

The Shotcrete Advantage: Enhancing Access, Efficiency, and Safety in Geohazard Mitigation

by Simon Boone

In recent years, shotcrete has emerged as an important tool for geohazard mitigation due to its versatility, strength, and sustainability in slope stabilization, rockfall protection, and erosion prevention. Shotcrete can be applied rapidly to even the most irregular surfaces and can be customized to fit nearly any shape or structure, including overhead or vertical surfaces. The application involves projecting a mixture of cement, aggregate, and water onto a surface at high velocity. This creates a dense, durable layer with performance characteristics generally equivalent to cast-in-place concrete, but with adaptability for hard-to-access locations and efficiency for emergency response.

Versatility in Challenging Locations

One of shotcrete's greatest advantages is its versatility. Shotcrete can be applied to natural and engineered slopes, and it can be seamlessly integrated with soil nails and rock anchors, making it popular in earth retention and structural support

systems such as pile walls and lagging walls.

In geohazard mitigation, crews often use shotcrete to stabilize slopes where rock or soil is prone to toppling or sliding. The material's rapid setting time accelerates project completion, reducing the time that slopes or rock faces are vulnerable.

Beyond its structural capabilities, shotcrete can be sculpted for aesthetic purposes. Shaping the concrete immediately after application allows it to include decorative textures or emulate natural rock formations. This approach helps integrate mitigation measures into the surrounding environment, and it allows functional support structures to blend in with natural landscapes.

Enhanced Strength for At-Risk Slopes

Shotcrete's strength lies in its ability to create a highly durable and stable surface. Applying shotcrete is a multi-step process, including thorough cleaning of the target surface, placement of reinforcing bars or wire reinforcement, and spraying a concrete

mixture at a high velocity. Each layer of concrete forms a strong coating that resists movement and provides critical stability.

Increased Safety on Complex Jobsites

Safety is always a concern in geohazard mitigation projects, and shotcrete applications play a significant role in enhancing on-site protection for crews. Introduced in 2022, shotcrete robots eliminate the need for technicians to manually hold a hose during application. These robots can be controlled using cordless remotes, allowing the operator to safely observe placements that would otherwise be hard to reach and could be potentially dangerous.

Providing a Sustainable Solution

Shotcrete is an indispensable solution in geohazard mitigation, excelling in its ability to stabilize slopes, protect against rockfalls, and prevent erosion safely and effectively. It also stands out for its sustainability benefits, aligning with the

growing demand for environmentally responsible construction practices. The process minimizes material waste and ground disturbances, enhances water quality by reducing runoff and sedimentation, and incorporates recycled materials, all without compromising performance.

As geohazard risks continue to grow, shotcrete offers crews a comprehensive mitigation solution that balances strength, safety, and sustainability, ensuring communities and infrastructure remain protected.

Soil Nail Wall Project

In July 2024, GeoStabilization International constructed a soil nail wall using shotcrete for a large data center in Atlanta, GA, USA. Although the design was already finalized, the construction team faced significant challenges due to extended lead times for specialty materials, including encapsulated galvanized soil nails. To address this, GeoStabilization proposed using hollow-bar soil nails instead, maintaining project specifications while expediting procurement to meet the demanding schedule.

Leaning on its engineering expertise and commitment to value-added solutions, GeoStabilization implemented innovative techniques, including the use of a shotcrete robot, to further enhance efficiency. This proved to be effective during the installation of the initial structural layer of the wall. The team also implemented open-hole drilling rigs to boost production rates from 800 to an impressive 1800 linear ft (244 to 550 m) per day. These strategies streamlined the project and ensured timely delivery despite demanding requirements.

Safety remained a top priority throughout the project. GeoStabilization employed open-hole single-stroke drilling techniques, eliminating the need for drill steel changes and significantly reducing hazards. The shotcrete robot



Open-hole drilling



Soil nails and wired mesh installed during the early stages of a soil nail wall



After shotcrete application that was placed by a robot



Aerial view of completed wall

further minimized manual labor exposure to high-risk activities, enhancing site safety and efficiency. Protective measures were also implemented to safeguard nearby trees and forested areas, particularly along the top of the wall. Stringent containment protocols were enforced to prevent contamination from machinery and cement materials, minimizing the project's environmental impact.

The success of this project underscores the effective integration of advanced technologies and innovative solutions in geotechnical engineering. By combining shotcrete robotics, strategic procurement adjustments, and effective teamwork, GeoStabilization delivered a high-quality soil nail wall for the data center.

Selected for reader interest by the editors.



As Director of Engineering, **Simon Boone** leads GeoStabilization International's engineering team throughout the United States and Canada. He works closely with the sales and operations teams to design and construct innovative, economically viable customer solutions. Before joining the team, he spent nearly 6 years working as a Project Manager for Access Limited Construction, a company GeoStabilization acquired in 2022. He brings a wealth of geohazard mitigation experience to the team with a background in engineering geology and construction.