



**Rex Goodrich, PE, Geologist**  
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### Education

M.S. (Mechanical Engineering/Computational Solid Mechanics) Colorado State University, 1994  
 B.S. (Geology) Colorado Mesa University, Grand Junction, Colorado, 1982  
 B.S. (Computer Science) Colorado Mesa University, Grand Junction, Colorado, 1984

### Professional Memberships

Registered Professional Engineer (PE Colorado, Utah, Texas, New Mexico, Idaho, P.Eng Saskatchewan)  
 American Society of Civil Engineers  
 Society of Mining Engineers; SME CO Plateau Section—Vice Chair (2015-2016)



### Chronology

11/20-present Goodrich Engineering LLC, President  
 3/20-11/20 Division Manager, Mays Construction Specialties, Inc.  
 2013–2019 Senior Associate, Agapito Associates, Inc.  
 2005–2013 Region Materials Engineer, Colorado Department of Transportation  
 2001–2005 Assistant Region Materials Engineer, Colorado Department of Transportation  
 1998–2001 Associate, Agapito Associates, Inc., Engineering Staff Coordinator  
 1994–1998 Senior Engineer, Agapito Associates, Inc.  
 1984–1994 Geotechnical Computer Analyst, J.F.T. Agapito & Associates, Inc.

### (part-time work during college)

1983–1984 Hydrologic Technician, U.S. Bureau of Reclamation, Grand Junction, CO  
 1981–1983 Junior Geologist, J.F.T. Agapito & Associates, Inc.

### Experience Summary

- **Geotechnical and Mining Experiences. (41 years in geotechnical workforce, 29 yrs as PE)**  
 I have been President of Goodrich Engineering LLC since November 2020. I have over 140 clients and over 250 projects ongoing or completed in western CO and eastern UT. I have a soils lab and test soil properties to support recommendations regarding geotechnical construction projects. I utilize contract drillers and/or contract excavation equipment for subsurface exploration. I analyze soil and rock for physical properties as well as soil and rock anchors of various kinds and conduct pullout testing of installed support.
- I was the Division Manager of Mays Construction Specialties Inc. Here I prepared cost estimates for geotechnical projects with micropiles, helical piers, soil nail walls, tie back anchors and underpinning of distressed and damaged foundations. It was during this period that I realized the sorely needed geotechnical engineering services here in Grand Junction.
- I managed the CDOT Region 3 Materials Lab for 12.5 years from 2001 through 2013. The lab manager and other testing personnel, including the Independent Assurance Testers, were my direct reports (11 persons).
- I gained experience through CDOT with heavy equipment construction. As the Materials Engineer I was often on site either to observe construction practices (especially compaction and placement of materials) or to mitigate disputes.
- I have 26 plus years with Agapito Associates Inc. I have worked on various aspects of underground soft rock, hard rock, and solution mining as a geomechanics engineer, numerical modeling/computer analysis and geologist. Primary duties included geomechanical design, site

characterization, numerical modeling, resource evaluations, instrumentation, geological interpretation, hydrology, and data collection related to mine design and underground stability of excavations, artificial support design, reporting, marketing, planning and management of specific engineering and geological projects.

- Resource evaluations for various industrial mineral projects including potash and trona. Resource modeling and Resource and Reserves estimates using MineSight 3D computer software.
- Authored mining and geology sections of NI43-101 documents for potash technical reports. Subsidence evaluations of creep and creep rates for potash solution mining projects. I am a Qualified Person (QP) under the NI 43-101 requirements for Standards for Disclosure for Mineral Projects to be traded through stock exchanges overseen by the Canadian Securities Administrators (Toronto Stock Exchange, TSX).
- Provided preliminary designs for vertical and horizontal wells, casing and tubulars for injection and recovery of brines from solution mining. Also, electric submersible pump sizing for lifting brines.
- Design of pillars and subsidence predictions for solution mining of NaCl, potash, trona and nahcolite. Written algorithms for salt cavern growth via dissolution.
- Expertise in use and adaptation of various rock mass rating systems. Stability evaluations for underground excavations in soft and hard rock, subsidence, solution mining, site characterization and geological interpretation.
- Design of tunnel span bolting support systems in soft and hard rock.
- Soft rock experiences include longwall and room and pillar mining in coal, trona and salt, design of pillars, entries, and barriers.
- Hard rock experiences include design in block caving, open stope, cut and fill and stope and fill. Cemented fill.
- Also heat transfer and thermal-mechanical issues related to rock for solution mining and for spent fuel nuclear waste repositories.
- Experienced with analysis of heat transfer to rock from solution mining solvents.
- Geological experience with site characterization, field data collection, resource evaluation, structural evaluation, and interpretation. Selection of drilling sites for resource and structural evaluation. Supervision of rock properties testing. Field logging of rock core. Core orientation and photography.
- Marketing and sales.
- Technical writing and report writing. Paper is our product and technical report writing has become a strength.
- Resource and reserves estimation in various economic deposits including brines.
- Instrumentation and monitoring program design. Stress determinations, interpretation, and data reduction.
- Wrote computer software for many years in the 1980's and 1990's for postprocessing of numerical models including finite element, finite difference, heat transfer, stress measurement data reduction, etc.

- **Transportation Experiences.**

- I was the Region 3 Materials Engineer for 12.5 years with CDOT and was a member of the Region Leadership Team (RLT) from November 2005 through December 2013. I developed friendships and working relationships with the other members of the RLT and other Regions within CDOT giving me an understanding and experience with Transportation Engineering and Maintenance in R3 and statewide.
- As administrator of the Region 3 Surface Treatment Program, I worked closely with Maintenance and Program Engineers to continuously revise and maintain the 6-year plan. The annual budget for the R3 ST program had historically ranged from \$15 to \$50 million. I managed two full-time

engineers to assist in this ongoing operation (Pavement Management Engineer and Assistant Materials Engineer).

- I prioritized and wrote justifications for the R3 Surface Treatment projects establishing preliminary budgets to meet the project lengths and degree of pavement distress. Often decisions were a compromise in design features to satisfy available budgets. I also approved and managed expenditures of the Materials unit within the Program East budget for the R3 Lab, drilling equipment including personnel expenditures and travel.
- Assisted Maintenance with scoping and contracting subcontractors for design and repair of soil and rock stability, landslide repair and rockfall mitigation.
- I worked closely with the R3 business office, the RTD and Program Areas in adjusting project priorities sometimes combining funds from various sources to achieve scoped project goals. Many times, we reordered our project list in the ST Program to satisfy budgetary constraints and unforeseeable circumstances. I am knowledgeable regarding CDOT policy and the manner of thinking regarding overall strategies in accomplishing Maintenance and Engineering project goals. I assisted in region manpower and budget shortages by assigning members of R3 Materials to Residencies to satisfy manpower needs without having to resort to hiring consultants.
- I have experience with and a good understanding of CDOT's stewardship agreement with FHWA and I'm sensitive to the conceptual as well as contractual constraints sometimes presented when working with the federal and local governments.
- I instituted regular safety training beginning in 2001 in R3 Materials several years before CDOT began reformation of its safety awareness program.
- Management: I managed 11 FTE's in R3 Materials. I have a calm disposition, I'm slow to anger but I can be persuasive in a decision-making environment. I respect others and strive to view all as equals.
- Management: I have been put on the spot in meetings between CDOT personnel and contractors over monetary disputes regarding project materials and workmanship. I experienced impromptu, confrontational situations and negotiated with the personnel involved to resolve differences to reach a fair solution or compromise.
- I was a voting member of the Materials Advisory Committee for 8 years (MAC). I served on many MAC Task Force subcommittees to develop and revise CDOT specifications and procedures.
- Sat on 15 MAC Task Force committees for the development of Specifications to be used on CDOT projects. These included: R3 Safety Committee, Pavement Warranty TF, Aggregate Quality TF (micro-deval), Nonstandard Mix Design TF, Baghouse Fines TF, Stone Matrix Asphalt TF, Sulfate Resistant Concrete TF, Segregation TF, Class S50 TF, Driven Piles for Landslide Mitigation Research Panel, Class N Flyash Research Panel, Shotcrete TF.
- I was frequently called upon to speak to groups ranging in size from a few people to a conference setting. I spoke at CDOT functions such as the SAFETY rollout, at semi-annual Materials reviews and at employee retirement parties. I gave oral presentations at conferences and served as moderator of technical sessions at conferences. I was often facilitator of Unit, MAC and RLT meetings.
- I received an Outstanding (Level 3) rating every year that I was employed at CDOT.
- I have over 26 years' experience in the private sector working for a geotechnical engineering consulting firm and 12.5 years at the DOT. This combined experience gives me a business perspective from both the "owners" as well as the "contractors" vantage. I am a competent PE in Civil, Transportation and Mining and Geotechnical fields of professional practice. I am also a Geologist.
- I initiated the trans-canyon reconstruction of I-70 in Glenwood Canyon with PCCP (Portland cement concrete pavement) and designed and supported the construction of several of those projects.
- I introduced the Region and CDOT to ultrathin-epoxy and polyester-concrete-wearing-surfaces and assisted in the development of the specifications for its use. I oversaw the resurfacing of several bridge-decks in Glenwood Canyon with this material. This is an exceptionally durable one inch to

two-inch thick waterproof, flexible wearing surface for protection of concrete bridge decks and other structures containing steel reinforcement. This material protects the steel from the penetration of deicing salts and associated chlorides. It is like a high-quality concrete in every way except that the binder is composed of resin. Expensive but durable.

- I received a concrete paving award from ACPA for the first concrete overlay (6") on Interstate in CO (Loma to Mack, I-70). Some of the unique innovations on this project included laser-guided planning of the existing asphalt and redesign of super-elevation on the corners.
- Testified at a Dispute Resolution Board hearing regarding changed conditions during the construction of the Snowmass Canyon Project on SH 82. As a result, taxpayers saved approximately \$500,000 in construction costs when the subcontractor failed to read and thoroughly understand our GDSR (geotechnical design summary report).
- I received multiple non-salary incentive awards for geotechnical contributions on Region 3 projects. These included dispute-resolution at Snowmass Canyon, foundation repairs on bridge abutments, and the use of soil nails as temporary shoring that extended under federal highways.

### Experience Details

- **12/13–12/19 Sr. Associate, Agapito Associates, Inc.**
- Resource evaluations for potash projects. Resource modeling and estimates using MineSight 3D computer software. Authored mining and geology sections of NI43-101 documents for potash technical reports. Subsidence evaluations of creep and creep rates for potash solution mining projects.  
I am a Qualified Person (QP) under the NI43-101 requirements for Standards for Disclosure for Mineral Projects to be traded through stock exchanges overseen by the Canadian Securities Administrators. Provided preliminary designs for vertical and horizontal wells for injection and recovery of brines from solution mining of potash (KCl). Provided preliminary design calculations for electric submersible pumps for brine recovery. Provided construction specifications package for preliminary cost estimate for construction of solution mining well field including surface and subsurface facilities.
- Brine deposit resource evaluation of a brine pumping operation in Northern Ontario.
- Underground roof support design at gold mine in Columbia.
- **11/05–12/13 Materials Engineer, Colorado Department of Transportation, Region 3 Materials.** In November 2005 I was promoted to PE II as the Region Materials Engineer (RME). I supervise 10 positions, oversee materials testing and pavement design, provide technical consulting on materials and construction related issues and manage the R3 Surface Treatment program (over \$50 million annually) and the R3 Independent Assurance program. The Surface Treatment Program consists of an annual list of highway segments that are to receive resurfacing, rehabilitation or reconstruction and their respective surface treatment design recommendations. Two of my direct reports are the Pavement Management Engineer and Assistant Materials Engineer. The remaining are one Administrative Assistant and 7 laboratory technicians including the two Independent Assurance personnel and the Region Finals Engineer. As RME, my staff and I provide technical support to construction personnel to assure that all the materials incorporated in the construction of transportation projects and the work accepted by sampling and testing follow the contract specification requirement. I provide the design and construction engineering personnel with technical and engineering services in transportation materials (concrete, asphalt, and soils) as it pertains to road bridge design and construction. I also provide analytical, service, technical direction, and training to field personnel in semi-annual Materials training and specification review classes. I have also provided direction and consulting regarding complex geotechnical issues related to landslides, subsidence, and rockfall or tunnel stability. I worked closely with Resident and Project engineers in construction

and in many instances, I have been called to negotiate with contractors regarding acceptance of materials on projects weighing the durability of the product and value to the taxpayer.

- **Accomplishments:** -I promoted the use of Ultrathin Epoxy Wearing Surfaces and Polyester-Polymer Concrete as an alternative bridge deck topping and have had it included in several engineering projects. To date, almost all of the bridge decks on I-70 in Glenwood Canyon have been resurfaced with Polyester Polymer Concrete.
  - I initiated the reconstruction of I-70 in Glenwood Canyon removing the asphalt pavement sections on-grade and replacing with concrete pavement. This took many years to complete.
  - I received multiple non-salary incentives for geotechnical contributions on dispute-resolution, foundation repairs, and the use of soil nails under federal highways.
  
- **4/01–11/05 Assistant Materials Engineer, Colorado Department of Transportation, Region 3 Materials**
- Provide materials recommendations relating to highway construction and resurfacing projects. Ensure that materials plans, and specifications are supplied to designers. Provide support related to gravel pits. Perform materials and geotechnical engineering support for Region 3. Materials and geotechnical issues include highway structural template design (including life-cycle cost analysis) and stability, asphalt and concrete mix design, soil and rock mechanics, geological interpretation and support and landslide and rockfall mitigation. Lab supervisor of testing personnel.
  
- **4/00–4/01 Senior Associate, Coordinator of Engineering, Agapito Associates, Inc.**
  
- **2/98–4/00 Associate, Agapito Associates, Inc.**
- Genwal, Crandall Canyon Mine, UT. Observations of stability of mains and bleeders following retreat of block of longwall panels. Design of barrier pillar for bleeder stability. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging.
- Andalex, West Ridge Mine and Aberdeen Mine, UT. Bleeder and barrier pillar design. Evaluation of location for extraction face. Evaluation of longwall retreat sequence on gateroad stability. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging.
- Sandia National Labs, Thermal-mechanical analysis for a nuclear waste repository in Korea. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging.
- U.S. Borax/Rio Tinto. Kazan Soda Project, Ankara, Turkey. Prefeasibility of solution mining of trona. Assisted in initiation and development of the geotechnical database for the project. Selection of core hole locations for resource and rock structure evaluation. Training of field personnel for structural logging of over 20,000 ft. of drill core. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging. Supervised data collection from drill core and data reduction.
- American Soda, Piceance Creek Basin, CO. Engineering support for county, state, EPA permits and DEIS and EIS. Testified at CO Division of Minerals and Geology Hearing regarding 112 Mining and Reclamation Permit. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging. Supervised data collection from drill core and data reduction.
- Intrepid Oil Co., Cane Creek Mine, Moab, UT. Thermal calculations of energy losses of a heated injection liquor in well bores and during cavern development for solution mining of potash. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging.
- American Soda, Piceance Creek Basin CO. Stability evaluation of well spacing for solution mining of nahcolite. Thermal calculations of energy losses during cavern development. Optimization



modeling for cavern growth. Corehole summary reports of geotechnical and geological data collected from six continuously cored exploration holes. Geologic resource evaluation. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging.

- Mountain Coal Co., West Elk Mine, CO. Geotechnical evaluation of drill core. Geotechnical design summary report for construction of shafts for ventilation, men, and materials. Observations of ground conditions in exhaust shaft under construction. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging. Supervised data collection from drill core and data reduction.
- Energy West Mining Co. Deer Creek Mine, UT. Evaluation of predictions for longwall mining through a graben associated with anomalous stresses. Sensitivity of lithology to entry stability. Effect of secondary support and shield loads on face and tailgate stability and burst potential. Stability evaluation for interburden between mains in the Blind Canyon Seam and proposed ramps to underlying Hiawatha Seam. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging.
  
- **6/94–1/98      Senior Engineer, Agapito Associates, Inc.**
- Stability evaluation of well spacing for solution mining of nahcolite. Corehole summary report of geotechnical and geological data collected from multiple continuously cored exploration holes (> 2000 ft. ea.) for American Soda, Piceance Basin, CO. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging. Supervised data collection from drill core and data reduction.
- Geotechnical Summary Report for construction of underground ramps for a coal mine. West Elk Mine, Mountain Coal Company, CO. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging. Supervised data collection from drill core and data reduction.
- Evaluation of longwall panel orientation and longwall shield capacities for the Trail Mountain Mine, Energy West Mining Company, UT. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging.
- Stress determinations and stability pre-evaluation of longwall mining through a graben, longwall panel orientation and yield pillar design; evaluation and prediction of potential surface impact from single-seam longwall mining subsidence to existing 345 kV surface powerline for the Deer Creek Mine, Energy West Mining Company, UT. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging.
- Backanalysis of caving and load transfer of a pillared area, evaluation of longwall gateroad designs, preparation of technical presentation to MSHA and backanalyses of stress conditions resulting in a face burst for the Aberdeen Mine, Andalex Resources, Inc., UT. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging.
- Conducted structural and lithological logging of exploration hole for proposed raise-bored shaft (Shaft 3); wrote Geotechnical Summary Report on rock quality, lithology, and hydrology for the bid document for the West Elk Mine, Mountain Coal Company, CO. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging. Supervised data collection from drill core and data reduction.
- Stability evaluation of barriers, bleeders, pillars for mains, and alternative gateroad designs for longwall mining at the Willow Creek Mine for depths of cover up to and more than 2400 ft., Cyprus Plateau, UT. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging.
- Technical review of longwall feasibility and evaluation of the stability of alternative gateroad designs for longwall mining at depths of cover up to 2500 ft at the Crandall Canyon Mine, GENWAL Mining Company, UT. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging.

- Panel layout evaluation for optimization of barrier pillar dimensions for long-term stability, and rock mechanics investigations and back-analysis of the collapse of multiple room-and-pillar panels at the Solvay Trona Mine, WY. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging.
- Thermomechanical analysis of potential causes for degradation of a cemented shaft liner for General Chemical, WY. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging.
- Structural stability evaluation of longwall face width expansion for Twentymile Coal Company, CO. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging.
- Evaluation of potential subsidence due to longwall mining including considerations of an abandoned overlying mine, impacts on existing landslides and the North Fork Gunnison River for Oxbow Carbon and Minerals, CO. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging.
- Subsidence evaluation for impacts of longwall mining on archeological sites, a canyon, and associated perennial stream and riparian ecosystem for SUFCO Mine, Canyon Fuel Company, UT, including a subsidence computer model using influence functions for vertical and horizontal movements. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging.
- Stress analysis and stability evaluation of modification of production panel layouts including variations on number of crosscuts and pillar widths; stress distributions were projected to the upper bed for evaluation of impacts on two-seam mining; performed a lineament study for long-range planning of a room-and-pillar trona mine for OCI Wyoming, LP, WY. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging. Supervised core logging and data reduction.
- Structural stability and subsidence evaluation of extraction by *in situ* combustion of a 25-ft-thick coal seam dipping 60° for the North Knobs Coal Gasification Project, Raven Ridge Resources, WY. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging.
- Structural stability evaluation of rubblization and leaching for secondary copper extraction and shaft pillar design for a new shaft at the White Pine Mine, Copper Range Company, MI. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core.
- Structural mine design for slot-and-fill and drift-and-fill mining at Independence Mining Company, NV. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging. Trained personnel for structural logging of core and conducted data reduction.
- Geotechnical and structural evaluation of data and mining methods for the Meikle Mine, American Barrick Resources, Inc., NV. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging.
- Numerical analysis of flatjack tests for Sandia National Laboratories. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging.
- Numerical analysis of creep in pillars for a new salt mine design, Akzo Nobel Salt Inc., NY. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging.
- **Jan–May 1994 Project Engineer, Agapito Associates, Inc.**
- Geotechnical evaluation and structural mine design using slot-and-fill and drift-and-fill methods for gold extraction at Independence Mining Company and Newmont Gold Company near Elko, NV. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging.

- Evaluation of optimum longwall panel orientation with respect to rock structure and stress regime, and evaluation of minimum interburden thickness for longwall mining and placement of gateroads for a two-entry yield pillar design for the Deer Creek Mine, Energy West Mining Company, UT. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging.
- Stability evaluation of proposed room-and-pillar panel rubblization at the White Pine Mine, Copper Range Company, for the purpose of enhanced secondary recovery by solution. Subsurface structural evaluation based on drill core logging, rock properties testing of drill core and geophysical logging.
- Rock mechanics testing for roof, seam, and floor properties for a proposed underground coal mine at the San Juan Surface Mine near Farmington, NM.
  
- **1984–1993      Geotechnical Computer Analyst, J.F.T. Agapito & Associates, Inc.**
- ***Mine Design Experience:*** Areas of design experience include structural mine design and layout of longwall mining in coal and trona; structural mine design of room-and-pillar mining in coal, trona, oil shale and hard rock; structural mine design for open stope and stope with cemented and uncemented backfill; stability evaluation and design of solution-mined cavities; and structural design of tunneling for a nuclear waste repository with thermal and mining-induced stresses. Other design experience includes tunnel support systems, foundation design in underground mining, mine production optimization and simulation, and mine ventilation design and simulation.
- ***Computational Experience:*** Computational design experience included computer modeling and numerical analysis. Experienced using elastic and nonlinear constitutive models with finite-element, boundary-element, finite-difference, and distinct-element methods. Model development experience includes the implementation of plasticity, joint and bolt models. Computer modeling experience includes surface water discharge, confined and unconfined aquifers, and contaminant transport in groundwater. Proficient in computer software engineering and development including computer graphics. Developed and implemented several large computer graphics programs designed for data reduction and pre- and post-processing results from numerical analysis computer models.
- ***Field Experience:*** Field experience includes site visits to various mines for inspection of conditions with respect to structural design. Conducted overcoring stress measurements and installed and monitored stress change deformation instrumentation in rock. Geological and hydrological field experience consists of lithological and structural data collection from drill core, structural interpretation, and surface mapping and hydrological well site tests.
  
- **1983–1984      Hydrologic Technician, U.S. Bureau of Reclamation, Grand Junction, CO.** Responsible for computer data reduction of surface and groundwater discharge and salt concentrations, and field measurements of channel cross sections and stream discharge.
  
- **1981–1983      Junior Geologist, J.F.T. Agapito & Associates, Inc.**
- Installation of extensometers, correlation of geophysical logs, lithological and structural logging of drill core, hydrology tests, and gas monitoring for Exxon Colony Shale Oil Project.

### **Publications**

- “In-Situ Stress Measurements and Instrumentation Installation Duke Energy Walters Dam, Waynesville, North Carolina”. 2018 Association of State Dam Safety Officials, Inc
- “Emergency Sinkhole Mitigation and Void Investigation of Abandoned Railroad Tunnel along US 24, Tennessee Pass, CO; Case Study”. ARMA 13-328, 2013.
- “Structural Repair of Cross-Passage 5, Interstate 70 Hanging Lake Tunnel-Paper Number 162. 2008.



- “Geotechnical Characterization and Structural Mine Design at the Murray Mine, Northeastern Nevada” American Rock Mechanics Association Symposium, Washington DC, July 2001.
- January 2000. Patent Pending. “Sodium Carbonate and Sodium Bicarbonate Production from Nahcolitic Oil Shale”.
- “Long-Term Stability for Two-Seam Mining at OCI’s Big Island Mine.” SME Annual Meeting and Exhibit, March 1999.
- “Subsidence Behavior at the SUFCO Coal Mine, UT.” 37<sup>th</sup> U.S. Rock Mechanics Symposium, June 1999.
- “Long Load Transfer Distances at the Deer Creek Mine.” 37<sup>th</sup> U.S. Rock Mechanics Symposium, June 1999.
- “Five Stress Factors Conducive to Bursts in Utah, USA, Coal Mines.” 9<sup>th</sup> International Congress on Rock Mechanics, August 1999.
- “Longwall Mining Through a Graben with Anomalous Stresses at the Deer Creek Mine.” NARMS 98, Cancun, Mexico.
- “Dealing with Coal Bursts at Deer Creek.” Mining Engineering, July 1997.
- “The Effect of Entry Spacing, Rock Strength and Horizontal Stress on the Roof Stability of Multiple Parallel Excavations.” Colorado State University, Mechanical Engineering Dept., M.S. Thesis, 1994.
- “Yucca Mountain Site Characterization Project: New Three-Dimensional Far-Field Potential Repository Thermomechanical Calculations.” SAND92-0589, Sandia National Laboratories, Albuquerque, NM, 1993.
- “Fault Stress Analysis for the Yucca Mountain Site Characterization Project.” Proc. Annual Nuclear Waste Conference, Las Vegas, April 1992.
- “Solution Mining Cavity Stability: A Site Investigation and Analytical Assessment.” Proc. Int’l ISRM EUROCK ‘92 Symp. on Rock Characterization, Chester, U.K., 1992.
- “Documentation and Verification of STRES3D, Version 4.0.” SAND89-7023, Sandia National Laboratories, Albuquerque, NM, 1991.
- “Preliminary Drift Design Analyses for Nuclear Waste Repository in Tuff.” Proc. 31<sup>st</sup> Rock Mechanics Symp., Golden, CO, June 1990.
- 1994. M.S. Thesis. Mechanical Engineering Dept., CO State Univ. “The Effect of Entry Spacing, Rock Strength, and Horizontal Stress on the Roof Stability of Multiple Parallel Excavations.”

### Selected Supervisory Training:

- Dale Carnegie
- Management Problems of the Technical Person in a Leadership Role
- CO Supervisory Leadership Cert.
- Developing Your Leadership Role
- Information Interchange Exchange
- LINKS
- Hiring the Best
- FHWA Detecting/Combating Fraud in Hwy Const.
- FHWA Contract Admin. Core Curriculum
- Employment Law
- Substance Abuse Recognition Training
- 7 Habits of Highly Effective People
- Genuine Leadership for CDOT Supervisors
- Influence & Motivation
- Environmental Justice

