

Statement of Qualifications

Geotechnical Forensic and Expansive Soils Investigations



Engineering Analytics, Inc.

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Statement of Qualifications-Forensic and Expansive Soils Investigations

Company Overview

Engineering Analytics, Inc. (EA) is a civil and environmental engineering firm specializing in providing turnkey engineering services to both the public and private sectors. The staff includes approximately 10 engineers specializing in geotechnical, hydrologic, hydrogeologic, and reclamation engineering. Our technical staff forms an exceptionally well qualified and experienced team capable of dealing with the most demanding technical and scientific problems related to site characterization, operations, remediation, reclamation, and closure. EA has recognized expertise in many areas of geotechnical and reclamation engineering. Our staff is experienced, technically outstanding, and conscientious about budgetary constraints, regulatory issues, and client priorities. Our approach to every project is basic: we employ excellent technical personnel who work with our clients to understand their needs and efficiently solve their technical problems. We emphasize common sense and practical approaches, bringing in more sophisticated methodologies only as required. Our expertise, experience and services include:

- Geotechnical Engineering
- Geoenvironmental Engineering
- Site Investigation and Remediation
- Surface Water and Groundwater Hydrology
- Water Resources Evaluation and Development
- Engineering Design and Construction Management
- Computer Modeling
- Geographic Information Systems (GIS)
- Regulatory Assistance



Engineering Analytics, Inc. provides management consulting and technical services in four principal business areas: Mining Design and Reclamation, Water Resources, Environmental Engineering and Forensic Investigations. EA has unique capabilities to perform geotechnical forensic studies and expansive soils investigations due to our well-rounded in-house expertise, our extensive geotechnical engineering experience, our state-of-the-art knowledge of expansive soils.

Our staff has performed forensic investigations for over two hundred projects during the last ten years. We have extensive experience with foundation and pavement engineering on expansive soils. Dr. John Nelson has had extensive experience dealing with practice, research and litigation support dealing specifically with expansive soils. Dr. Nelson is an author of a widely used technical reference book on expansive soils.

FORENSIC AND EXPANSIVE SOILS QUALIFICATIONS

Engineering Analytics, Inc. provides forensic support and technical expertise for forensic studies and litigation support. EA routinely provides expert witness services for the following areas:

- Expansive Soils, Pavement, and Ettringite Investigations
- Compaction and Settlements Investigations
- Landslide Investigations
- Hydroconsolidation Investigations
- Retaining Wall Investigations
- Surface Grading and Drainage Investigations
- Tailings Dam Failure Investigations

KEY PERSONNEL

EA has found that our clients return for additional work primarily because of our excellent staff and its reputation for providing what the client wants in a manner that also meets the client's specific project needs. Brief summaries of selected staff members are presented below.

- John D. Nelson, Ph.D., P.E., Principal Engineer
- Daniel D. Overton, P.E., Principal Engineer
- Erik J. Nelson, P.E., Senior Engineer
- Kuo-Chieh (Geoff) Chao, Ph.D., P.E., Senior Engineer
- Michael Malusis, Ph.D., P.E., Senior Engineer
- Adam Hoffman, P.E., Senior Engineer
- Eileen Dornfest, M.S., P.G., C.E.G., Senior Engineering Geologist
- Jason Andrews, P.E., Staff Engineer
- Robert Schaut, P.E., Staff Engineer
- Jong Beom Kang, Ph.D., Staff Engineer
- Denise Weinkauf, Staff Geologist
- Jesse Dunham-Friel, Staff Engineer
- Kristle Hawkins, Staff Engineer
- Keith Morse, Staff Engineer

John D. Nelson, Ph.D., P.E., Principal Engineer

Dr. Nelson was responsible for the development of the Geotechnical Engineering Program, and was formerly the Head of the Civil Engineering Department at Colorado State University. He provides technical direction and senior level review on dam projects. He has worked on numerous dam projects involving safety inspections, geotechnical investigations, raises and repairs. He was involved in many dam design and review projects. Dr. Nelson has also taught graduate level courses and continuing education courses on dam design and operation and maintenance for the past 25 years.

Daniel D. Overton, P.E., Principal Engineer

Mr. Overton has over 23 years of geotechnical and reclamation engineering experience on a diversity of projects. Mr. Overton has served as the project engineer or project manager for many dams and tailings impoundments. Technical specialties include cover design, tailings consolidation, seepage and groundwater analyses, stability analyses, infiltration modeling and determining grading plans, quantities and costs. Mr. Overton has also served as the project engineer or project manager for facilities design of heap leach pads, process solution ponds and waste rock disposal sites. Mr. Overton also has experience in forensic studies, expert witness consultation, expansive soils design, public works projects, foundations for commercial and mid-rise buildings, residential and master planned communities and geotechnical instrumentation.

Erik J. Nelson, P.E., Senior Engineer

Mr. Nelson has over 22 years of experience in site assessment, remediation design and implementation, and geotechnical engineering. He has designed water retention dams and tailings dams for coal, uranium, and copper mine tailings, designed and tested deep foundations for multi-story buildings and grain elevators, been responsible for the design, construction and operation of remediation systems for the treatment of soil and groundwater contamination. He has prepared numerous permit applications including: construction permits, aquifer protection permits, solid waste landfill permits, and environmental resource protection permits. He has also prepared backflow prevention and potable water studies for mines and industrial facilities, prepared remedial investigations, feasibility studies, and remedial designs as well as implementing remedial actions for EPA Superfund sites, and provided construction management services for the construction of large scale remediation systems. In addition, he has provided oversight for large scale grading projects for both commercial and residential projects involving the excavation and placement of up to 44 million cubic yards of soil and the stabilization of large landslide complexes.

Kuo-Chieh (Geoff) Chao, Ph.D., P.E., Senior Engineer

Dr. Chao has over 10 years of geotechnical and reclamation engineering experience on a diversity of projects. Dr. Chao has served as a geotechnical engineer for many dams and tailings impoundments. Technical specialties, including cover design, infiltration modeling, seepage and groundwater analyses, slope stability analyses, tailings settlement/consolidation and liquefaction analyses, hydrologic analyses and other general aspects of geotechnical engineering. Dr. Chao has experience in forensic studies, expert witness consultation, expansive soils design, geotechnical instrumentation and laboratory testing.

Michael Malusis, Ph.D., P.E., Senior Engineer

Dr. Malusis has 15 years of experience in geotechnical/geoenvironmental engineering consulting and research and has specific expertise in the design and performance of geoenvironmental containment systems, including landfill/impoundment liner and cover systems, *in-situ* vertical barriers, and geosynthetic barriers. His expertise includes waste-soil interactions, chemical compatibility testing, clay behavior, contaminant transport through soil and geosynthetic barriers, flow in saturated and unsaturated soil systems, and alternative earthen final covers. Currently, Dr. Malusis is a professor of civil engineering at Bucknell University (Lewisburg, PA) and is a part-time employee for EA. Dr. Malusis previously worked as a project manager and senior engineer for numerous projects involving design, construction, and/or performance analysis of landfills, tailings impoundments, soil-bentonite cutoff walls, and evapotranspirative covers.

Adam Hoffman, P.E., Senior Engineer

Mr. Hoffman has over 20 years of engineering experience. He has specific expertise in site characterization and remediation. Other areas of work experience include engineering design, regulatory negotiations, budgeting, client communications, hiring and management of staff. Mr. Hoffman's areas of study include civil and ground water engineering, as well as environmental law.

Eileen Dornfest, M.S., P.G., C.E.G., Senior Engineering Geologist

Ms. Dornfest has over 8 years of experience in engineering geology and geoenvironmental engineering on a diversity of projects. She has served as senior engineering geologist and project manager for mine reclamation projects, dams, forensic investigations, commercial/industrial development, and residential repair projects. Investigations performed include seepage and slope stability analyses, settlement/consolidation analyses, and other general engineering geologic investigations related to dams, mining, and development.

Jason Andrews, P.E., Staff Engineer

Mr. Andrews has a Masters Degree in Engineering from Colorado State University. He has experience in geotechnical engineering pertaining to mine site remediation, exploratory borings, construction defect litigation, and quality assurance and quality control oversight relating to geotechnical and environmental projects. His areas of emphasis and study include slope stability, laboratory testing, mining projects, settlement analyses, and other aspects of geotechnical engineering.

Robert Schaut, P.E., Staff Engineer

Mr. Schaut has several years of consulting and construction experience in geological engineering as applied to expansive soils, ground water hydrology, characterization of mine and mine waste facilities, and development of mine reclamation plans. His experience includes expansive soil evaluations, slope stability analysis, site investigation and characterization, geologic mapping, field collection of water and soil samples, geotechnical instrumentation, and other general aspects of geotechnical engineering.

Jong Beom Kang, Ph.D., Staff Engineer

Dr. Kang has geo-environmental research experience involved to membrane behavior of GCL with containment system to waste disposal/contaminant transport. He has geotechnical experience including laboratory testing, piping/seepage analyses of embankment, slope stability analyses of soils/rock slope, consolidation/settlement evaluation in soft clayey soils, and expansive soils evaluation related to unsaturated flow/frost modeling, heave predictions, and wetting front migration for surface grading and groundwater mitigation.

Denise Weinkauff, Staff Geologist

Ms. Weinkauff has a Masters Degree in Earth and Atmospheric Science from Purdue University. She has multiple years of research experience in environmental geology, water quality assessment, and natural resource management. She has engineering geology experience relating to exploratory borings, construction defect litigation, and foundation remediation.

Jesse Dunham-Friel, Staff Engineer

Mr. Dunham recently completed his Masters Degree in Civil Engineering with a Geotechnical concentration in expansive soils. He has performed subsurface exploration, monitoring of geotechnical instrumentation, laboratory testing, dam inspection, report writing, and topographical surveys.

Kristle Hawkins, Staff Engineer

Ms. Hawkins is currently completing her Masters Degree in Geoenvironmental Engineering at Colorado State University. She has performed geotechnical laboratory testing, site easement documentation, cost estimating, and budgeting.

Keith Morse, Staff Engineer

Mr. Morse is currently completing his Masters Degree in Civil Engineering at Colorado State University. He brings experience in surveying, field work, and CAD to his position with Engineering Analytics, Inc.

SELECT PROJECT EXPERIENCE

Engineering Analytics, Inc. staff has performed forensic studies for over 200 litigation cases. Short descriptions of representative cases are presented below.

Expansive Soils, Pavement, and Ettringite Investigations

Expansive Soils Distress, FAA TRACON Building

Engineering Analytics, Inc. staff was contracted by the FAA to perform a geotechnical engineering investigation of the TRACON building at Denver International Airport. Mr. Overton was the project manager, Dr. Nelson served as corporate consultant and Dr. Chao was the geotechnical engineer. The TRACON building had a slab-on-grade concrete floor and was supported on a pier and grade beam foundation. The site is located in an area with highly expansive soils. The subsoil at the site consisted of 7 to 13 feet of fill and natural soils underlain by weathered claystone and claystone bedrock. The natural soils, weathered by claystone and claystone bedrock, exhibited moderate to very high swell potential. The investigation and analyses performed included identification of design and construction deficiencies and calculations of free field heave, pier movement and design pier length. Additionally, conceptual repair options and costs were presented.

Foundation Movement, Woodward Governor

Engineering Analytics, Inc. staff performed an investigation of the heave of Woodward Governor's 200,000 square foot manufacturing facility in Loveland, Colorado. Mr. Overton was the project manager and Dr. Nelson was the corporate consultant for this project. The facility rests on 18 to 42-inch diameter piers, founded in Pierre shale bedrock, with depths of 23 feet at the bottom of a 19 feet deep basement. Piers had experienced heave from 0 to 11 inches at the time of the investigation. The investigation and analyses showed the piers were being affected by deep-seated swelling soils and that the piers should be anticipated to have a total heave of 10 to 15 inches. Analyses of groundwater flow were also performed and groundwater flow was determined to be along fractures and bedding.

Pavement Distress, 78th Avenue Parking, Denver International Airport

Engineering Analytics, Inc. staff performed an investigation of distress to the pavement and structures at 78th Avenue, Airside and Landside Parking Facilities at Denver International Airport. Dr. Nelson was the corporate consultant, Mr. Overton was the project manager and Dr. Chao was the geotechnical engineer for this project. The parking lot is underlain by expansive clay soil and Denver formation bedrock. The subgrade soils were lime-treated prior to construction. The parking lot has experienced distress due to expansive soils and development of ettringite. Our in-house geochemical expertise was used to evaluate the impact of chemical changes to the overall expansion.

Slab and Foundation Movements, Highlands Ranch

This project comprised a class action lawsuit brought by approximately 950 homeowners against the Mission Viejo Construction Company. Dr. Nelson served as the expert witness for the plaintiffs. The project team consisting of Mr. Overton, Dr. Nelson and other staff engineers conducted analyses of movement of slabs and design of foundation piers. Heave predictions for the expansive soils profiles were conducted along with general analyses of ground water movement. A large part of this project included development of a large database in Access to facilitate analyses of elevation surveys taken in 181 houses. The database was used to present patterns of movement of slabs, differential movement and total movement for comparison with heave predictions. Dr. Nelson provided testimony for two trials related to this case. This particular case was estimated to have been one of the largest litigation cases in Colorado dealing with expansive soils. The results presented by Engineering Analytics, Inc. staff led to major changes occurring in the practice of foundation engineering on expansive soils in the Front Range area.

Distress to Residential Structures, Powderhorn Subdivision, Littleton, Colorado

Engineering Analytics, Inc. staff performed an investigation of 16 residences in the Powderhorn subdivision in Littleton, Colorado. The subdivision is underlain by steeply dipping claystone/shale bedrock. All of the houses had structural wood floors. However, 11 of the houses had pier foundations and five of the houses had spread pad foundations that rested on over-excavated fill material. The investigation and analyses performed by EA staff included prediction of pier heave, prediction of heave of the conventional spread footing and analyses of pressure exerted on the basement walls by expansive soil backfill. The investigation was performed by Dr. Nelson, Mr. Overton, and Dr. Chao.

General Litigation Support, Expansive Soils

Engineering Analytics, Inc. staff provided ongoing litigation support on cases involving foundation and slab failures for houses and light structures constructed on expansive soils. To date, approximately 150 cases have been involved. Typically, each case includes a review of original soil reports and construction, some soil sampling and laboratory testing, preparation of an opinion report that details the causes of failure, factors that contribute to the failure, prediction of heave amounts and required pier lengths, and a review of applicable or recommended repair measures. Testimony is given at a deposition or in a trial.

In general, Dr. Nelson has served as the expert witness and technical director, and Mr. Overton or Dr. Chao were project manager for the projects. Projects have been located in areas ranging from the flat-lying bedrock areas in the eastern parts of the Front Range area, to steeply dipping bedrock areas near the foothills. EA staff work has had a significant impact on the successful settlement or trial of these cases. Also, the work conducted by EA staff has formed a basis for publications that have advanced the state-of-the-art in heave prediction and has had a significant impact on the state-of-the-practice.

Compaction and Settlement Investigations

Roadway Fills and Landslide Stabilization, Cedar Heights Subdivision

Engineering Analytics, Inc. staff performed an investigation of approximately seven miles of distressed roadways for a large private housing development in Colorado Springs, Colorado. The major distress of the roadways was from inadequate compaction of fill soils where the roadway crosses drainages. Additionally, 23 active landslides were present within the development. The estimated repair cost was 9.4 million dollars. The project team consisted of Dr. Nelson, Mr. Overton, Dr. Chao, and others.

Foundation and Slope Movement, Patel Residence

The Patel residence is a house that cost approximately \$700,000 to build. The original lot consisted of sloping ground. To extend the limits of the constructable area of the lot, a fill approximately 20 feet deep was constructed. The foundation consisted of drilled piers advanced through the fill to expansive bedrock. Because of poor compaction of the fill, the slope underwent large plastic downhill deformation, which exceeded 18 inches in some areas, causing severe distress to the house. The project team included Mr. Overton, Dr. Nelson and others. A field investigation was undertaken to analyze the cause of distress, the degree of compaction of the fill, the nature of the slope movement and the movement of water in the slope. Costs for repair were estimated to be approximately one million dollars.

Landslide Investigations

Landslide Mitigation Plan, Colorado Springs, Colorado

Engineering Analytics, Inc. staff performed a geotechnical investigation and developed a mitigation plan for the stabilization of a 175-acre landslide at a recreation facility in Colorado Springs, Colorado. The project team consisted of Dr. Nelson, Mr. Overton, Dr. Chao and others. Surface water, groundwater and geotechnical aspects of the landslide were studied in detail, and the proposed mitigation plan consisted of extensive surface water and groundwater controls.

Landslide Causation and Mitigation Plan, 6th Avenue Estates, Jefferson County, Colorado

Engineering Analytics, Inc. staff performed a forensic study into the causes of a landslide on the north facing slope of Green Mountain. The landslide traversed two streets and caused damage to six residences. EA staff also reviewed a mitigation plan for stabilization on the landslide using tie-back anchors. The project team consisted of Dr. Nelson, Mr. Overton and others.

Landslide Causation Study, The Redlands, Grand Junction, Colorado

Engineering Analytics, Inc. staff performed a study to determine the causes of a landslide in the Redlands area of Grand Junction, Colorado. The landslide is located south of the Colorado River, and has caused one residence to be condemned. The project team was comprised of Dr. Nelson, Mr. Overton and Ms. Dornfest.

Hydroconsolidation Investigations

Unstable Subgrade Soils, Parker Market Place

Engineering Analytics, Inc. staff performed an investigation of distress at the Parker Market Place, Parker, Colorado. Dr. Nelson, Mr. Overton, and Dr. Chao comprised the project team. The site was underlain by seven feet of fill and alluvial natural soil. Both the fill and alluvial soils had low densities and were subject to large immediate settlement upon loading, hydroconsolidation and long-term deformation of the soils.

Hydroconsolidation Investigation, Riverbend Subdivision

Engineering Analytics, Inc. staff performed an investigation of hydroconsolidation of five residences of the Riverbend Subdivision in New Castle, Colorado. The site was underlain by approximately 100 feet and alluvial soils. These soils experienced settlement, movement and ground cracking shortly after release of water onto the site by an up-gradient irrigation ditch. Several of the houses in this project had significant distress and have since been vacated.

Foundation Failure, Rangely Middle School

The Rangely Middle School is a heavy multi-story masonry building constructed on a pier and grade beam foundation. The soil profile consisted of a 60 to 70 feet deep deposit of silty clay and clayey silt (ML/CL), underlain by a claystone/clayshale bedrock. Between the bedrock and the ML/CL soils was a layer of gravel approximately 2 feet thick. Foundation piers were designed and constructed to a depth that was approximately 15 feet short of the bedrock (45 feet \pm). As a result of water movement into the collapsible subsoils, extensive movement of the piers occurred, causing severe structural distress to the grade beams and superstructure. Engineering Analytics, Inc. staff was retained to determine causes of movement, sources of subsurface water and movement of groundwater at the site. Dr. Nelson served as the project manager and engineer, and represented the owner on the mitigation design. The remedial repair that was instituted consisted of pressure grouting the soil between the bottom of the piers and the bedrock. Dr. Nelson reviewed the building performance for approximately one year after completion of the repairs.

Retaining Wall Investigations

Retaining Wall Failure, Port Moody, British Columbia, Canada

Engineering Analytics, Inc. staff performed a forensic investigation of the collapse of a 35-foot-high stress wall retaining system in Port Moody, British Columbia. The investigation focused on the crib design and construction, the wall backfill, analyses of rainfall events, seepage analyses and stability analyses. It was determined that the wall failed due to excess pore pressures in the wall backfill. Dr. Nelson, Mr. Overton and Dr. Chao worked on the investigations.

Distressed Retaining Wall, Calabasas, California

Prior to employment with Engineering Analytics, Inc., Mr. Overton investigated a distressed crib wall system located near the City of Calabasas City Hall. Mr. Overton investigated the design and construction of the wall, and identified several items that were contributing to distress of the wall, including but not limited to inappropriate backfill soils, poor internal crib compaction and use of shimming on the crib members.

Surface Grading and Drainage Investigations

Surface Grading and Drainage Investigation, Colorado Springs, Colorado

Engineering Analytics, Inc. staff performed a surface grading and drainage survey of 47 town homes located in Colorado Springs, Colorado. The survey consisted of measuring the slope away from the units within the first 10 feet for each unit at 219 locations within the entire development. The Soils Report specified a slope of 10% in the first 10 feet away from the structures. Sufficient grade is necessary to direct water away from the foundation and soils around the buildings to reduce infiltration of water into the soils around the buildings. Failure to obtain this grade will result in an increase in infiltration of water into the backfill and natural soils around the buildings, which increases the risk of foundation movement. The results of the grading survey indicate that the current grading at 181 out of 217 locations does not meet the minimum 10% grading specified by the Soils Report. It was recommended that the slopes at the site be regraded to 10 percent in the first 10 feet around the structures. EA provided cut and fill volume estimates for remediation of the drainage conditions. We also provided a third party review of proposed drainage improvement at the site. The investigation was performed by Dr. Nelson, Dr. Chao, and Mr. Andrews.

Tailings Dam Failure Investigations

Tailings Dam Failure, Talache Mine Site, Idaho

Engineering Analytics, Inc. staff performed an investigation of a tailings dam failure at the Talache mine site in Idaho. Analyses were performed to determine the quantity of

tailings from different mine operations that were involved in the breach of the dam. The project team consisted of Dr. Nelson, Mr. Overton and others.

Church Rock Tailings Dam Failure, Church Rock, New Mexico

Prior to employment at Engineering Analytics, Inc., Dr. Nelson was the chief technical reviewer for the United States Nuclear Regulatory Commission in review of the failure of the Church Rock Tailings Dam. Failure occurred as a result of cracking of the dam caused by large settlement of collapsible foundation soils. Failure to maintain a beach allowed tailings water to enter the cracks in the dam directly, thereby causing the dam to fail from the piping of highly dispersible compacted embankment fill. Improper construction of the drainage zone of the dam exacerbated the problem. Dr. Nelson conducted analyses of the failure and reviewed the proposed repairs. Subsequently, he was retained as an expert witness on this case on behalf of Sphere Insurance Company.

Appendix A

Title Page: *Expansive Soils, Problems and Practice in Foundation and Pavement Engineering*, By John D. Nelson and Debora J. Miller