NEWSLETTER
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Treadwell&Rollo

Decision Analysis and Risk Management

Decision analysis and project risk management are among the full range of environmental services provided by Treadwell & Rollo. These services have assisted our clients in assessing alternative site remediation approaches, implementing effective negotiation and litigation strategies, and making and documenting difficult business decisions.

Today's complex and often sensitive projects require special expertise in decision analysis methods and project risk management principles in addition to our extensive capabilities and experience in environmental and geotechnical engineering. The work we do includes:

- *probabilistic cost estimates for soil and groundwater remediation in support of cost negotiations among multiple parties involved in property transactions*
- *decision analyses to evaluate site remediation alternatives and identify preferred alternatives*
- *probabilistic cost estimates combined with decision analyses to support settlement negotiations with multiple potentially responsible parties (PRPs) and coverage negotiations with insurance carriers*
- *probabilistic performance assessments of treatment systems to predict the likelihood of meeting state and Federal discharge criteria*

Our capabilities extend to related areas of strategic business decision-making, including facility siting; development planning; mediation and litigation strategy; and real property transactions. We use decision analysis to target optimal remedial solutions for our clients and to evaluate the effectiveness of ongoing remediation. The decision analysis model incorporates the client's values and preferences, financial goals, and attitudes toward risk as well as uncertainties regarding site conditions and remedy performance. This special capability can also be used to evaluate remedial alternatives to provide cost-saving and liability-reducing modifications. With decision analysis, our clients can weigh competing objectives to arrive at a better solution.

Treadwell & Rollo uses advanced computer software to compile, manage, analyze, and communicate environmental data. Our geologic and chemical database management systems dramatically improve the storage and retrieval of site data, enabling more rapid evaluation of large data sets for technical input to probabilistic cost estimates and decision analyses.

Uncertainties associated with cost estimate components such as the site data, resulting evaluations, or disposal costs are identified and quantified. The components are then incorporated in a systematic manner and the variables that contribute the most uncertainty to the cost (and the project risk) are identified. Using a decision analytic approach provides the added capability of being able to quantify the value of reducing or eliminating any of the uncertainties by obtaining additional information or taking specific actions, thereby managing project risks.

This article was written by Sigrida Reinis, PhD and Dorinda Shipman, RG, CHG of Treadwell & Rollo. Using decision analysis and probabilistic cost estimating techniques, they have assisted the City and County of San Francisco in assessing the potential cleanup costs associated with accepting title to the former Hunters Point Naval Shipyard.

"Treadwell & Rollo's probabilistic cost estimate enabled the City to understand the credible range of potential remediation costs which provided us with a firm basis for negotiations. An added benefit was having a parallel cost analysis to those performed by insurance companies in assessing appropriate insurance premium costs."
Jesse Blout,
Mayor's Office of Economic Development

In this issue:

A Decade

Since its founding in 1982, Sun Microsystems has emerged as a global Fortune 500 leader in enterprise network computing. To accommodate its phenomenal growth, the company is and has been engaged in an extensive expansion of its Bay Area facilities. Treadwell & Rollo has provided a wide range of geotechnical and environmental consulting services to Sun Microsystems since 1991.

Menlo Park

Treadwell & Rollo performed a series of detailed geotechnical investigations for the Sun Microsystems development in Menlo Park near the western terminus of the Dumbarton Bridge. The development is a campus-like facility containing nine buildings, constructed in three phases. Phase I included offices, engineering laboratories, a central facility housing a cafeteria and kitchen, a maintenance area, and 11 acres of parking. Phases II and III involved two buildings each, a recreation center, and additional parking.

Our engineers found that the site was blanketed by 2 to 9 feet of sandy and gravelly clay fill, which was underlain by 3 to 11 feet of weak, compressible marine clay known locally as Bay Mud. Based on these soil conditions, we recommended 14-inch-square, precast, prestressed concrete piles for support of the major buildings and a grid foundation for the recreation center. We also provided conclusions and recommendations regarding site seismicity and seismic hazards, site grading and excavation, pavement design, and placement of utilities trench backfill.

In addition, Treadwell & Rollo provided geotechnical quality assurance services during construction. These services included observing production pile driving, coordinating with the design team during foundation installation, observing excavation and backfilling of on-site utility trenches and subgrade preparation, and base rock placement for on-site parking lots, roadways, paths, and courtyards. We also provided a supplemental geotechnical report to present recommendations for surcharging the recreation building site in order to use a shallow foundation.

Newark

Treadwell & Rollo performed geotechnical investigations for all phases of the construction of the Sun Microsystems manufacturing campus in Newark. Encompassing almost 58 acres, the site is being developed in a campus-type arrangement, which will include about 670,000 square feet of office space, a 190,000 square foot manufacturing building, and 36,000 square feet of plant facilities. The office buildings are two and three stories high and the manufacturing building is a very high single story structure. In addition, there is at-grade parking for approximately 3,000 vehicles.

We also performed a geotechnical evaluation for the protection of the Union Sanitary District force main water supply lines that pass through the campus. The force mains are 39 inches in diameter and approximately 1,500 feet long and are located in a parking area where four feet of fill was placed.

The main geotechnical concern for development of the site is the presence of loose to medium dense sand that would probably liquefy during a major earthquake on a segment of one of the nearby active faults. Treadwell & Rollo engineers investigated a variety of measures to reduce the liquefaction potential and settlement. These included excavation, removal, and recompaction of potentially liquefiable

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soil, in-situ ground densification, ground modification techniques, stiffened shallow foundations, and deep foundations. A mat foundation was selected for the manufacturing facility. A combination grid and structural slab foundation scheme was selected for the remainder of the buildings.

Santa Clara

Treadwell & Rollo provided the geotechnical engineering for the Sun Microsystems facilities at the former Agnews State Hospital site in Santa Clara. The site encompasses the western 90 acres of the old hospital grounds and a number of buildings that occupied the site. The clock tower, director's residence, administration building, and auditorium were renovated and incorporated into the new campus. The remaining buildings were razed and eleven new buildings and two parking structures will complete the new facility.

Our services consisted of exploring the subsurface conditions at all the building sites and providing geotechnical recommendations for the new construction.

The project also included major off-site infrastructure elements for which Treadwell & Rollo provided the needed geotechnical expertise. A four-lane street around the east-west side of the site and an on-ramp to the Montague Expressway were constructed at the request of the City of Santa Clara and have been dedicated to the City.

Dublin

Treadwell & Rollo is the geotechnical consultant to Sun Microsystems for their Dublin Transit Center project. The Dublin Transit Center is located near the intersection of Iron Horse Parkway and Dublin Boulevard, north of Interstate 580. The project will occupy parcels totaling about 12 acres.

Present plans are to construct three or four buildings totaling approximately 750,000 square feet. The buildings will be five to eight stories in height and will be placed above one to two levels of below-grade parking.

Our work includes reviewing subsurface information presented in previous investigation reports for the site and adjacent properties, reviewing geologic and special study maps for the vicinity, performing a site reconnaissance, and performing engineering analyses. Our findings will include a summary of probable subsurface conditions, potential geologic and seismic hazards, potential foundation types and preliminary estimates of capacities, and other geotechnical issues relevant to site development.

Over the past decade, many Treadwell & Rollo professionals have made substantial contributions to our work for Sun Microsystems. Under the leadership of Richard Rodgers, these key staff members have included Russell Thompson, Elizabeth Gouchon, Carolyn Ronan, John Gouchon, Osama El-Fiky, Peter Cusack, Don Oman, Aimee Landes, Kelly Candra, and Hadi Yap.

High Tech and Treadwell&Rollo

We have been fortunate to be the geotechnical and environmental consultant to many of the leaders of the "new" economy, including Sun Microsystems. Many of the projects for clients highlighted here will be featured in upcoming issues of our Newsletter.

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Construction-Induced Ground Deformation

Ramin Golesorkhi, Christian J. Divis, and Jeffrey S. Saunders have published their paper titled "Estimates of Construction-Induced Ground Deformation at a Deep Excavation in San Francisco" in the proceedings of the 10th Conference of the International Association for Computer Methods and Advances in Geomechanics. The technical paper was presented at the conference in January, hosted by the University of Arizona.

The estimates were developed as part of the design and construction observation performed for the new Four Seasons Hotel and Tower in San Francisco. The development required an excavation of 70 feet for five levels of underground parking. The underground structure supports a 36-story tower, which is nearing completion as of the date of this newsletter. Adjacent structures include a 42-story Marriott Hotel, an 8-story masonry office building, a tall one-story historic former brick power substation, and the BART and MUNI transit tunnels. These adjacent structures imposed stringent controls on allowable construction-induced ground deformations.

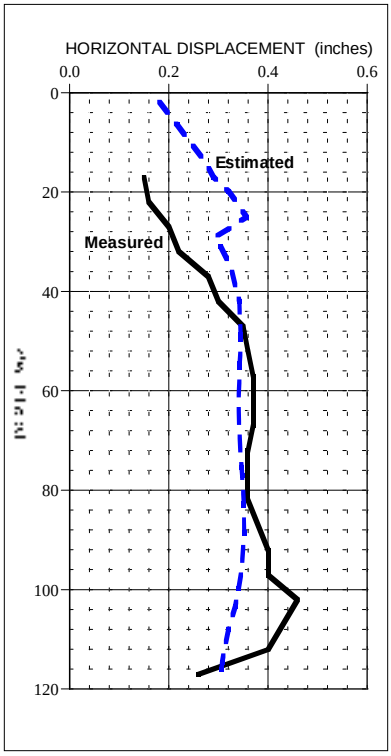
The transit tunnels lie beneath Market Street and run parallel to the Four Seasons site boundary about 30 feet away from the excavation. The subsurface conditions to the excavated depth consisted of predominantly medium dense to very dense sand. Subsurface construction was enabled by a concrete diaphragm perimeter wall installed using slurry techniques to an average depth of about 110 feet below street level. The diaphragm wall was successfully used as temporary shoring, as a groundwater cutoff wall, and as the permanent basement wall.

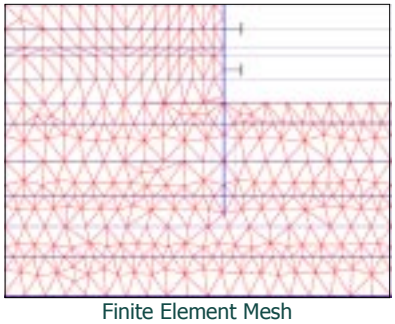
Excavation in Progress

The paper compared the results of a finite element method analysis of the wall system with the measured deformation of the wall. In general, the analysis provided reasonable estimates of the maximum deformations of the wall. However, the measured deformations in the top 30 feet of the wall were about one-half to two-thirds of those estimated.

This work was sponsored by the professional development program of Treadwell & Rollo. For a copy of the paper, contact Christian J. Divis at: *cjdivis@treadwellrollo.com*

International Association for Computer Methods and Advances in Geomechanics





Finite Element Mesh

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