



Millennium Partners and WDG Ventures are building the new

Four Seasons Hotel and Tower

on the south side of San Francisco's famed Market Street. Part of a mixed-use urban living environment, the 1,000,000 sq. ft. project, scheduled to open next year, includes:

- 277-room Four Seasons Hotel
- 140 residential condominiums
- 300-vehicle underground parking garage
- more than 180,000 sq. ft. of commercial space, including retail stores, restaurants, and a health club

MP MILLENNIUM PARTNERS Builds the Four Seasons Hotel and Tower

The Four Seasons Hotel and Tower in San Francisco is under construction on a 1.3-acre parcel on the south side of Market Street between Third and Fourth Streets. Existing buildings flank the site on the west, south, and east. To the north is Market Street with its underground BART and MUNI Metro tunnels.

The northern half of the site consists of a 36-story steel frame high-rise structure and the southern half is a four-story low-rise. The Four Seasons hotel will occupy 11 floors of the high-rise with the remaining floors slated for condominiums and retail space. The five levels of underground parking required a 70-foot deep excavation, one of the deepest in San Francisco history.

As geotechnical, environmental, earthquake, and groundwater consultants to Millennium

Partners, Treadwell & Rollo has been involved in the Four Seasons project since the initial planning stages. In addition to assisting in the evaluation of alternatives for foundation systems and excavation shoring, we performed Phase I and Phase II environmental assessments, a detailed geotechnical investigation, a probabilistic seismic hazard analysis, and a groundwater (hydrogeologic) study.

The massive below-grade construction required a dewatering system capable of depressing the water table at least 30 feet below the bottom of the excavation with minimal impact on adjacent structures and facilities. Using the finite difference MODFLOW computer model, we evaluated five dewatering alternatives, including combinations of extraction and recharge wells

and various slurry wall configurations.

Our other services addressed soil disposal issues, foundation support, earthquake design, excavation, shoring, tiedown anchors, and construction monitoring and documentation.

Subsurface conditions at the site consist of sandy fill over dune sand. A thin layer of compressible marsh deposits underlies the dune sand. This layer is in turn underlain by dense Colma sand which extends to the Old Bay Clay encountered at a depth of about 100 feet below the ground surface.

Because of the site conditions, depth of excavation, and other requirements associated with dewatering, a concrete diaphragm cutoff wall was constructed using the slurry construction technique. The

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Excavation for Level Two Bracing

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Treadwell&Rollo
ON THE
WORLD WIDE WEB

Launched in 1996, the Treadwell & Rollo web site (www.treadwellrollo.com) was originally a simple presentation of company capabilities and contact information. Today, the site details our capabilities, highlights notable projects, provides employment and contact information, allows access to downloadable brochures and newsletters, and provides links to other sites.

Since 1997, the site has been managed and extensively improved by Minnick Web Services (www.minnickweb.com). The most significant upgrade has been a database-driven content management system, custom-built and installed in 1999. The management system allows authorized personnel to add, change and update the content using a straightforward web-based interface.

Traffic to the Treadwell & Rollo web site has steadily increased and currently averages 3,200 hits per month. The site receives a high number of visitors from client groups, universities, governmental agencies, and from overseas. During the past year, the site has had visitors from Malaysia, the Netherlands, South Africa, Nepal, and many other countries.

Don Treadwell of Treadwell & Rollo stated "We are very pleased with our web site and feel that it is an important part of our business. Our internet exposure to potential clients and employees makes the site especially cost-effective. Having a high-quality, cutting edge web site is in line with our standards."

This article was written by Margaret T. Minnick of Minnick Web Services.

MP MILLENNIUM PARTNERS
Builds the Four Seasons Hotel and Tower

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diaphragm wall was designed to act as both temporary shoring and permanent basement wall. The wall was constructed using 18 to 20 foot long panels, three feet wide, and extended to a depth of about 110 feet. The wall was keyed 10 feet into the Old Bay Clay to provide the cutoff needed for dewatering. The foundation included a mat with tiedown anchors.

From a geotechnical standpoint, the most critical aspect of the project was the support and protection during construction of the adjacent structures, the BART and MUNI facilities located about 30 feet away from the face of the excavation, and the underground utilities.

Excavation shoring included

two rows of diagonal bracing along Market Street, four rows of tiebacks along the east and south walls and one row of ties along the Marriott Hotel side on the west. The lower level of shoring consisted of a row of inclined rakers "kicking" into the foundation mat.

The rakers were constructed in a two step process. First, a 10 foot wide soil bench and a sloping berm were left in place along the excavation wall and the perimeter to provide lateral support while the middle of the site was excavated to final depth. Subsequently, the mat was constructed and after adequate curing of the concrete, the rakers were placed and "kicked" into the mat. Once the raker system was in place and prestressed, the remaining soil was

excavated from the perimeter and the mat was completed.

The mat under the high-rise tower is about 7-feet thick. It is about 4-foot thick under the low-rise part of the structure. Tiedowns were installed through the mat to provide resistance against hydrostatic uplift pressure underneath the low-rise portion of the structure.

To measure the effect of the excavation on ground deformation along Market Street, a geotechnical instrumentation and monitoring program was implemented. This program included installation and monitoring of four inclinometers, two sets of piezometers, and optical surveys of both the BART and MUNI tunnels. The program continued measurements during the construction of the diaphragm wall, excavation, shoring installation, and the construction of the underground structure. The maximum measured lateral ground deformation was about 0.8 inches towards the excavation; our estimated maximum deformation was 1.0 inch. The deformations measured in the tunnels were within the criteria set by BART.

Ramin Golesorkhi managed our services to Millennium Partners and served as senior engineer. Other Treadwell & Rollo professionals included Christian Divis, Jeff Ludlow, Dorinda Shipman, Phil Smith, and Richard Rodgers.



Level Three Bracing - Northerly View



Rakers Connected to Central Mat

Treadwell&Rollo Provides Emergency Assistance to Public Utilities Commission

During the “El Nino” storms of the winter of 1997-1998, a substantial landslide occurred along a section of Meters Road in San Mateo County. In 1998, the Public Utilities Commission (PUC) of the City and County of San Francisco repaired the affected road and hillside by excavating the landslide mass and rebuilding the slope with compacted fill. However, the slope began moving again in early 1999. More severe slope movements occurred during the late winter of 1999-2000.

On 8 March 2000, Treadwell & Rollo received an emergency call from the PUC and immediately conducted a field inspection of the landslide along with PUC staff and others. The landslide was observed to have affected about 100 feet of the road in a location where a vital water supply pipeline passes as close as 8 feet from the landslide scarp (Figure 1).

The pipeline is part of the system that conveys fresh Hetch Hetchy water to the City of Half Moon Bay and to San Francisco. It was concluded that additional movement would pose a substantial threat to this important facility and that it must be protected.

Soldier piles were selected as the protective measure because of their ability to resist lateral movement and because they could be installed rapidly.

Within days, Treadwell & Rollo and SOHA Engineers designed the soldier piles and obtained a construction cost estimate. After the estimate was accepted by the PUC, the contractor immediately mobilized and began work.

The soldier piles were installed during a 12-day period in the latter half of March 2000. To provide support for vehicle access, seven temporary piles were first installed along the outboard side of the road (Figure 2). Then 34 permanent soldier piles, spaced 4 and 5 feet on center, were installed just downhill of the pipeline (Figure 3). The piles, consisting of W16x40 steel beams encased in concrete, were installed in 24-inch diameter predrilled holes about 30 feet deep. A capping beam, also a W16x40 steel section, was welded to the top of the permanent soldier piles.

Finally, the road was regraded (Figure 4) and opened for limited service. The temporary soldier piles were left in place to facilitate eventual reconstruction of the slope and roadway, scheduled for this summer.

Hadi Yap, Tony Mencarini, Russell Thompson, and Frank L. Rollo of Treadwell & Rollo worked collaboratively on the pipeline protection project with SOHA Engineers and the PUC staff. The contractor was Malcolm Drilling of South San Francisco.



Figure 1
The landslide on Meters Road threatened a concrete water pipe buried under the road.



Figure 2
Temporary soldier piles provided temporary support for vehicle access.



Figure 3
Thirty-four permanent piles were installed south of buried pipeline.



Figure 4
The affected road was regraded. Temporary piles were left in place.

Opus Center at Sierra Point

Located on a shoreline landfill site between Highway 101 and the San Francisco Bay, Opus Center at Sierra Point straddles the city limits of Brisbane and South San Francisco. As many as 15 new commercial buildings will be constructed on the property.

Treadwell & Rollo is the geotechnical and environmental consultant to Opus West for the entire 131-acre development, which is being built over a former municipal waste and construction debris landfill. Among the important issues at Sierra Point are the capping of the landfill, the design and installation of deep foundations, and the control of landfill gas.

Although the site is considered a closed landfill, state regulations required the installation of a clay cap. To accomplish this, about 120,000 cubic yards of approved Bay Mud were hauled to the site and placed in a 12-inch layer over a 24-inch foundation layer. Geotextiles were used beneath portions of the foundation layer to stabilize the subgrade. Site preparation was completed with 4 to 5 feet of protective soil cover (about 330,000 cubic yards) compacted over the clay cap.

Sierra Point is underlain by about 75 to 100 feet of fill, refuse, and

weak, compressible marine clay, known as Bay Mud. As much as five feet of settlement has been measured across the site during the last twenty years. Consequently, existing and new structures are supported on piles.

Currently under construction are an 8-story, steel-frame office building, a 2-story parking structure, two 3-story, steel-frame office buildings, and a 7-story hotel. The buildings will be supported on deep piles that derive their capacity through friction, except for the hotel where the piles are bearing in bedrock. Pile lengths vary from about 120 to 180 feet and are designed for downdrag loads as high as 225 kips. In addition to the downdrag loads, the piles are designed for building column loads ranging from 120 to 210 kips.

Because of the substantial lengths required, steel piles were the preferred foundation support system for almost all of the buildings. The piles are trucked to the site in 60-foot lengths. Because the landfill is corrosive, cathodic protection for steel piles is required. However, the hotel, which is near the entrance to the Sierra Point, is supported on 14-inch square concrete piles with steel H-pile stingers. Concrete piles were selected for the hotel

because bedrock is relatively shallow and cathodic protection is not needed.

The services being provided by Treadwell & Rollo include document review, geotechnical and environmental investigations, consultation on foundation types and earthwork, coordination with regulatory agencies, and the design of landfill-gas collection and monitoring systems for each building. We are also providing all earthwork, foundation, and environmental observation and testing services during construction.

Opus West is a member of the Opus Group, a full-service national developer headquartered in Minnesota. The Opus Group has completed nearly 1,800 commercial projects in over 35 states and plans to develop more than 28 million square feet of new commercial space in 2000. Opus West is headquartered in Phoenix with offices in Pleasanton, Sacramento, and Orange County.

John Gouchon, Jeff Ludlow, Jeff Saunders, Matt Rosman, Micah Rapoport, Richard Rodgers, and Don Treadwell are among the Treadwell & Rollo staff involved with the Sierra Point project.



*Sierra Point (1999)
The 131-acre development with site preparation and construction in progress simultaneously. The view is northward along Highway 101 with Candlestick Point and Hunter's Point in the far background.*



Installation of Methane Collection Piping



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