

2025 Carl E. Akeley Award



Andy Thompson

The 20th annual Carl E. Akeley Award was presented to Andy Thompson for his article, “Shotcrete as Final Liner – Design Considerations,” which was published in *Shotcrete* magazine, Volume 27, Number 3, 3rd Quarter 2025.

The article discusses how shotcrete (often called sprayed concrete) is increasingly used worldwide as the permanent final lining for underground structures due to its flexibility in forming non-uniform shapes and eliminating complex formwork. This can improve construction logistics, reduce costs, and accelerate schedules. While shotcrete is primarily a placement method and does not fundamentally change the structural design of a reinforced concrete lining, its use introduces specific design, specification, and quality control considerations.

Key initial considerations include compliance with governing codes and standards, which can significantly influence where and how shotcrete may be used. Shotcrete is often employed both as initial ground support and as the permanent lining, typically in conjunction with rock bolts, lattice girders, mesh, or steel fibers. Initial linings resist short-term ground and construction loads, while permanent linings address long-term ground, hydrostatic, thermal, and shrinkage effects, as well as operational loads and fire resistance where required.

Design commonly relies on 2D and 3D numerical modeling to capture ground/structure interaction and time-dependent strength development. Waterproofing systems play a critical role: Sheet membranes usually limit composite action between linings, while spray-applied membranes may allow it if long-term bond performance is demonstrated. Surface smoothness and preparation are essential to protect membranes and ensure durability.

Final lining designs must consider constructability, including reinforcement congestion, layer thickness, and whether hand-sprayed or robotic application is used. Alternatives such as steel fiber-reinforced shotcrete can simplify reinforcement but demand high workmanship and rigorous quality control. Case studies, notably New York’s

East Side Access project, illustrate how local codes can restrict reinforcement layouts yet allow flexibility through preconstruction testing and mockups.

Safety is a major concern in overhead shotcrete placement. Exclusion zones, early-age strength testing, and detailed construction planning are critical to preventing accidents. Ultimately, successful use of shotcrete as a final lining depends on integrating code compliance, design detailing, testing, quality assurance, and safety into a coordinated project approach.



Scan or click the QR code to read the full article.

AKELEY AWARD HISTORY

ASA established the Carl E. Akeley Award in 2005 to honor his founding of what is today referred to as the shotcrete process. This award is presented to the author(s) of the best technical article appearing in *Shotcrete* magazine in the past 12 months, as determined by the Akeley Award Committee of ASA.

Carl E. Akeley invented the cement gun in 1907 and introduced a commercial version of it at the Cement Show in New York in December 1910. For this reason, Akeley is considered the inventor of the shotcrete process.¹

Born in Clarendon, NY, on May 19, 1864, Akeley was a noted naturalist, taxidermist, inventor, photographer, and author. He made many significant contributions to the American Museum of Natural History and many other museums around the United States. He initially invented the cement gun to repair the façade of the Field Columbian Museum and later used it to improve the quality of his taxidermy exhibits at the museum. Akeley made five expeditions to Africa, during which time he procured many animals for museum exhibits. President Theodore Roosevelt accompanied him on one of those expeditions and encouraged him in his development of the cement gun. During his fifth expedition to Africa, he contracted a virus and died on November 17, 1926.

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PAST AKELEY AWARD RECIPIENTS

- 2024—C. Poulin and M. Jolin, “A Study on Low-Velocity Sprayed Mortars”
- 2023—R. Bracamontes, “The Use of Rapid-Set Accelerators in Shotcrete”
- 2022—Program Paused
- 2021—O. Duckworth, “Slump—The Most Misunderstood Characteristic of Wet-Mix Shotcrete”
- 2020—A. Gagnon, M. Jolin, and J. D. Lemay, “Performance of Synthetic Sheet Waterproofing Membranes Sprayed with Steel Fiber-Reinforced Shotcrete Testing for Waterproofing Membrane Integrity After Spraying.”
- 2019—W. Clements and K. Robertson, “Compatible Shotcrete Specifications and Repair Materials”
- 2018—K. Yun, “Cellular Sprayed Concrete”
- 2017—A. Nitschke, “Modeling of Load-Bearing Behavior of Fiber-Reinforced Concrete Tunnel Linings”
- 2016—M. von der Hofen, “East End Crossing”
- 2015—E. Yurdakul and K.-A. Rieder, “Effect of Pozzolanic-Based Rheology Control Agent as a Replacement for Silica Fume”
- 2014—L. Zhang, “Variability of Compressive Strength of Shotcrete in a Tunnel-Lining Project”
- 2013—Jolin, Nokken, and Sawoszczuk, “Sustainable Shotcrete Using Blast-Furnace Slag
- 2012—R. C. White Jr., “Pineda Causeway Bridge Rehabilitation”
- 2011—C. S. Hanskat, “Shotcrete Testing—Who, Why, When, and How”
- 2010—L. Zhang, “Is Shotcrete Sustainable?”
- 2009—Dufour, Lacroix, Morin, and Reny, “The Effects of Liquid Corrosion Inhibitor in Air-Entrained Dry-Mix Shotcrete”
- 2008—E. S. Bernard, “Embrittlement of Fiber-Reinforced Shotcrete”
- 2007—K. F. Garshol, “Watertight Permanent Shotcrete Linings in Tunneling and Underground Construction”
- 2006—Dufour, Reny, and Vézina, “State-of-the-Art Specification for Shotcrete Rehabilitation Projects”