

Douglas S. Santo, PG, CEG, CHG
Engineering Geologist

EDUCATION

Bachelor of Science –Geology
CSULA
Los Angeles, California

Graduate Studies in Engineering Geology
CSULA
Los Angeles, California

PROFESSIONAL REGISTRATIONS

State of California, Professional Geologist, No. 5917

State of California, Certified Engineering Geologist, No. 1866

State of California, Certified Hydrogeologist, No. 450

State of Idaho, Registered Geologist, No. 860

State of Arizona, Registered Geologist, No. 30709

TECHNICAL EXPERIENCE

Tunnels

Metro Rail Tunnel Project, Los Angeles, CA:

- Engineering geologic study of a 3 mi. section of shallow, soft ground tunnel alignment below high-rise structures near Pershing Square in downtown LA. Developed special sampling equipment for use in pre-drilled grout pipes located in the high-rise basements. Prepared geologic profiles with emphasis on micro soil stratigraphy for identification and remediation of running sands.
- Performed geotechnical pre-siting evaluation and prepared geotechnical portion of EIS/EIR for the Metro Red Line Eastern Extension Corridor Study Area. The investigation included geotechnical and environmental analyses of twelve proposed subway routes through eastern Los Angeles. Performed deterministic and probabilistic seismic hazard analyses and identified the design level earthquakes and ground motions. Evaluated potential gaseous tunneling conditions.
- Hydrogeological investigation at the proposed Universal City Station in North Hollywood. The investigation included installation of pumping wells and monitoring wells, performance of pump tests, evaluation of the pump test data, and drawdown modeling. Developed aquifer characteristics using Cooper-Jacob and Hantush type curves. Modeled drawdown using the Hantush-Jacob equation for leaky confined aquifers. Developed recommendations for construction dewatering.
- Assisted in preparation of Geotechnical Design Summary Reports for three separate contract segments.

Narragansett Bay CSO Tunnel, Providence, RI:

- Member of Lead Design Management Team, responsible for geotechnical pre-siting evaluation for a deep tunnel CSO facility. The tunnels were to penetrate glacial deposits and metasedimentary bedrock with up to 100 feet of groundwater head. Collected and evaluated existing information. Developed regional geologic and hydrogeologic settings for the northern Narragansett Basin. Located potential tunnel corridors and ranked them based on local geotechnical and hydrogeological conditions. Evaluated geotechnical SOQ's and contributed in the selection of short listed firms. Prepared RFP for geotechnical exploration and conceptual tunnel design.

River Mountains Tunnel, Las Vegas, NV:

- Engineering geologic study for 4 miles of 17-foot-diameter pressure tunnel through hard volcanic rock. Developed and managed field exploration and laboratory testing program and all phases of geotechnical work. Performed engineering rock mass classification using the Rock Mass Rating (RMR) and the Q-System. Evaluated initial support requirements and TBM performance. Evaluated potential hazardous tunneling conditions. Prepared Geotechnical Data Report (GDR) and Geotechnical Design Summary Report (GDSR). Interfaced with 5 man design review board.
- Responsible for fault investigation at west portal and seismic hazard analyses for all project elements. The west portal fault crosses water transmission laterals that provide 85% of the municipal water for the Las Vegas Valley. The investigation included aerial photo analyses, fault trenching, and soil stratigraphic analyses. Determined characteristic earthquake events, and predicted maximum surface displacement based on empirical relations. Recommended design alternatives for lateral crossings. Developed probabilistic fault model for the Las Vegas valley and identified the design level earthquakes and ground motions.
- Responsible for geotechnical siting studies for earth embankment dam storage facilities and surge tanks at portal locations.
- Responsible for geotechnical study for mass grading at portal locations including cut slope design in rock. Developed recommendations for slope stabilization including rock bolting.
- Responsible for geotechnical studies for roughly 1,000 feet of hard rock and soft ground connector tunnels excavated by road header and drill and blast techniques. Developed recommendations for tunneling below in-service water laterals with less than 6 feet of rock cover.
- Managed construction monitoring phase, including geologic/geotechnical logging of tunnel bore.

DAMS

Devil's Gate Dam Water Tunnel, Pasadena, CA:

- Hydrogeologic investigation for 5,000 feet of water collection tunnel constructed prior to 1902. The purpose of the investigation was to estimate the effect of tunnel water production from impounding water behind the newly renovated dam. Developed hydrologic model to estimate tunnel water production based on rainfall records, well hydrographs, tunnel production statistics, and local geology. Estimated hydraulic conductivity of alluvium based on specific capacity test data. Estimated rock tunnel water inflow based on packer test data. Developed recommendations for tunnel repair and maintenance.

Barret Lake Dam Renovation, San Diego, CA:

- Engineering geologic study for 11 mi. of overflow conduit at Barrett Lake Dam. Performed joint analyses and developed recommendations for extensive rock bolting in granitic rock to stabilize flume supports and bridge abutments. Performed seismic hazard analysis for all project elements.

LANDFILLS

Warren County Landfill, Warren County, NJ:

- Performed geologic and hydrogeologic reconnaissance to evaluate the potential for faulting and possible effects on groundwater flow and contaminant migration at a partially completed solid waste landfill. Evaluated existing landslides within the working landfill.

High Grove Landfill, Riverside, CA:

- Slope stability investigation for landfill expansion including installation of monitoring wells, performance of packer tests and slug tests, seismic refraction lines, fault trenching, and extensive geologic mapping.

CITY REVIEW SERVICES

Geologic/Geotechnical/Hydrogeologic Review

Palmdale, Santa Clarita, Torrance, Azusa, West Hollywood, Diamond Bar, and Numerous Other Cities and Counties, CA:

- Responsible for review of geotechnical, hydrogeological, landslide, and neotectonic investigations performed for proposed 100 ac and larger residential and commercial developments located astride the San Andreas Fault and major landslide complexes. Prepared recommendations for city officials regarding adequacy of work performed, requirements for additional studies, and general comments on city policy issues. Interfaced with city officials, consultants, developers and owners.

SEISMIC HAZARDS

Seismic Hazard Analyses, CA & NV:

- Responsible for deterministic and probabilistic seismic hazard analyses at over 60 sites in California and Nevada including tunnels, dams, bridges, water storage facilities, hospitals, schools, industrial sites, and commercial developments. Extensive experience with the USGS Frisk program as modified by Blake, also proficient with Eqfault, Eqsearch, and Seisrisk III. Developed seismo-tectonic source models for Northern and Southern California, and Southern Nevada. Developed databases of historic and recorded earthquakes in California and Nevada using Cal Tech, USGS, and NOAA records. Prepared deterministic and uniform hazard response spectra. Prepared detailed analyses of potential secondary effects of seismicity including primary and secondary ground rupture, liquefaction, differential settlement, landslides, tsunamis, seiches and flooding. Recent hospitals include UCLA/Santa Monica Hospital, Santa Monica; Santa Terrasita Hospital, Duarte; Granada Hills Community Hospital, Granada Hills; The Memorial Hospital of Southern California, Arcadia; Robert F. Kennedy Memorial Center, Hawthorne; Redding Medical Center, Redding, Huntington Memorial Hospital, Pasadena.

Loma Prieta and Northridge Earthquake Assessment, CA:

- Member of Emergency Earthquake Response Team. Responsible for post-quake safety inspections for over 40 single family residential and commercial structures.

FAULT STUDIES

Fault Investigations, CA & NV:

- Responsible for 10 separate investigations focusing on Quaternary aged faults in Southern California and Nevada. These investigations included geomorphic and topographic analyses, imagery interpretation, field mapping, exploratory trenching or borings, geophysical methods, soil stratigraphic analyses, determination of slip rates and characteristic earthquakes, and recommendations for design of major infrastructure or

construction projects. Faults that I have investigated include: The San Andreas, Sierra Madre, Raymond, Hollywood, Benedict Canyon, Newport-Inglewood, and unnamed faults in the Mojave Desert and Nevada.

JPL/NASA Deep Space Communications Complex, Mojave Desert, CA:

- Responsible for Fault and seismic hazard investigation for 70m and 34m Mars and Uranus antennas. The antennas are one of three critical ground stations in the NASA Deep Space Network. The investigation included remote sensing imagery analysis covering 6,000 square miles of Landsat Thematic Mapper imagery, Side Looking Airborne Radar (SLAR) transparencies and mosaics, and false color infrared and black & white aerial photography. Lineaments were field checked and rated based on geomorphic evidence. Roughly 2,000 linear feet of backhoe trenches were excavated across the interpreted lineaments. Three previously unrecognized faults were identified and age dated using geomorphic and soil stratigraphic evidence. A probabilistic seismic hazard analysis was also performed to determine design level earthquake criteria for seismic retrofit of existing and proposed structures.

DEVELOPMENT

South Shores, Rancho Palos Verdes, CA:

- Geotechnical feasibility investigation for a 220 ac. ocean front property. The parcel is located between two mega-landslide complexes. Performed every aspect of the investigation including continuous core diamond drilling, geophysical logging, and exploratory trenching. Designed the equipment for two, in-situ direct shear tests and successfully completed them. Developed a detailed laboratory schedule for characterization of bentonitic tuff including specialized direct shear, triaxial shear, and ring shear testing, x-ray diffraction analyses, and direct current plasma spectroscopy. Performed an in depth rock mass classification using the Rock Mass Rating system and the Q-system. On completion of the investigation, I made presentations of the project to the city council and planning commission and several home-owner groups.
- Prepared Grading Plan Review Report for residential and golf course development. Developed geotechnical recommendations for grading.
- Managed field services during grading including geologic observations of bottoms, back cuts and cut slopes. Directed field activities for soil technicians. Prepared operations and maintenance manual for golf course.

Aliso Viejo Planning Areas 11.3 and 11.4 Aliso Viejo, CA:

- Performed geotechnical investigation and prepared Grading Plan Review Reports for 300 acre residential and commercial development located in hillside area. Evaluated large landslides, developed geotechnical recommendations for grading, performed three dimensional slope stability analyses of proposed fill slopes up to 160 feet high, interfaced with client and local geologic reviewer.

Monterey Views Development, Monterey Park, CA:

- Prepared Grading Plan Review Report for 33 acre residential development located in steep hillside terrain. Reviewed and designed 1:1 geogrid reinforced fill slopes up to 150 feet high, developed geotechnical recommendations for grading, prepared slope repair plans for restoration of illegally graded slopes, interfaced with client, owner, contractor, and local building officials. Managed geotechnical field work during grading.

LANDSLIDES

Spy Glass Hill Landslide, Whittier, CA:

- Geotechnical investigation of a landslide affecting 17 residential properties. Performed field exploration including geologic mapping and downhole logging of bucket auger borings. Installed and monitored slope inclinometers, piezometers and horizontal drains. Performed slope stability analyses and back calculated strength parameters for the slide. Designed a slope repair plan that involved removing the slide mass with heavy grading equipment and construction of a shear key buttress.

Montellano Avenue Landslide, Hacienda Heights, CA:

- Geotechnical investigation of a landslide affecting 12 residential properties. Evaluated existing information. Performed slope stability analyses and back calculated strength parameters for the slide. Designed a slope repair plan that involved dewatering, removing the slide mass with heavy grading equipment, installation of soldier piles, and construction of a soil-cement shear key buttress.

Deep Valley Drive Landslide, Rolling Hills Estates, California:

- Geotechnical investigation of a landslide affecting 10 commercial properties. The investigation included geologic mapping, downhole logging of bucket auger borings, and installation and monitoring of slope inclinometers and piezometers. Performed slope stability analyses and back calculated strength parameters for the slide. Designed a slope repair plan that involved removing the slide mass with heavy grading equipment, installation of an extensive subdrain system with horizontal drains, and construction of a shear key buttress.

HYDROGEOLOGY

Soledad Canyon Sand and Gravel Mining Project, Santa Clarita, CA:

- Prepared hydrogeologic study of a 2 mile reach of the Santa Clara River near Lang. The work was performed in support of litigation relating to the amount of unappropriated water available in the area. The aquifer consists of river alluvium bounded on all sides by relatively impermeable crystalline bedrock. Characterized the depth and subsurface geometry of the river aquifer using seismic refraction lines and exploratory borings. Developed hydrogeologic cross sections at fifteen locations along the 2 mile reach. Estimated the total volume of groundwater available to pumping. Evaluated pumping test results using techniques developed by Boulton and Stallman for unconfined anisotropic aquifers. Determined hydraulic conductivity, specific yield, anisotropy, and recharge from underflow. Evaluated the affects of delayed yield and negative hydraulic boundaries on test results. Evaluated 19 years of historic stream gaging records and factored in project water use to estimate the project's affect on downstream surface flow and local water users. Evaluated sustainable yield. Recommended changes to hydrogeologic aspects of biological assessments and biological opinions prepared by the US Fish and Wildlife Service and US Bureau of Reclamation.

Commerce Center and River Court Developments, Santa Clarita, CA:

- Prepared hydrogeologic investigations to characterize local reaches of the Santa Clara River to develop recommendations for construction dewatering for bank stabilization. The work included installation and completion of pumping wells and monitoring wells, laboratory testing of aquifer materials, multi-day pumping tests, evaluation of test results, drawdown modeling for estimation of well configuration, well spacing, pumping rates, and estimated time to achieve drawdown. Consulted with owner and dewatering contactor on contract language and requirements.

Old Road Bridge Over the Santa Clara River, Santa Clarita, CA:

- Prepared hydrogeologic investigation to identify and compare the chemical characteristics of surface water from the local reach of the Santa Clara River with groundwater from the south bank of the river near proposed construction for a bridge abutment and determine if a hydrologic connection exists between the water bodies. The work included installation and sampling of monitoring wells, analytical testing of surface water and groundwater, collection of analytical results for other nearby wells, comparison of analytical results, development of Stiff diagrams for each well and each surface flow collection point, development of a hydrogeologic map showing the distribution of Stiff diagrams and development of conclusions and recommendations with respect to hydraulic connections between surface flow and groundwater.