

DD Structural Narrative

October 19, 2021

1. **Structural Design Summary**

- a. The basic structural design will conform to the 2015 IBC and ASCE 7-10 as referenced therein and as adopted and amended by the local building code.
- b. The structure will be designed to meet Risk Category II criteria as defined in the 2015 IBC.
- c. The design wind load shall utilize a design basic wind speed of 115 mph.
- d. Seismic loads shall utilize local Site Classifications (Site Class C) and Design Coefficients (SDS=0.07, SD1=0.055) per IBC and an Importance Factor I_e of 1.0. The structure shall be classified as Seismic Design Category 'A'.
- e. The ground snow load at the site is listed by ASCE 7 as 5psf and shall account for snow drift in specific areas as applicable. The minimum roof live load required by IBC is 20 psf. Snow drift loads shall be considered if in excess of the 30psf minimum design load. Snow loads shall utilize a Snow Importance Factor equal to 1.0
- f. For the office tower, office spaces shall be designed for a live load of 100psf (reducible). Storage areas shall be designed for a minimum of 100psf (unreducible) or higher if determined by type of storage. For the residential tower, the residential units and corridors shall be designed for a floor live load of 40psf (reducible). Public areas and the corridors that serve them shall be designed for 100psf (unreducible). Stairs and other means of egress shall be designed for 100psf (unreducible).
- g. For the parking garage, the parking areas shall be designed for a live load of 40 psf (unreducible). The occupied areas on the Ground Level, slab-on-grade, shall be designed for 100 psf (unreducible). Stairs and other means of egress shall be designed for 100 psf (unreducible).
- h. A draft Report of Geotechnical Exploration has been submitted by Fargo Consultants, Inc. Based on this report, and a maximum estimated interior column load of approximately 2,600 kips (office tower) and 2,100 kips (residential tower), it is anticipated that the primary foundation elements will consist of drilled piers.

2. **Structural System Description**

Two structures, an office tower and residential tower, are anticipated to sit above a common 4-story parking structure. The office tower is anticipated to be 5 stories above the parking deck podium (9 stories total). The residential tower is anticipated to be 6 stories above the same parking deck podium (10 stories total). The columns at the base of the individual towers may not align with columns in the 4-story podium and it is anticipated a network of transfer girders will be required. All concrete shear walls in both towers are expected to align vertically with the podium walls below.

Office Tower

- a. The floors and roof framing for the office tower above the podium structure are anticipated to consist of a cast-in-place, reinforced concrete, pan-joist system. The floors will utilize 16-inch deep pans to form 21-inch deep beams and joists. The beams and joists shall be post-tensioned. The joists are anticipated to be 14-inches in width and have an approximate 6'-8" spacing. The floor slab above the pans will be 5-inches thick. Column bays are approximately 30'-0" x 40'-0". Basic column layouts are shown on the Schematic Architectural Plans.
- b. Columns are anticipated to be 24"x24"

- c. One 16-inch thick concrete core will encompass the stairs and elevator shafts and will resist lateral loads in addition to gravity loads. A separate 18-inch thick concrete wall will also resist lateral loads and will be located North of the North stairs.
- d. All concrete for elevated slabs, slabs, and joists to be $f'c = 5,000$ psi. All concrete for columns and walls to be $f'c = 4,000$ psi.
- e. Along the East façade of the office tower, a cantilevered floor is presented and will be accomplished by cantilevered concrete beams and joists.
- f. At the southeast corner of the roof of the office tower a large canopy is planned. The canopy is planned to be accomplished with cantilevered concrete joists.
- g. The exterior façade is expected to consist of a combination of window wall glazing or light-gage framing with applied materials consisting of metal panel, cementitious panel, or stucco. The facade is planned to be supported by the framing at each level.

Residential Tower

- a. The floors and roof framing for the residential tower above the podium structure are anticipated to consist of a cast-in-place concrete, post-tensioned, flat-plate system. The floor plates will generally consist of post-tensioned 9" thick floors. Integral beams or thickened floors may be required depending on final layout. Basic column layouts are shown on the Schematic Architectural Plans.
- b. Columns are anticipated to be 20"x30"
- c. Two 16-inch thick concrete cores will encompass the stairs and elevator shafts and will resist lateral loads in addition to gravity loads. A separate 18-inch thick concrete wall will also resist lateral loads and will be located just West of the expansion joint.
- d. An expansion joint is required near the midpoint between cores.
- e. All concrete for floors, columns, and shear walls shall be $f'c = 4,000$ psi.
- f. Residential units will have balconies that will be utilize cantilevered concrete slabs.
- g. The exterior façade is expected to consist of a combination of window wall glazing or light-gage framing with applied materials consisting of metal panel, cementitious panel, or stucco. The facade is planned to be supported by the framing at each level.

Parking Structure

- a. The parking structure podium level floor slab is anticipated to be 6" thick consisting of cast-in-place concrete, post-tensioned, one-way slab construction. Floor beams are required at an anticipated spacing of 23'-4 feet on center to provide support to the podium level slab plus to provide vertical support to Multi-Family Residential Tower and at a spacing of approximately 20ft to provide support to the podium level slab and to provide vertical support to Office Tower columns. Transfer girders or secondary beams will also be required at all those locations where Residential and Office Tower columns do not align with Parking Structure beams and columns or where podium level beams frame into a transfer girder at turning bays. Approximate size of podium level beams is 30 to 36" wide x 108" deep and approximate size of podium level girders is 48" wide x 108 deep. All concrete for podium level floor, beams, columns shall be with 7000 psi concrete at 28 days.
- b. Elastic deflection for sustained gravity loads at podium level long span beams is anticipated to be in the range of 1/2" to 3/4" at mid-span of beams. Long term deflection of podium level beams is anticipated to be twice the magnitude of elastic level deflections.
- c. Floor slab at Parking Structure 2nd, 3rd, and 4th level is anticipated to be 5" thick consisting of cast-in-place concrete, post-tensioned, one-way slab construction. Floor beams are required at a spacing similar to podium level beams. Approximate size of Parking Structure beams is 15" wide x 36" deep. Approximate size of parking structure girders is 24 to 36" wide x 42" deep at exterior and 42" wide x 42" deep at interior grid lines. All concrete for parking structure floor, beams, columns shall be with

5000 psi concrete at 28 days and for parking structure girders shall be with 6000 psi concrete at 28 days at interior grid lines and with 5000 psi concrete at 28 days at exterior grid lines.

- d. Parking structure columns are cast-in-place concrete, and their size is anticipated to be 24" wide and 36" deep (all levels) where there are beams framing into columns at exterior and 36" square where there are girders framing into columns (all levels) at exterior. Anticipated column size at interior where there are transfer girders supporting multiple office tower or multi-family column loads within the interior of the garage will be 42" square (all levels).
- e. Vehicle and pedestrian barrier protection around parking structure perimeter at all levels consist of 8" thick cast-in-place bumper wall (or upturn cast-in-place upturn beams) projecting minimum of 3'-6" above finish concrete surface at each level.
- f. Vehicle and pedestrian barrier protection at parking structure ramp edges at all levels consist of (13) 1/2" round barrier cables, galvanized, projecting minimum of 3'-6" above finish concrete surface at each level.
- g. Ground slab at Parking Structure area is anticipated to be 5" thick slab-on-grade consisting of cast-in-place concrete supported on stabilized and compacted sub-grade in accordance with project Geotechnical report.
- h. Enclosed stairs at Residential and Office Towers, and within the limit and height of the Parking Structure are to consist of metal pan stair system using galvanized structural steel members.
- i. All concrete for parking structure floors, beams, girders, CIP bumper walls, columns at Ground, 2nd, 3rd, and 4th levels shall be 5000 psi at 28 days.
- j. Parking structure columns are supported on deep foundation system.
- k. Anticipated size and length of drilled piers at interior columns is (2) 48" diameter round drilled pier embedded minimum of 8 feet into dark gray shaly limestone bearing stratum. Anticipated size and length of drilled piers at exterior columns is (1) 42 or 48" diameter round drilled pier embedded minimum of 8 feet into dark gray shaly limestone bearing stratum. There is significant amount of variation in loads at exterior column lines due to the framing of beams and girders at exterior of the structure. Approximate length of drilled piers is in the range of 40 to 50 feet based on how far the temporary casing is going to extend into the bearing stratum to prevent seepage of water and to seal drilled pier hole from moisture contamination of freshly poured concrete. Approximate size of drilled pier cap at interior column foundation is 8'-0" wide x 14'-6" long x 84" deep. Approximate size of drilled pier cap at exterior column foundation is 5'-0" square x 48" deep. All concrete for grade beams, wall footings, drilled pier caps, drilled piers shall be 4000 psi concrete at 28 days.