

First National Bank Tower

PROJECT

First National Bank Tower

LOCATION

Omaha, Nebraska

OWNER

First National Bank of Omaha

ARCHITECT AND STRUCTURAL ENGINEER

Leo A Daly

Omaha, NE

GENERAL CONTRACTOR

Kiewit Construction Company

Omaha, NE

CONCRETE SUPPLIER

Ready Mixed

Concrete Company

Omaha, NE

CONCRETE PUMPING

Hotz Concrete Pumping, Inc.

Omaha, NE

LIGHTWEIGHT CERAMIC AGGREGATE PRODUCER

Buildex, Inc.

Ottawa, KS

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Omaha's First National Bank Tower Using Structural Lightweight Concrete to Build a Landmark

by Susan Jorgensen, Leo A Daly

LANDMARK BUILDING DESIGNED FOR OMAHA

In 1997, the architectural and engineering firm of Leo A Daly was selected by the First National Bank to design a landmark Tower in downtown Omaha, Nebraska. The result is a 40-story office building designed around a variety of uses including executive space, modular offices, high-density storage areas, vaulted lobbies, glass-enclosed Wintergarden and a multi-story parking garage. At 633 feet, the First National Tower is the tallest building in the upper Midwest between Minneapolis and Denver. The nearly one million square-foot office utilizes both steel-frame and concrete construction.

LIGHTWEIGHT CONCRETE MINIMIZES DEAD LOADS AND REDUCES COST

Lightweight concrete was selected for the floor slabs on metal deck in the First National Tower to minimize



At 633 feet, the First National Tower is the tallest building in the upper midwest between Denver and Minneapolis.



First National Bank Tower rises high above the Omaha skyline.

cubic yards of structural lightweight concrete, which was placed by concrete pump. The mix contained Vacuum Saturated expanded shale lightweight aggregate from Buildex Inc's New Market Missouri plant. In addition to using pre-saturated lightweight aggregate, pumpability of the mix was aided by the incorporation of Ash Grove Cement Company's Duracem Type IP pozzolan cement.

DESIGN AND CONSTRUCTION

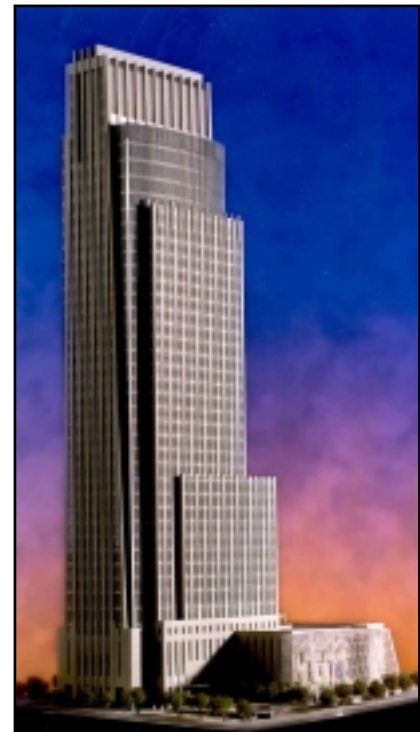
Exterior steel columns located outside of the concrete floor plates are spaced at 10 feet on center around the perimeter of the building. Composite wide-flange beams span up to 47 feet between the exterior columns and the central normal weight concrete core. The core was designed to house the elevator shafts and provide the primary lateral resistance for the Tower. Using 8000-psi concrete to provide the necessary rigidity, the core is constructed of 30-inch and 32-inch cast-in-place walls throughout the height of the Tower. The core was constructed with a self-climbing form system provided by Peri-Form and includes 17,500 cubic yards of concrete and 1680 tons of reinforcing steel.

A portion of the 300-stall parking garage extends under the steel framing of the office Tower. The structural steel members are encased in concrete to provide continuity with the structural framing above while maintaining a cast-in-place appearance. Constructed of concrete for its durability and minimal maintenance requirements, the remainder of the parking garage features cast-in-place normal weight concrete beams, typically 36 inches deep, spanning up to 60 feet. Site restraints did not allow room

the floor dead loads and support the design live loads for offices including select areas of high-density storage areas. By using lightweight concrete, a two-hour fire rated floor was provided in a 5.25-inch slab without the need to spray-fireproof the metal deck, realizing considerable savings in the project. The slabs contain reinforcing steel only at the perimeter of the building, over girders and at deck direction changes with the remainder of the slab containing only synthetic fibers. This further added to save time and the cost of labor in constructing the floor slabs.

The floor slabs required 11,000

cubic yards of structural lightweight concrete, which was placed by concrete pump. The mix contained Vacuum Saturated expanded shale lightweight aggregate from Buildex Inc's New Market Missouri plant. In addition to using pre-saturated lightweight aggregate, pumpability of the mix was aided by the incorporation of Ash Grove Cement Company's Duracem Type IP pozzolan cement.



Model of First National Bank Tower



Night skyline of Omaha, NE, with First National Bank Tower illuminated at center

for expansion or separation joints or post-tension construction so the structural steel Tower and cast-in-place parking garage were designed as a single structure.

Large shear and uplift forces required the core to be supported on a concrete pile cap 120 feet by 76 feet by 12 feet deep that contains 950 tons of reinforcing steel. Placement of the cap was accomplished in one continuous 11-hour pour with concrete supplied by two concrete plants and over 40 delivery trucks. This constituted the largest single placement of concrete in the state of Nebraska. A consultant specializing in mass concrete issues was retained to help develop the mix utilized in the 4,300 cubic yard pile cap.

Deep foundations extending to limestone bedrock support the structure. The central core and pile cap are supported by 28 drilled shafts, each 90 inches in diameter, installed using an auger-cast, slurry-replacement method. Excavation of the 90-inch shafts required the use of the largest drilling rig available in the country. The remainder of the Tower and most of the parking garage are supported by 30-inch to 60-inch cast-in-place concrete drilled shafts extending as deep as 70 feet. A large number of existing wood piling on the north end of the site required placement of steel pipe piles with cast-in-place concrete caps to bridge the existing foundations.

A Wintergarden featuring a multi-story glass-enclosed space near the main entry is constructed of bowed tube trusses supported by a cast-in-place curved concrete foundation wall along Dodge Street. Terracotta fascia removed from the historical building that previously occupied the site was restored and mounted on the back concrete wall of the space. Bent plates were cut to fit each section of the terracotta and are anchored to the north concrete wall of the parking garage with adhesive anchors to support this architectural feature. The Wintergarden also features a mezzanine that leads to the two-story lobby and is supported by two tapered, cantilevered cast-in-place concrete beams rising out of a fountain in the floor. Stairs and glass-covered ramps behind the fountain connect the parking garage to the cast-in-place concrete tunnel under Dodge Street leading to the Bank's existing headquarters.

During the design of the structural framing for the Tower, the structural engineers determined the probable maximum axial shortening that would occur in both the concrete shear core and the exterior

steel columns due to vertical loads. The results of both the concrete and steel analyses were compared to determine the differential shortening expected between the concrete core and the exterior steel columns. In an effort to monitor the actual shortening of the steel and concrete members, a study in cooperation with the Civil Engineering Department at the University of Nebraska - Omaha is underway. Strain gauges have been installed in the building at 12 levels and measurements are being collected at regular intervals. The results of this study will be shared with the engineering and academic communities.



AWARD WINNING STRUCTURE

Construction of the First National Tower in Omaha is complete and the owner is in the process of occupying the facility. The combination of cast-in-place concrete and steel for the structural framing proved to be the most economical system to meet the project needs. The project recently received the Nebraska Chapter ACI Award of Excellence for Use of Concrete in the State of Nebraska, the Engineering Excellence Honor Award from the Nebraska Chapter of ACEC (American Council of Engineering Companies) and a National Finalist Recognition from the National ACEC organization. The final project has reshaped the Omaha skyline and is an architectural landmark of which we can all be proud.

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