

## Optimization of Compaction Grouting in Collapsible Soils

Jason M. Cumbers, P.E., M.ASCE<sup>1</sup>, Eileen M. Dornfest, P.G., CEG<sup>2</sup>,  
Daniel D. Overton, P.E., F.ASCE<sup>3</sup>, Joe Harris<sup>4</sup>

*Proceedings of ASCE Fifth Congress on Forensic Engineering, Washington, D.C.. November 2009.*

### **ABSTRACT**

Six multi-family residential buildings consisting of wood frame structures founded on post-tensioned slabs-on-grade were constructed in approximately 1995 in Basalt, Colorado. Collapsible soils had been identified at the site, in geohazard evaluations, as early as 1976 and a pre-construction geotechnical investigation indicated that the silty clay soils at shallow foundation depths could have high collapse potential when wetted. The buildings experienced between 4.8 and 13.0 cm (1.9 and 5.1 in.) of differential settlement between 1995 and December 2006. Compaction grouting test pads were constructed and pre- and post-grouting analyses of the soils were conducted to quantify changes in moisture content, density, compressive strength, and collapse potential of the soils. Introduction of water into the soils prior to grouting played a significant role in the improvement of soil conditions under the buildings. The grouting methodologies are summarized, and the resulting soil improvement at the test pads and stabilized buildings is discussed.

---

<sup>1</sup> Project Engineer, Soil and Materials Engineers, Inc., 3301 Tech Circle Drive, Kalamazoo, Michigan, 49008 USA, 269-323-3555. E-Mail: [cumbers@sme-usa.com](mailto:cumbers@sme-usa.com)

<sup>2</sup> Senior Engineering Geologist, Engineering Analytics, Inc., 1600 Specht Point Road, Suite 209, Fort Collins, Colorado 80525 USA, 970-488-3111. E-Mail: [edornfest@enganalytics.com](mailto:edornfest@enganalytics.com)

<sup>3</sup> Principal Geotechnical Engineer, Engineering Analytics, Inc., 1600 Specht Point Road, Suite 209, Fort Collins, Colorado 80525 USA, 970-488-3111. E-Mail: [doverton@enganalytics.com](mailto:doverton@enganalytics.com)

<sup>4</sup> Vice President, Hayward-Baker, 11575 Wadsworth Blvd., Broomfield, CO 80020, 303-469-1136