

## UP-DOWN CONSTRUCTION

During the building booms of the 1980s and 1990s, the capacity to create underground space intensified in the United States, primarily due to increasing land values in major urban areas. Increases in the value of urban sites made constructing underground space more economically attractive, particularly in congested urban environments. The application of “Up-Down” construction method in the U.S. addressed this need and additionally, offered advantages for certain difficult site and subsurface conditions.

The Up-Down method allows for the simultaneous construction of a project’s substructure and superstructure. This approach evolved from the Milan method for subway construction, which has been described as “cover then cut” that is, parallel slurry walls are installed and then a bridge between the slurry walls is constructed and decked over for traffic. The soil is then mined from underneath the decking to create the structure. This concept led to the development of Up-Down construction in Europe and the Far East, but until the 1980s this construction method had found little application in this country.

Haley & Aldrich, Inc. was the geotechnical engineer for the first Up-Down project performed on the east coast, the Rowes Wharf project in Boston. The \$193 million Rowes Wharf is a mixed-use development located on a narrow strip of land adjacent to Boston Harbor with twin 15-story towers and five levels of below grade parking. The challenging site and subsurface conditions dictated a creative construction procedure. Working with the design and construction teams, Haley & Aldrich recommended that Up-Down construction be utilized to create the structure. Since the construction of Rowes Wharf in 1985, Haley & Aldrich has successfully completed six additional projects that employed Up-Down construction.

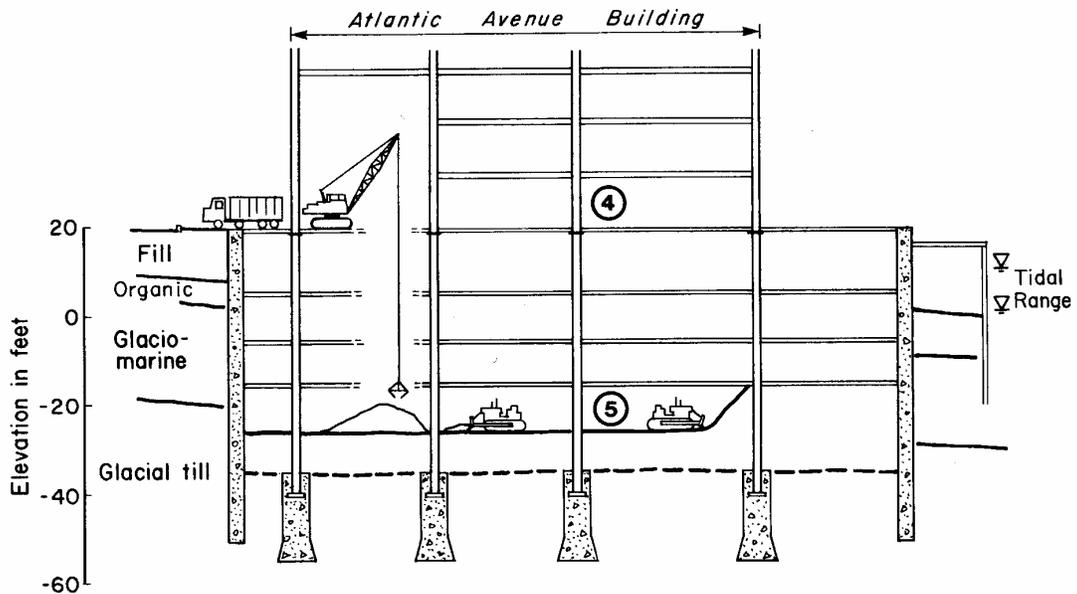
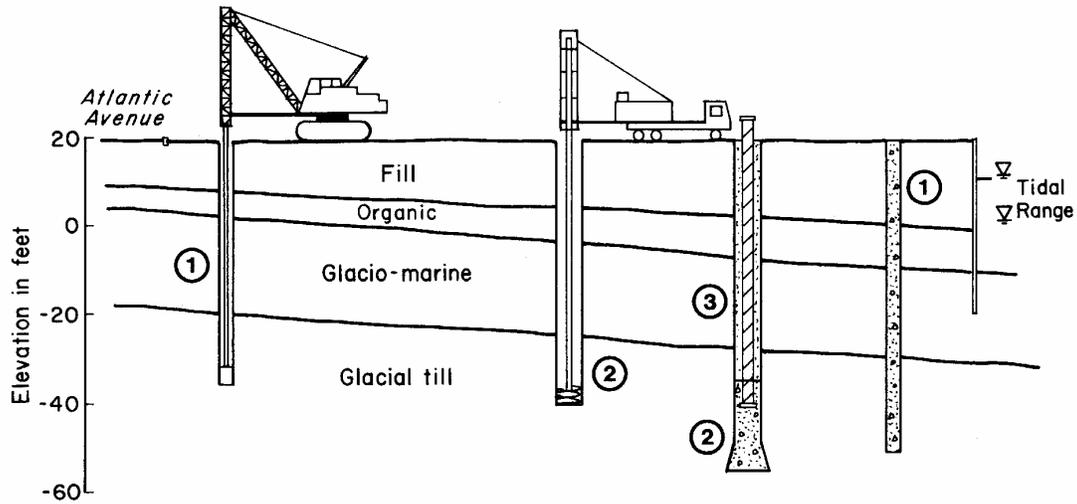
Up-Down construction is innovative because it requires no radical changes in construction technique, but rather a creative sequencing of techniques that have already been proven in either the building or heavy construction industry. As shown on the attached graphic, Up-Down construction involves the installation of the substructure’s walls, below-grade columns and foundation system, prior to excavation. Concrete diaphragm walls constructed using the slurry trench method are typically used for the perimeter walls. They serve the dual purpose of lateral support during construction and as perimeter walls for the final structure. After the perimeter walls are completed, the structure’s columns and foundation elements are installed from the existing ground surface. Then excavation begins and the substructure’s floor system is installed. The floors also serve the function of cross-lot braces during construction by providing lateral support to the diaphragm walls, through their sequential installation as the excavation proceeds downward by mining the soil below the lowest installed floor level. At the same time the excavation proceeds downward, the superstructure is erected. The concrete diaphragm wall is typically 3 feet thick and provides a stiffer system than conventional sheeting and shoring schemes and can result in reducing lateral movements of the support system during construction.

Up-down construction provides a secure, low-risk excavation support system that becomes more attractive for deeper excavations. This is due to the advantage of a shorter construction schedule and cost savings. The Up-Down method usually results in a shorter, overall construction schedule due to the early start of the superstructure. Typically, the project construction period is shortened by four to six months over the conventional construction techniques which results in cost savings.

The need for constructing in congested urban environments where site and subsurface conditions are increasingly more challenging makes the use of Up-Down construction a valuable technique for facilitating the cost-effective development of projects.

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Haley & Aldrich, Inc.  
 Up-Down Building Technique – Rowes Wharf Project, Boston, MA



The construction sequence was as follows:

1. A 30 to 36-inch thick concrete diaphragm wall is installed by the slurry trench method to a depth of at least 10 ft. below the lowest excavation level around the perimeter of the building.
2. High capacity foundation elements, such as drilled piers or load bearing elements (LBE) are advanced from ground surface to bear in competent soils below the lowest floor level. They are filled with concrete only to the lowest basement level.
3. Columns are set on the drilled piers and the annular space filled with sand or weak concrete to ground surface.
4. The street-level concrete floor slab is then cast and the superstructure erected above the column supports.
5. The below-grade excavation proceeds to the next floor level by mining below the street level floor slab. The next floor level is concreted to provide cross bracing for the walls. This is repeated down to the lowest basement.