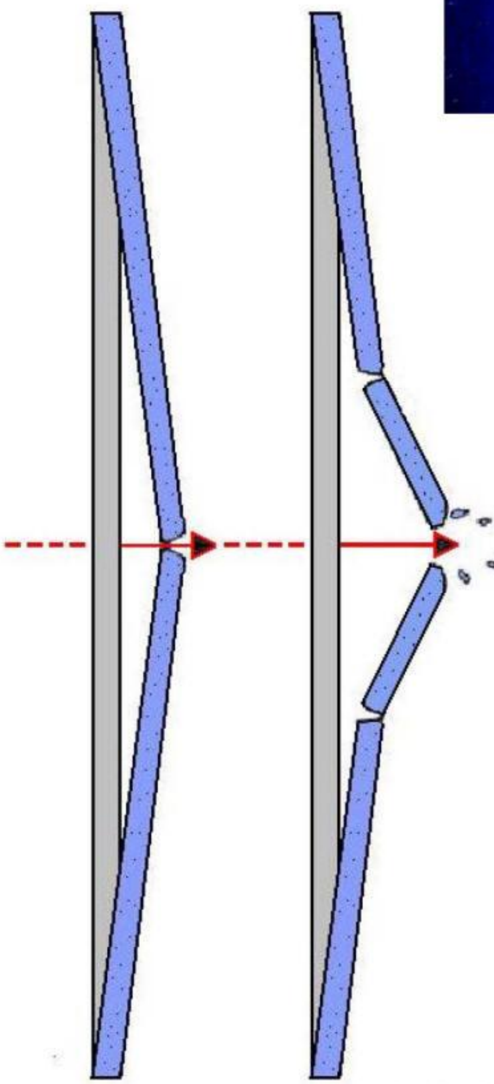
Glass Fractures

Glass bends in response to any force that is exerted on any one of its surfaces. When the limit of its elasticity is reached, the glass will fracture. Frequently, fractured window glass will reveal information that can be related to the force and direction of an impact; such knowledge may be useful for reconstructing events at a crime scene.

The penetration of ordinary window glass by a projectile, be it a bullet or a stone, produces a familiar fracture pattern. Cracks radiate outward and encircle the hole, as shown above. The radiating lines are appropriately known as *radial fractures*, and the circular lines are termed *concentric fractures*.

Often it is difficult to determine from the size and shape of a hole in glass whether it was made by a bullet or by some other projectile. For instance, a small stone thrown at a comparatively high speed against a pane of glass will often produce a hole very similar to that of a bullet. On the other hand, a large stone can completely shatter a pane of glass in a manner closely resembling the result of close-range gunfire. However, in the latter instance, the presence of gunpowder deposits on the shattered glass fragments does point to damage caused by a firearm.

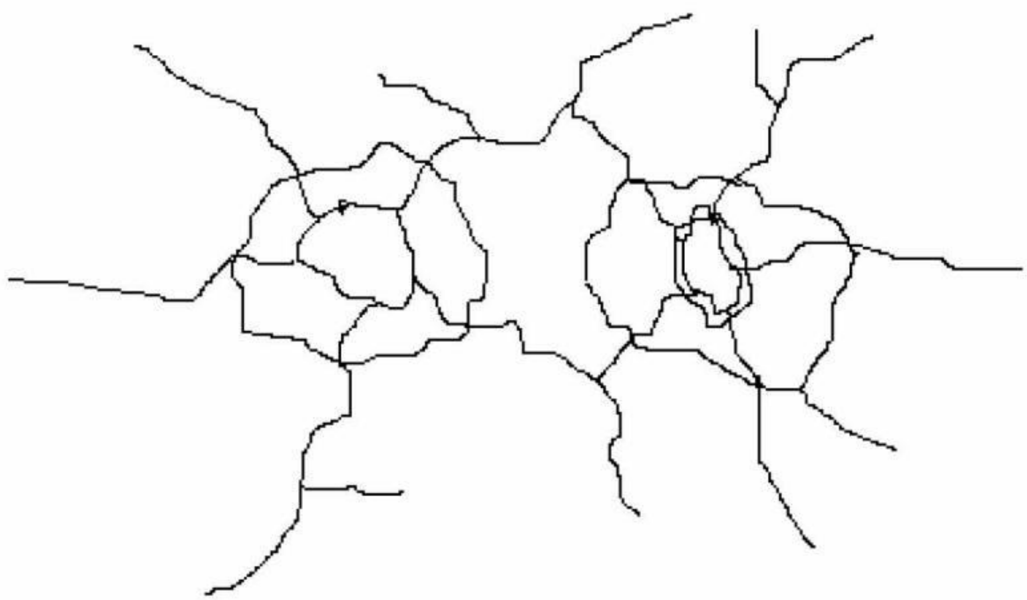
A projectile hole is inevitably wider at the exit side, and hence its examination is an important factor when determining the direction of impact.



When a force pushes on one side of a pane of glass, the elasticity of the glass permits it to bend in the direction of the applied force. Once the elastic limit is exceeded, the glass begins to crack. As seen at left, the first fractures form on the surface opposite that of the penetrating force, and these fractures develop into radial lines. The continued motion of the force places tension on the front surface of the glass, resulting in the formation of concentric cracks. An examination of the edges of the radial and concentric cracks frequently reveals stress markings whose shape can be related to the side on which the window first impacted.

Stress Marks

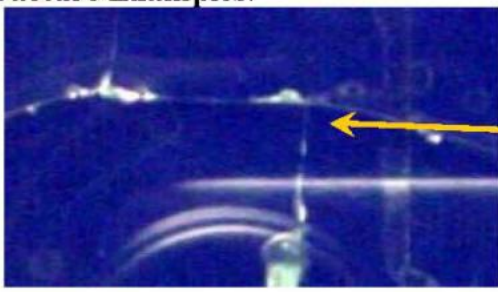
Stress marks, seen on a cross section of a glass fracture, are shaped like arches that are perpendicular to one glass surface and curved nearly parallel to the opposite surface. The importance of stress marks stems from the observation that the perpendicular edge always faces the surface on which the crack originated. Therefore, in examining the stress marks on the edge of a radial crack near the point of impact, the perpendicular end is always located opposite the side from which the force of impact was applied. For a concentric fracture, the perpendicular end always faces the surface on which the force originated. These facts enable the examiner to readily determine the side on which a window was broken. Unfortunately, tempered glass does not produce reliable cracking patterns for study.

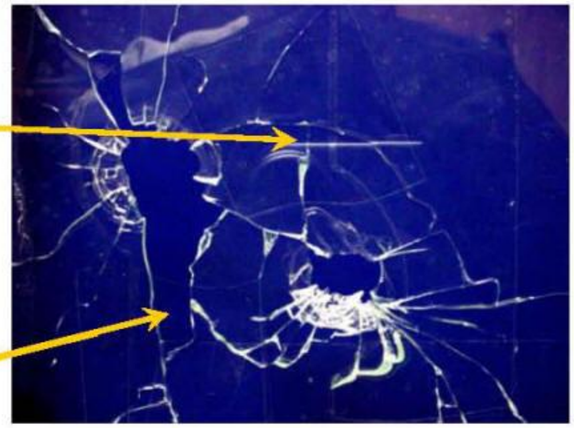


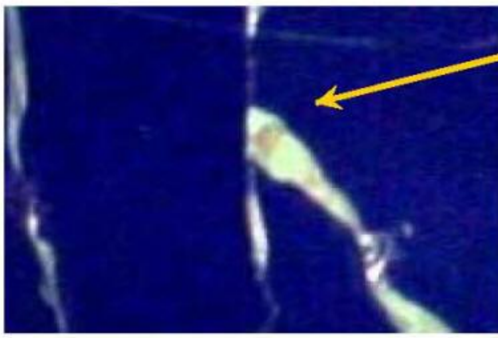
Successive Penetrations

When there have been successive penetrations of glass, it is frequently possible to determine the sequence of impact by observing the existing fracture lines and their points of termination. **A fracture always terminates at an existing line of fracture.** Above, the fracture on the left preceded that on the right; this is evidenced by the latter hole's radial fracture lines terminating at the cracks of the former.

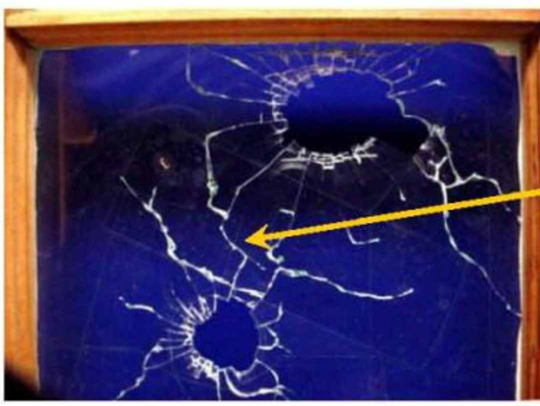
Facture Examples:

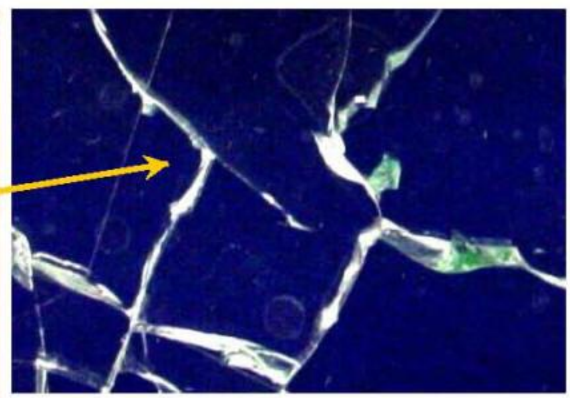






In the glass above, the top hole was made first. Notice how fracture lines from the lower penetration terminate at fracture lines from the top hole. Below: once again the top hole was penetrated first as evidenced in the close-up view.





Examine the fractured glass to the right. Which fracture was formed first?

Right hole penetrated first.