NELSON ENGINEERING CO.

Project: 188 OTTER ROCK DRIVE
GREENWICH, CONNECTICUT

Completed: OCTOBER 2011

DANBRO
DISTRIBUTORS
3700 South 26th Street
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General Discussion.

The following case history is a representative job we completed in the latter part of October of this year. It was part of a high end residential excavation shoring and logistics project we participated in as Engineers and Technical Directors, embedded in the contractors work forces. Our job was to provide them with a vertical range of analysis, design, layout, procurement, and hands on personnel supervision in the field.

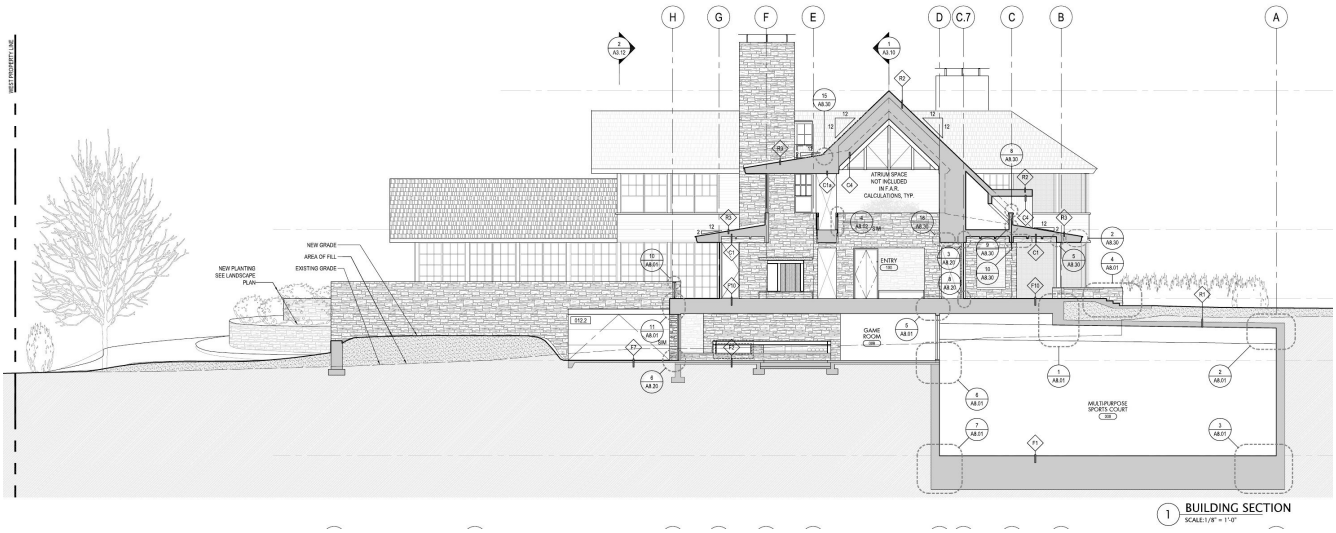

Illustration 1: Building cross section looking north. The large foundation component and subject of this history is to the lower right. The structure is a clear span box, 75' wide, 130' long, and 35' deep, and will enclose an indoor tennis court. There are no interior columns at all.

Soil conditions at the site generally consisted of approximately 12 to 15 ft. of glacial till, over severely undulating ledge rock with erratic levels of decomposition throughout. The excavators had opened the hole up some 15 feet deep prior to our involvement, and the general site arrangement and soil required treating the North, South, East, and West embankments individually, each with its own unique method of stabilization. The North Face received a Helical Soil Nail & Tie Back with a full height reinforced gunite facing.

Illustration 2: The North Face of the hole. Shown here with the upper portion of the cut roughed out. The bench in front of it will remain until the Soil Nails and facing system are installed. The underlying rock can be seen at mid-right in the photo. The top of the finished slope face is only 3 ft. from the adjacent property line and wood fence.

The north face of the hole was to be excavated 35 feet deep. We broke the face into an upper and lower excavation, with the top tier consisting of 3 rows of Chance Helical Soil Nails, and the bottom with 4 rows of drilled and grouted tie-backs. The entire face was reinforced with a system of welded wire mesh and 20' re-bars, which are tied and hung on the anchor grid extensions. The two methods represent a very well matched combination and extension of these 2 very similar methods, used in difficult conditions found in soils with unpredictable obstructions and high ground water flows.

Illustration 3: North Face of the hole, cut back & staked out for Soil Nails.

Here, the layout work is visible a day prior to driving the Soil Nails. The accuracy and consistency of the anchor placement makes installation of the reinforcing system easier. The primary steel on this job was set in a diagonal pattern, made with double #4 bars and 6x6 welded wire mesh. The cleanly cut face also helps to cut down on excessive gunite thicknesses, keeps the job looking neat, and controls all those loose clods of soil and rock that tend to roll down the bank at the worst possible moment.

Illustration 4: Soil Nails being driven into the upper North Face. The drive took 2 days, with 2 men on the ground. The rows in this photo are spaced in a 5' x 5' grid, though some wander higher along the top of slope. These are a lead section and single extension going in to straddle the failure plane.

Illustration 5: Gunite operations. Some adjustment to the Nail pattern was necessary to avoid hidden rock formations in the embankment. The jump is visible in row 2, just right of center in the photo.

Illustration 4: Another photo of the gunite guys laying it on.

After the upper assembly was allowed to set for a few days, the lower portion of the dig was advanced, initially another 5', and then to full depth because of the soil conditions encountered. In general, it was anticipated that there were homogeneous ground conditions below, but when the lower reach was opened up, the highly decomposed layer of rock was inconsistent enough that drilled and grouted tie backs would work the best.

Illustration 5: The finished product.

At left, the finished job with footings just underway.

The lower gunite face is about 16' tall and was partially back-filled in front with a 3 ft. deep compacted bed of aggregate, as an interface between the foundation and the hard rock bottom of the hole.

For some better perspective, note the 16' ladder in the corner of the dig.

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Illustration 6: Rough sledding down south. Note the density of the soil mass in the photo. The loping profile of the shist is seen clearly here. The semi-competent parts of it break in 6 different planes, and make each face (n-s-e-w) terminate uniquely. What works up north - does not work down south. The north and west sides of the hole were problematic in this way.

Illustration 7: Heavy Hibrid Structure. A nice use of classical proportions and robust balance. Includes a row of big plate anchors and tie rods for the "head set". The black band is the low-horizontal arm of it that also serves as a base. Its geometry is taken directly from the ancient.