Engineering
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FOUNDATION CONSTRUCTION IN DIFFICULT CLOSE-QUARTER CONDITIONS

This project involved an owner who wanted to construct a city building between two older existing buildings. This presented a problem as the new construction could result in severe damage to these existing structures. The adjacent building owners were so concerned about the potential damage that they, in fact, threatened legal action.

The damage concerns were mainly focused on the proposed basement of the new building. The basement would be constructed within close quarters of the existing structures which were supported on shallow foundation systems (see Figure 1). If not handled properly, construction vibrations and the undermining of these shallow foundations when installing the basement structure could result in significant damage.

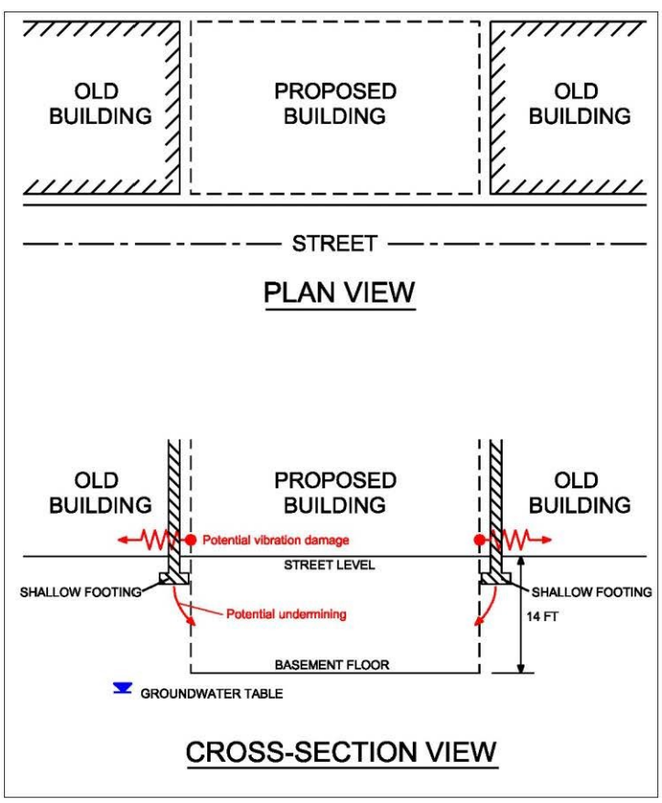

FIGURE 1: PLAN OF THE CLOSE-QUARTERS CONSTRUCTION OF PROPOSED BUILDING

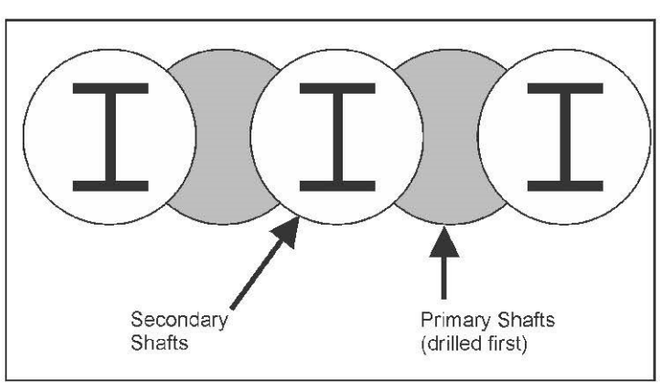

FIGURE 2: SEQUENCE OF TYPICAL SECANT WALL CONSTRUCTION

More common methods were investigated to support the ground beneath the adjacent structure while constructing the basement, but all were found to be too risky. The retaining wall systems which were considered to construct the basement could potentially damage the immediate structures from vibration during installation and/or loss of ground and settlement from beneath the adjacent structures (see Figure 1). In fact, the design engineer determined from the engineering analyses that all the wall systems considered to construct the basement would deflect significantly inward from the earth and foundation pressures on the wall and would cause damage to the adjacent buildings.

After consultation with MEA's Senior Geotechnical Engineer, a solution was found. In order to provide stiff resistance against lateral movement with nominal disturbance to the adjacent structures during construction, a modified Secant Wall System was proposed. Normally this wall system consists of a line of drilled-in unreinforced concrete shafts that are then interlocked with reinforced concrete shafts (see Figure 2). However, to stiffen these drilled-in shafts, a steel I-beam was embedded into the concrete in lieu of steel reinforcement. Also, to reduce the construction difficulty and cost, the shafts were not interlocked. These 24 in. diameter drilled-in shafts had at least a clear distance on the order of 2 to 3 in. between each pile (see Figure 3). An added benefit of this wall system was that it could be structurally incorporated in the building, acting as part of the permanent basement wall and

FIGURE 3: SUCCESSFULLY INSTALLED MODIFIED SECANT WALL CONSISTING OF STIFF CONCRETE SHAFTS THAT PROTECTED IMMEDIATE EXISTING BUILDINGS

foundation for the superstructure.

This project was successfully completed with no damage to the adjacent older existing buildings.

SUMMARY

This project involved construction of a new building within tight quarters of two older existing structures. As a result of the proposed immediate construction, significant concern over the associated damage to the older buildings existed. Moreover, the new building included a basement and consequently would undermine these adjacent structures. This was handled by installing a line of stiff, drilled-in concrete shafts reinforced with steel H section beams which resulted in nominal ground disturbance beneath the existing building and innocuous vibratory effects during their installation. Also, this Secant Wall System had the capability to be incorporated into the building structure.

Other Engineering UPDATES of Interest:

UPDATE 8: Geotechnical Investigation of Building Damage

UPDATE 7: Soil Provides Poor Road Construction Support

UPDATE 9: Hard Excavation Dispute

ABOUT MEA: Marino Engineering Associates, Inc. focuses on engineering research, practice and expert evaluations and is licensed in 24 states in the U.S. Our projects primarily have an emphasis on Geotechnical Engineering, however, we also have significant experience in projects involving transportation, subsidence engineering, laboratory testing, training, and geophysical exploration. Gennaro G. Marino, Ph.D., P.E., D.GE is president and principal engineer of Marino Engineering Associates, Inc., and has been a licensed professional engineer since 1984. To obtain additional information on MEA, one can also visit our website at www.meacorporation.com.

FOR MORE INFORMATION: There is a significant amount of additional information that is available on the above subject. For more information, please contact Dr. Marino at the address listed below.

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