B72 Practical Techniques for the Enhancement of Textile Impressions in Vehicle Surface Coatings

Jessica E. Hovingh, State College, PA 16803; Abigail J. Bender, BS*, Pennsylvania University, University Park, PA 16802; Ralph R. Ristenbatt III, MS, Pennsylvania State University, University Park, PA 16802*

Learning Overview: After attending this presentation, attendees will gain an appreciation for the challenges associated with detecting and photographing three-dimensional fabric impressions in vehicular surfaces and will learn practical enhancement and recording techniques.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by equipping practitioners with techniques for enhancing and capturing fabric impressions in vehicle surfaces as demonstrated by use of common materials and studying various techniques.

Several different physical and material traces can be generated because of pedestrian-vehicle collisions. Many traces recovered from the scene are often categorized as so-called "trace evidence." These traces frequently originate from the vehicle and can include fragments of paint, glass, metal, plastic, and other synthetic materials; patterns from the vehicle's tires or other structural components may also be found, often on the roadway and occasionally on the victim or their clothing. If a vehicle is recovered, physical evidence transferred to the vehicle may be discovered; these traces can include biological substances (blood, saliva, hair, skin, and other tissues), pieces of clothing fabric and fibers. Occasionally, three-dimensional (3D) pattern impressions from clothing fabrics may be found on the vehicle, often in the vehicle's surface coating ("paint"). While these patterns may be present, they are often overlooked or considered unsuitable for further analysis due to the difficulties associated with detecting, visualizing, and recording the impression, especially when the indented substrate is white or light in color. This study aims to investigate familiar and novel methods to optimally visualize and record such impressions.

Consistent 3D fabric impressions like those seen in pedestrian-vehicle collisions were generated using a large pendulum impact device. A simulated knee, consisting of a domed weld cap covered in 1/2-inch thick foam, was fixed to the end of the 6-foot pendulum arm. A square piece of washed Levi's 550™ denim jeans was then fastened over the foam. The pendulum arm was equipped with a quick-release, permitting it to swing only under the influence of gravity. The simulated denim-covered knee was then released, allowing it to impact a section previously removed from a vehicle, resulting in the generation of a 3D textile impression. All variables were held constant (pendulum drop height, simulated kneecap, fabric, and vehicle sections) to produce consistent impressions, which afforded ideal comparison of the enhancement methods.

Several enhancements and recording methods were evaluated in this study. Many familiar tools and techniques, including optical filters, fingerprint dusting powders and small particle reagent, showed potential for enhancing 3D impressions. To identify a recommended approach for fabric impression enhancement, the success of the evaluated enhancement methods was compared. Popular techniques, such as the application of fingerprint dusting powder with a feather brush were determined to be suitable for detecting and enhancing impressions in some vehicle surfaces. Other powders, including fluorescent fingerprint dusting powders and small particle reagent, also provided enhancement. Visualization can be improved by removal of excess powder. Transfer techniques, such as lifting using gelatin lifters and Mikrosil™ casting, can be implemented. Use of specialized instrumentation may also provide a supplemental method of impression recording. This study investigated the use of the Zygo® Nexview™ 3D Optical Surface Profilometer to scan fabric impressions. The profilometer scans the vehicle surface, recording the fine detail of the impression. Impression depth can also be determined with this instrument, providing additional useful information to analysts.

3D Impression Evidence, Enhancement, Collision Investigation