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# The High-rise as a Retirement Community



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## Bridget Lesniak

Bridget Lesniak believes that a principal's leadership of an integrated and collaborative process facilitates successful projects. Since joining Perkins+Will in 1999, she has focused on facilitating design excellence on very large, technically complex projects. Twenty years of challenging projects form a broad technical foundation to Ms. Lesniak's multi-disciplinary team leadership. Her project leadership relies on understanding the client's big picture, belief in an integrated and collaborative team approach, comprehensive delivery method experience, and client accountability. She is committed to design excellence and client service.

## Robert Neper

Robert Neper is a Senior Associate at Perkins+Will, Chicago. He has over 20 years of professional experience in a wide range of project types including corporate, commercial, civic, education, residential, retail and hospitality. His role as senior project architect ensures proven design ability and production of high quality architecture.

## Donald Hamlin

Donald Hamlin has been with Thornton Tomasetti since 1988 and is a Senior Associate with the firm's Chicago office. He is involved in the structural design of a wide range of structures, including commercial, educational, residential and institutional facilities. His experience includes new design, as well as renovations and modifications. He is responsible for overall project management, structural design, preparation of structural drawings and specifications, review of shop drawings, and coordination with architects, detailers, contractors and outside consultants.

"Our cities are getting denser than the model of the traditional central business district with surrounding mid-rise neighborhoods. The traditional uses for high-rises are also evolving. ...The Clare is the first high-rise retirement and skilled care community to address building code issues within the multi-use context."

As cities are becoming denser, the functions of high-rises are expanding. In addition, the central business district is no longer the exclusive region of the high-rise form. The traditional office/hotel/residential uses for high-rises is changing along with their location within the urban fabric. The Mode Gakuen Cocoon Tower in Tokyo (see CTBUH Journal 2009 Issue I) is one example, transforming the traditional school campus to a high-rise tower. Another new function is described in this senior retirement center in Chicago.

## Challenges in Designing Multi-Use Buildings

The Clare at Water Tower is a Continuing Care Retirement Community developed by the Franciscan Sisters of Chicago Service Corporation on a parcel of land owned by Loyola University (the program for the tower also includes new education space for the university) at 55 East Pearson Street in Chicago. The project is the Franciscan's first high-rise and represents an urban living option for seniors. The project is unusual in that the functional elements, usually distributed in several buildings in a typical CCRC, have been stacked vertically. This unique combination created planning and engineering challenges on a constricted urban site, and resulted in a slender 53-story building (see Figure 1).

The Owner's program dictated seven major functional uses to be stacked vertically (see Figure 2). The first conceptual decision point was establishing the order of the layers. The educational program needed to be closest to grade for ready access to the student population of Loyola. Parking logically had to stack above the education floors. This massing allowed for a large outdoor roof garden (see Figure 3) and, therefore, the indoor pool and fitness spaces for the seniors belonged on this level. Above this podium roof level, the smaller tower footprint rises (see Figure 4). The

marketability of the Independent Living Units dictated that they be located on the top floors of the tower. Associated with these residential units and the healthcare floors are common dining, social, and chapel spaces. These spaces were located on floors 16–19 to take advantage of the views above adjoining properties. Below these amenity floors, the Assisted Living and Skilled Nursing floors were



Figure 1. View of north and east elevations  
© James Steinkamp

located. The functional layers were set early in concept design and did not change through the course of the project.

### Architectural Design

The building's architectural design subtly expresses the various functions of the building without looking like a jumble of seven different layers. It was a design imperative that the building not become a mix of varying

floor-to-floor heights with multiple fenestration patterns, but rather a cohesive high-rise tower with base, shaft, and top. This was accomplished by a strong, single tower design reading from ground to level 53 and a subservient podium massing. The tower has a very rigorous, repetitive fenestration pattern that was designed to align with all of the varying functional plans. The ABA window module accommodates the various partition layouts of the different uses. The curve of the tower responds to the views of Lake Michigan and its single carved out slot was important in generating residential unit layouts. Below this, the curve is continuous and occupied by a sweep of healthcare rooms. The fitness level has an arcade along this curved facade, behind which a higher floor-to-floor and full height glass accommodates an indoor pool and fitness spaces (see Figure 5). The arcade is repeated below the parking levels for the ground and second floor levels, identifying the educational and lobby functions.

### Distinct Entries

The tower and podium masses also provided for two distinctive front door entries for the Clare residents and Loyola University. This provides separate visual identities at grade. In addition, the Clare wanted two entries for itself: Independent Living and Health Care. This requirement also had to be coordinated with the internal building circulation.

## ...screaming

“Everyone will be dragged kicking and screaming from here.”

*Airie Stuart, publisher of Palgrave of MacMillan Publishers, in reference to MacMillan Publishers leaving the Flatiron Building when their lease expires in 2018. Source: "A Quirky Building That Has Charmed Its Tenants" by Helene Stapinski, NY Times, May 26, 2010, page B6*

### Vertical Transportation

The vertical building systems, and the core in particular, required accommodating different corridor circulation patterns for the varying functional layers. Elevator core design had to accommodate four separate travel paths: Loyola, Parking, Health Care, and Independent Living. Only the fitness center at level 9 and an administration function at level 16 can be reached by both the Independent Living and Health Care elevator banks. This generated a back-to-back elevator core arrangement and necessitated that the elevator lobbies and related circulation on the Independent Living did not stack above the same on the Health Care floors. The Loyola students have one ↻

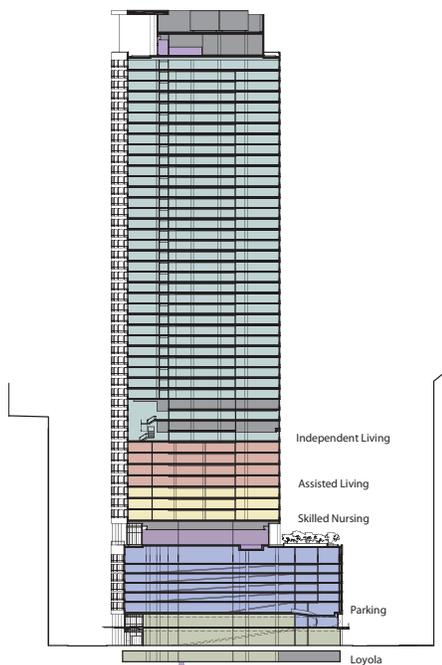


Figure 2. Building section © Perkins + Will

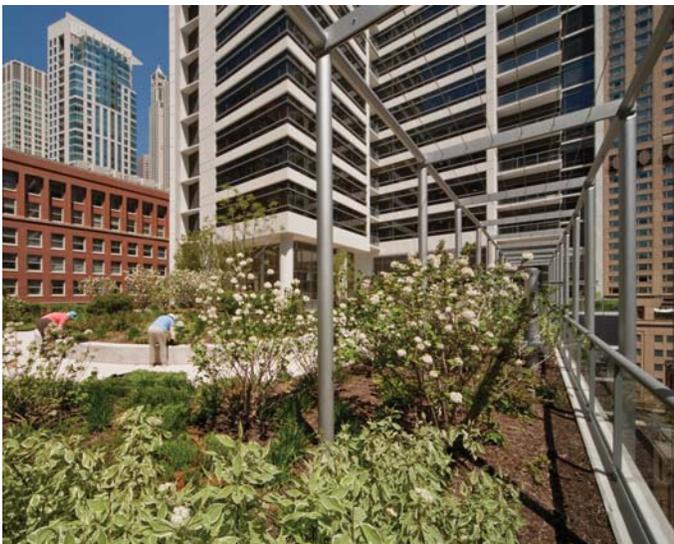


Figure 3. The roof garden © James Steinkamp

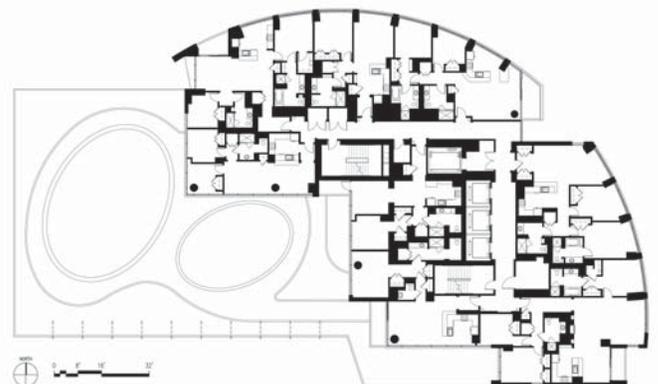


Figure 4. Typical "independent living" floor plan © Perkins + Will



Figure 5. Pool room with increased floor-to-floor height  
© Marian Kraus

elevator dedicated for their use while the seniors above have five elevators.

Two service elevators were also planned. One of them was dedicated to the dining and commercial kitchen on level 17. The connection from this elevator to the loading dock for food and waste transportation was an operational priority. Egress stairs also had to work for varying functions. The locations were determined by the most stringent occupancy's travel distance requirements, in this case the licensed Skilled Nursing floors.

### Vertical MEP

The vertical mechanical, electrical, and plumbing systems were required to remain in one location that could be threaded through varying functional floors in the tower due to floor-to-floor height constraints with limited transfers at the bottom of functional zones. This constraint was driven by economics: the cost effective, repetitive cast in place concrete structure. Without physical space or budget to transfer building systems, the architectural planning for each function was a challenge and had to accommodate major shafts for neighboring functional uses. For instance, the HVAC for the large amenity floors on levels 16–19 is supplied from level 8 up to through the healthcare floors. The level 17 commercial kitchen has black iron exhaust ductwork that runs directly to the roof at level 53. These vertical risers, set inside the structural walls of the core, created a vertical element for the systems. As a result, the concrete encased electrical risers run un-interrupted through the entire height of the building.

### Challenges in Constructing the Foundation

The challenges regarding the site were the existing buildings and their caissons, the tight urban site for construction of a tower of this size, and the soil conditions in this area of Chicago (see Figure 6). Some of these challenges were foreseeable and others were not. Thornton Tomasetti, the structural engineers, designed a foundation system of belled caissons bearing on a very stiff clay layer known as hardpan. It is the most common foundation type for tall buildings in downtown Chicago. The largest bell diameters for the project were 17'-6" (5,330 millimeters).

### Soil Conditions

AECOM/STS, the geotechnical consultant, revealed soil conditions from the soil borings that were typical for the area and consisted of urban fill at the top, then soft clay with very stiff hardpan clay directly above a dense silt layer at the bearing levels. It was also known that there were existing caissons on the site from the previous buildings, which were demolished for the new tower (see Figure 7). The design team had the original structural drawings from the demolished buildings that located the caissons. Two potential bearing strata were presented in the geotechnical report, with the deeper elevation providing a higher allowable bearing capacity of 48,000 pounds per square foot (2,300 kN/m<sup>2</sup>). A small site and building footprint, combined with the need to bell below the existing caissons, dictated the selection of the deeper bearing stratum. A potential problem associated with the deeper bearing stratum, revealed by the soil borings, was the presence of a water-bearing sand/silt seam in certain locations very near the desired bearing elevation. If the sand/silt layer was cut by the excavation, water under pressure would enter the hole and cause the bell to collapse before concrete could be placed. In order to reduce the likelihood of water entering the holes, three dewatering wells were constructed prior to caisson drilling to draw down the water level on the site. This approach had been attempted on other sites and experience indicated that success was unpredictable due to the random location of fissures and cracks in the bedrock that allow the water to travel successfully to

the wells. The wells consisted of a 4-foot-diameter (1,200 millimeters) shaft to bedrock with a well casing and filter backfill.

### Digging the Foundation

The construction schedule led to the first dewatering well being constructed on a Friday with the hole left open over the weekend under bentonite slurry prior to installation of the casing and backfill. At some point over the weekend, the lower 23 feet (7,000 millimeters) of the shaft and surrounding dense silt collapsed, resulting in a significant loss of soil density in that area and potentially the surrounding caissons. Compaction grouting of the soil in that area was performed to re-densify the silt. The volume of grout pumped into the ground was slightly more than the amount of the silt cave in. After the compaction grouting was completed, soil borings were performed with pressuremeter testing. The testing confirmed that the compaction grouting was successful. Another well pumped out enough silt to reduce the surrounding soil density. This resulted in compaction grouting and the addition of several micropiles to control settlement below the core.

Because the water-bearing layer was near the caisson bearing elevation, some caissons were installed without incident and others encountered water infiltration. One caisson below the core experienced water infiltration during belling, which caused the bell to collapse. The partially excavated bell was then plugged with grout up to a level above where the water was entering. The plan was to construct an oversized bell the next day, at the higher bearing layer, but a larger bell was not possible as the belling tool ran into existing caissons. The final condition consisted of the previously grouted plug at a 12-foot-diameter (3,660 millimeters) combined with the 11'-6" (3,500 millimeters) bell at the higher elevation. To make up for the reduced capacity of the caisson, three 200-ton (1,780 kN) micropiles were placed below the core grade beams near the caisson. In addition, concern about loosening of the supporting silt, because of water rushing into the hole, prompted pressuremeter testing, which showed loss of soil strength. Compaction grouting was



Figure 6. View of site from above. © James Steinkamp



Figure 7. Construction photo © James Hermle

performed around the caisson and improved soil strength was verified through more pressuremeter testing. Other techniques utilized, to install caissons with water infiltration, included grouting the original hole to a higher bearing elevation (lower bearing capacity) and providing a smaller bell to fit between the existing caissons.

#### Accommodating Existing Conditions

Although we had the original structural drawings for the project, there were several instances where the new bells ran into existing bells in unexpected locations. In these instances, similar techniques were used to provide adequate foundations. In some cases the original hole was filled with concrete by the tremie method under slurry and a smaller caisson was placed on top of the plug. Settlement was checked by AECOM/STS and, if not acceptable, additional caissons were placed under the grade beam to share the load. In some cases the settlements were acceptable and no further work was required.

#### Lessons Learned

Some of the lessons learned from this project's foundation were:

- Very clear communication with the people in the field is critical when problems are being solved "on the fly."
- Good cooperation between the structural engineer, geotechnical engineer, and contractor was critical to providing extremely quick solutions that allowed construction to proceed in the midst of many obstacles.

- Deep soil conditions can vary greatly in short distances. One caisson had water while the adjacent hole was dry. The soil borings do not always provide the full picture.
- Predicting the number and location of dewatering wells is very difficult and requires more testing than is typically done.
- Supplemental micro piles can be an effective means to control building settlement, as there have not been any observed settlement issues.
- Compaction grouting is an effective means of re-densifying disturbed loosened silt.

#### Code Compliance

Another challenge was an evolving interpretation of which floors were Institutional by the Illinois Department of Public Health (IDPH), which regulates the Skilled Nursing areas of the project. The Institutional requirements, in early reviews, were deemed to apply to three floors. During construction, the decision was made that they should apply to the entire project. The design team worked with IDPH to evaluate equivalent construction and avoid revisions that would have had a cost impact on the project with no improvement to life safety.

#### Conclusion

Our cities are getting denser than the model of the traditional central business district with surrounding mid-rise neighborhoods. The traditional uses for high-rises are also evolving.

This paper discussed a retirement community above classroom space for a university. It also discussed the complexity of the foundation conditions for this specific site. The Clare is the first high-rise retirement and skilled care community to address building code issues within the multi-use context.

Significant exterior pedestrian sidewalks and an open plaza with enhanced landscaping are provided along Pearson and Rush Streets. From an urban planning perspective, the building form respects the Chapel of St. James at Quigley Seminary and Loyola's campus buildings west of Wabash Avenue. We believe the unique solution to the design program and the community it creates within the building is a new model for Senior Living.

Multi-use buildings present challenges in their design. In certain cases, as with The Clare, new uses are presented to local authorities. Without previous experience with these multi-use projects, early and direct dialogue is important for its success. The design team must convince the local authorities that these uses can be designed and constructed in a safe and beneficial manner.

Site conditions can be analyzed, reviewed and assessed, but actual conditions may vary. Analysis and experience can guide the foundation design but be prepared for the unexpected. Good site supervision and communication are pivotal to the success of a project. ■