OSAC RESEARCH NEEDS ASSESSMENT FORM

Title of research need:	Evaluation of Comparison Criteria used for Interpretation of Glass Refractive Index Data
Keywords:	glass, refractive index, E1967, forensic comparison

R&D Need Rank: Low, Medium, High	High	**SAC Approved Date:**	6/18/2025

Submitting subcommittee(s):	Trace Materials, Glass Task Group

Research Need Summary:

The purpose of these research needs is to build a stronger scientific foundation for forensic science standards. The information provided herein will help to evaluate and strengthen existing standards, and/or fill any standards related gaps. In the space below, please provide a brief narrative of the need to be addressed. This should include:

- The identity of any specific standards that would be affected/improved/evaluated
- A discussion on gaps that exist within the standards or standards related gaps that need to be filled
- How this work would fill those gaps
- An overview of any current or past research efforts that may be relevant to this effort
- A discussion regarding how this research might improve current laboratory capabilities and/or forensic services within the criminal justice system
- Any relevant references

The Glass Task Group of the Trace Materials Subcommittee is currently working on the 5-year revision of ASTM standard E1967. This standard guides the forensic comparison of glass samples by refractive index using an oil immersion method. The current standard recommends one comparison interval to determine whether the known glass is a potential source of each questioned fragment. However, in practice, forensics labs are currently calculating comparison intervals in a variety of manners. Research is needed in order to determine the strengths and weaknesses of these comparison techniques.

Utilizing existing data for sets of tempered and laminated vehicle windows, we will evaluate various comparison criteria to determine rates of false exclusion and inclusion of each. (Data collected at the FBI Laboratory.) This will inform the revision of E1967's section 8: Calculation and Interpretation of Results before we submit our recommendations to the Trace Materials Subcommittee and to ASTM for publication. This study will also compare results acquired when calculations are performed using different amounts of measurement replicates. This will inform the revision of the Procedure portion of E1967. The task group work on the revision aims to recommend the comparison criteria and minimum replicate measurements that balance and minimize type I and type II errors.

Further work will include continuing this evaluation with data sets from other classes of glass, to include architectural flat glass, container glass, and personal electronic device (e.g. smartphone) glass. Portions of this data already exist; other data would need to be collected.

Relevant references include:

- Seyfang, K.E., Redman, K.E., Popelka-Filcoff, R. & Kirkbride, M. P., "Glass fragments from portable electronic devices: implications for forensic examinations", *Forensic Science International*, Vol 257, 2015, pp 442-452.

- Davies, M.M., Dudley, R.J. & Smalldon, K.W, "An investigation of bulk and surface refractive indices for flat window glasses, patterned window glasses and windscreen glasses", *Forensic Science International*, Vol 16, 1980, pp 125-137.
- Insana, J. & Buzzini, P, "The Differences Between Refractive Index Measurements of the External Surface and Bulk Area of Container Glass", *The Microscope*, Vol 64, Issue 2, 2017, pp 51-60.
- Haase, E., Henry, E., Neumann, C., Webb, J.B. & Smith, M, "Intra-pane refractive index variability and adequate sample sizes in forensic glass analysis", *Forensic Science International*, Vol 347, 2023.
- Munger, C., Gates, K., & Hamburg, C, "Determining the Refractive Index Variation within Panes of Vehicle Windshield Glass", *Journal of Forensic Sciences*, Vol 59, Issue 5, 2014, pp 1351-1357
- Trimpe, M. & Sammarco, J, "Variability of Refractive Index and Thickness of Tempered Glass throughout an Automotive Window", *JASTEE*, Vol 7, Issue 1, 2017, pp 35-40.
- Sandercock, P. M. L., "Sample Size Considerations for Control Glass in Casework," *Canadian Society of Forensic Science Journal*, Vol 33, No. 4, 2000, pp. 173–185.
- Garvin, E. J., and Koons, R. D., "Evaluation of Match Criteria Used for the Comparison of Refractive Index of Glass Fragments," *Journal of Forensic Sciences*, Vol 56, No. 2, 2011, pp. 491–500.
- Alamilla, F., Calcerrada, M., Garcia-Ruiz, C., and Torre, M., "Validation of an Analytical Method for the Refractive Index Measurement of Glass Fragments. Application to a Hit-and-Run Incident," *Analytical Methods*, Vol 5, 2013, pp. 1178–1184.

This research need has been identified by one or more subcommittees of OSAC and is being provided as an informational resource to the community.