

SEAN P. HARVEY, P.G.

PROJECT MANAGER

Mr. Harvey is a licensed professional geologist with over ten years of progressive experience in geotechnical and geologic engineering applications for tunneling, mining, and commercial construction. His responsibilities include tunnel design and construction, tunnel design evaluation, initial support design and evaluation, rock mechanics, geotechnical investigations, geologic interpretation, and construction observation.

Mr. Harvey's experience in tunneling, underground construction, and mining includes responsibility for subsurface investigations, tunnel design evaluations, Geotechnical Baseline Report (GBR) preparation, geologic mapping, tunnel mapping, ground anchor design and construction, and deep / shallow foundation design and construction. He has also served as a project geologist / engineer for tunnel design and construction management projects. Mr. Harvey has worked on projects in various locations throughout the United States involving soft ground, hard rock, and mixed face conditions. Technical skills obtained through these projects include drilling and coring methods of subsurface exploration, in-situ and laboratory testing methods, geologic mapping and map interpretation, groundwater monitoring and modeling, rock mechanics investigations and interpretations, instrumentation installation and interpretation techniques, report preparation, and design methods and techniques.

Mr. Harvey completed a Master of Science degree in Mining and Earth Systems Engineering at the Colorado School of Mines where he was involved in a research project funded by the National Institute of Occupational Safety and Health (NIOSH). The project focused on studying the rock mechanics of dynamic loading conditions encountered in underground coal mines and whether a support system could be developed to assist with the dissipation of dynamically induced energy and containment of ejected material during a rock burst.

Years of Experience: 10

Years with Brierley: 2

Education

M.S., Colorado School of Mines,
Mining and Earth Systems
Engineering, 2009

B.S., Fort Lewis College, Geology,
2000

Professional Registration

Professional Geologist, Wyoming
(PG-3661)

Professional Geologist, California
(PG-8815)

Professional Societies

Association of Engineering
Geologists (Rocky Mountain Section
Chair 2008-2009)

Society for Mining, Metallurgy, and
Exploration

Underground Construction
Association of SME

American Rock Mechanics
Association

PROJECT EXPERIENCE

Caldecott Improvement Project, Bore No. 4 of the Caldecott Tunnel, California Department of Transportation, Tutor-Saliba Corporation, Alameda and Contra Costa Counties, CA.

Bore No. 4 is located north of the existing Caldecott Tunnel on SR 24 between SR 13 in Oakland, CA and Gateway Boulevard in Orinda, CA. The mined tunnel portion of Bore No. 4 will be 3249-ft long and have a horseshoe shape with excavated dimensions of approximately 49 ft in width and 36 to 40 ft in height. Seven cross passages will also be mined between Bore No. 4 and the existing Bore No. 3. The horseshoe-shaped cross passages will range from 107 to 145-ft long and have excavated dimensions of about 14-ft wide and 15-ft high. Excavation is anticipated to take place from two portals using roadheader equipment. Engineering geologic conditions are anticipated to range from highly weathered (near soil) shale under shallow cover to blocky and seamy sandstone

under approximately 530 ft of cover. The design and construction of Bore No. 4 and cross passages is based on the philosophy of the sequential excavation method (SEM). Depending on ground conditions along the alignment, the initial support system will include shotcrete, rock dowels, lattice girders, spiles, and grouted steel pipes in various combinations.

Mr. Harvey performed analyses of the anticipated geologic / geotechnical conditions to be encountered during construction and evaluated the contract design documents in order to provide construction recommendations and bid assistance to Tutor-Saliba Corporation. Tutor-Saliba Corp. was the low bidder and was awarded the construction contract.

During the preconstruction and submittal phase, Mr. Harvey performed further evaluation of initial support design and anticipated ground characteristics for use in finite element analyses and construction means and methods recommendations. Construction phase services will include evaluation and documentation of ground conditions, sequential excavation consulting, and initial support recommendations during excavation of the tunnel.

New Irvington Tunnel, San Francisco Public Utilities Commission, Oscar Renda Contracting, Fremont, CA.

The New Irvington Tunnel (NIT) will be located in the San Francisco Bay Area, east of the City of Fremont, CA. The project involves the construction of a new tunnel, connections to existing facilities at each end of the tunnel, and construction of ancillary facilities. The NIT will be roughly parallel with the Existing Irvington Tunnel (EIT), which was constructed over 80 years ago. The new tunnel will be about 3.6 miles long and will have a finished inside diameter of approximately 120 in., to be determined by the Contractor.

The NIT is expected to encounter difficult and highly variable ground conditions. The rock mass is generally composed of weak, intensely fractured and sheared sedimentary rocks (mainly sandstone, siltstone, interbedded siltstone/sandstone, and shale), and also includes some sections of stronger and more massive rock. Along the proposed alignment, the tunnel will also intercept a number of fault zones with abundant clay gouge.

Mr. Harvey performed an analysis of the anticipated geologic / geotechnical conditions to be encountered during construction and evaluated the contract design documents in order to provide construction recommendations and bid assistance to Oscar Renda Contracting during the bid preparation phase.

Eastside Water Supply Raw Water Intake Tunnel, Monroe County Water Authority, Southland Contracting, Webster, NY.

Freeport Mine Slope, Alpha Natural Resources, Clarksville, PA.

The proposed project consists of developing approximately 3200 LF of declined tunnel, with an excavated opening about 20-ft by 20-ft in cross-section. The proposed decline tunnel will have a portal opening at the ground surface, with a grade of 24.9% (14 deg) to the mine floor at an approximate depth of 745 ft. The decline tunnel is proposed to penetrate a large solid coal pillar in the mined-out section of the Pittsburgh Coal seam at a vertical depth of about 135 ft below the planned portal opening.

Freeport Mining, LLC contracted with Brierley Associates, LLC to conduct geotechnical investigations to verify the feasibility and confirm the preliminary design of the Freeport Mine Slope at its proposed location. The field investigation program consisted of four geotechnical investigation borings varying in depth from 143 ft to 910 ft, water pressure (packer) testing at selected intervals in each boring, installation of vibrating wire piezometers, and laboratory testing on rock samples recovered from the borings. Mr. Harvey provided full time on-site drilling observation, core logging, pressure testing, piezometer installation documentation, and geologic / geotechnical characterization.

Lake Mead Intake No. 3, Southern Nevada Water Authority, Vegas Tunnel Constructors, Las Vegas, NV.

The Lake Mead Intake No. 3 project includes five major components: a deep-water intake riser and inlet structure; an intake tunnel driven beneath the lake and a portion of Saddle Island; a pumping station on Saddle Island; a discharge pipeline connection to the extant Alfred Merritt Smith WTF; and a tunnel connecting the IPS-3 facilities with the existing IPS-2. IPS-3's basic concept is to draw water from below the lake's thermocline, providing reliable access to better water quality (minimizing the need for additional treatment processes).

Main areas of work include a 30-ft diameter, 600-ft deep tunnel access shaft; a TBM-excavated, 20-ft diameter, three mile long intake tunnel beneath the lake; an intake structure in the lake consisting of a caisson structure that will be fabricated on the lake surface, immersed into a preformed excavation, and encased in tremie concrete. The intake structure will serve as a dock to receive the TBM.

Brierley Associates has been retained by Vegas Tunnel Constructors to provide the detailed design for the contract; providing the lead engineer, tunnel design, geotechnical characterization, and specification and submittal review. Mr. Harvey provided temporary relief for the Brierley Associates on-site Shaft Design Engineer's Representative. Responsibilities included geotechnical / geologic mapping and characterization of the tunnel access shaft and TBM Assembly Cavern for use in initial support design as well as general construction observation.

Nickajack Tunnel, South Cobb Tunnel Project, Cobb County Water System, W.L. Hailey, Cobb County, GA.

The Nickajack Tunnel is a connector tunnel which will connect to the South Cobb Tunnel. The Nickajack Tunnel is approximately 3,223-ft long. It will be excavated from end of the South Cobb TBM tail tunnel to the start of the Nickajack Chamber. It will be lined with a 78-in. carrier pipe and is anticipated to have an excavated diameter of about 8 ft. The Nickajack Chamber is about 19-ft wide, 18-ft high and 64-ft long. It will be lined with reinforced cast-in-place concrete. Modified contact grouting will be performed behind the cast-in place concrete. The Nickajack area is characterized by blocky and seamy ground with a steady supply of groundwater from the Chattahoochee River. The depth of cover ranges from 90 to 140 ft.

A significant pre-excavation grouting program is planned for the Nickajack Chamber due to groundwater and location in a geologic zone of transition from overlying soil to underlying bedrock. Brierley Associates performed a review of the geologic / geotechnical conditions, pre-excavation grouting program, initial support, and construction methods and recommended methods to improve the anticipated success of the project. Mr. Harvey evaluated the structural geology and initial support design and provided input into the recommended improvements.

Bi-County Water Tunnel, Washington Suburban Sanitary Commission, Renda / Southland / SAK Joint Venture, Montgomery County, MD.

The Bi-County Water Tunnel project consists of approximately 5.3 mi. of 84-in. internal diameter pipeline to be installed by TBM excavation methods. The tunnel alignment will be constructed beneath Rock Creek Park, I-270/I-495, and existing WSSC rights-of-way. The tunnel is located at depths ranging from 90 ft to 275 ft below ground surface in rock with tunnel access to the surface via three vertical shafts. The working shaft site is being used as the base for construction operations, including tunnel excavation and material extraction, materials laydown, site access, worker parking, and construction offices. Two other shafts are being constructed as TBM retrieval shafts. All three shafts are being excavated using a combination of mechanical equipment in soil above the top of bedrock and blasting methods for bedrock excavation.

Brierley Associates provided preconstruction and construction engineering services to the Renda / Southland / SAK Joint Venture contractor (RSS JV). Preconstruction engineering services included submittal preparation for Geotechnical Instrumentation, Control of Water, Packaged Water Treatment Facilities, Drill and Blast Excavation, Tunneling, Rock Support, Tunnel Shafts, and Temporary Bridge. Further engineering services prior to and during shaft and tunnel excavation include blasting consulting and blast cover design, tunnel utility layout, rail and switch layout support, dewatering design for shaft construction, rock stability analyses, and initial support design for shafts, TBM chamber, and tail tunnels.

Mr. Harvey evaluated the structural geology and initial support design for the rock portions of the shafts, TBM chamber, and tail tunnel and developed an optimized initial support design based on the contractor's preferred construction methods.

Stapleton Redevelopment Project, Matrix Design Group, Denver, CO.

Mr. Harvey provided construction monitoring for two tunneled utility crossings beneath I-270, an 84-in. storm sewer and a 42-in. sanitary sewer each of which were approximately 350-ft in length. Ground conditions consisted of sand below the water table, which required careful tunneling to reduce the potential for roadway settlement. Work performed included a basis of design report, technical specifications, and contract drawings. Construction phase services including tunnel inspection and observation began in early 2005, and were completed in the summer of 2005.

Mr. Harvey performed submittal reviews and monitored the daily construction activities. He documented the shaft excavation, daily tunneling rates, jacking pressures, changes in ground conditions and geology, grade control, contact grouting, compaction grouting, carrier pipe installation and backfill. The 42-in. sanitary sewer was constructed using an Akkerman guided boring machine (GBM) and an American Augers auger boring machine. The 84-in. storm sewer was constructed using a Herrenknecht slurry microtunnel boring machine.

Upper Shoal Creek-Spicewood Branch at Wood Hollow Drive, ACWP, Austin, TX.

Mr. Harvey performed geotechnical investigations and geologic site characterization for a geotechnical baseline report used in the design and construction of a sanitary sewer pipeline. This portion of the pipeline (approximately 300 ft) was constructed using an American Augers auger boring machine as part of the Austin Clean Water Project. Ground conditions consisted of Edwards Formation limestone in close proximity to the Balcones Fault.

Mr. Harvey performed geotechnical subsurface investigations by rock coring method to evaluate subsurface conditions and identify potential problems that may be encountered during auger boring construction. Mr. Harvey also performed general geologic mapping and a geologic site assessment. Mr. Harvey was on site full time during construction and was responsible for monitoring and documenting rates of progress, jacking pressures, changes in ground conditions and geology, grade control, and contact grouting.

Lake Pleasant Waterline Tunnel Project, City of Phoenix, Phoenix, AZ.

Mr. Harvey provided tunnel engineering and field construction inspection services for the excavation of a 1700-ft long, 9.5-ft high by 9.5-ft wide rock tunnel excavated by roadheader and drill and blast methods. Tunnel initial support included steel sets with blocking and lagging, rock bolting, and shotcrete. All blasting operations were seismically monitored. Observation of the installation and backfill of the carrier pipe within the tunnel was performed after the excavation. Ground conditions consist of soft to very hard granitic rock. Work performed included a basis of design report, technical

specifications, and contract drawings. Construction phase services included tunnel inspection and observation as well as documentation of the geologic conditions encountered in the tunnel.

McCullough Lateral Pipeline, Southern Nevada Water Authority, Henderson, NV.

Mr. Harvey served as project geologist during planning and preliminary design services for the tunneled portions of this major water transmission project. The project includes 26 mi. of 10-ft diameter pipe to provide treated water to south Las Vegas. Tunnel segments include a 1 mi. rock tunnel, a 5 mi. rock tunnel and several soft ground tunnel segments through the developed parts of Henderson, NV. The project also includes a major pump station, reservoir, and other appurtenant structures.

Mr. Harvey developed a local geologic map and prepared a detailed geologic description of the conditions which may be encountered during tunnel excavation. Work performed also included assistance with selection of the preferred project alignment from a tunneling perspective and preparation of preliminary design documents. Project challenges include mitigating and minimizing potential environmental impacts/permit requirements and determining optimal tunneling methods consistent with optimizing project costs and minimizing risks.

Upper Tannehill-Lower Fort Branch & Manor Hills Sewer Tunnel, ACWP, Klotz Associates, Inc., Austin, TX.

Mr. Harvey provided construction services which involved monitoring and documenting the daily activities during construction of more than 700 LF of new sewer line installed by microtunneling. The new pipeline consisted of 21-in. diameter fiberglass reinforced polymer-mortar pipe. Trenchless construction was achieved using an Iseki microtunnel boring machine. Ground conditions consisted of stiff clay and gravel located below groundwater. Mr. Harvey monitored and documented shaft excavation, tunneling rates, jacking pressures, grade control and changes in ground conditions and geology during tunneling operations.

Parkdale Mine Plan, Front Range Aggregates, Parkdale, CO.

Mr. Harvey served as project geologist for the development of the geotechnical design portions of a mine plan for a granite bedrock quarry near Parkdale, Colorado for Front Range Aggregates. The mine is an expansion of an existing gravel pit which is extracting aggregate from alluvial deposits near the Arkansas River. At full build out the new rock quarry will cover an area of 72.5 acres, and have highwalls up to 700-ft high. Key considerations included the sizes and configuration of highwalls and benches, development phasing, access and product removal, and reclamation. The mine plan was submitted to the Colorado Division of Reclamation, Mining and Safety for approval.

PAPERS & PUBLICATIONS

- Harvey, S.; Ozbay, U., 2009. "Review and Applicability of Yielding Support Systems for Bump Prone Coal Mines in the Western United States" Proceedings of the 2009 Society for Mining, Metallurgy and Exploration Annual Meeting and Exhibit; Denver, CO; February, 2009.
- Harvey, S.; Ozbay, U., Neugebauer, E.; Warfield, B.; Koontz, W.; Anderson, T.; Avery, J. "In-Situ Testing of Roofex Yielding Rock Bolts in Coal Ribs" Proceedings of the 28th International Conference on Ground Control in Mining, Morgantown, WV; July, 2009.