The Nebraska Capitol HVAC Project

2016-2026

After two years of planning, the project to replace the 60 year old heating, ventilation, and air conditioning system in the Nebraska State Capitol is in progress. The project is replacing the existing steam and chilled water HVAC system with a closed loop ground source geothermal heating and cooling system. The project is being conducted in five phases and will require the eventual relocation of every office in the building to allow for contractor access. During Phase V the 14th floor Memorial Chamber and Observation Decks will be closed to the public.

HVAC History

During the Nebraska State Capitol's 1922-32 construction period, with limited space on site for a power plant, the state took advantage of the University of Nebraska's 1929 construction of a new coal fired power plant and enlarged the system to handle both facilities. The Capitol then relied on steam generated at the University's 14th and U Street power plant and sent through pipes in a tunnel under 14th street to fill radiators located throughout the building. In the 1960's, the decision was made to upgrade the Capitol's system to accommodate chilled water provided by the University's system and cool offices in summer. Most of the original radiators were replaced with induction units which pass air over heated or cooled fan coils. The 1964 units used the original one pipe supply and one pipe return system; the Capitol could be heated or cooled, but not at the same time. The temperature fluctuations of Nebraska's spring and autumn seasons mean elected officials and staff in the Capitol spend some time each year too hot or too cold. By the mid-1990's the aging pipes under 14th Street could no longer carry high pressure steam safely. A natural gas fired steam generation facility was built near the Capitol rather than replace the pipes coming from the University which continued to carry chilled water to the Capitol. The standard life of a HVAC system is 20 - 30 years. Considering the Capitol's system was approaching 60 years of use, the difficulties encountered keeping the system running, and the level of discomfort in the building, the Nebraska Legislature decided in 2014 it was time for a new system.

New System Description

The Office of the Capitol Commission hired BVH ARCHITECTURE, as consulting architects, and consulting engineers, Alvine Associates, to research systems and develop alternatives for heating and cooling the Capitol. It was determined a closed loop ground source geothermal system was the most energy efficient and cost effective over the long term. Fortunately, the State of Nebraska had just acquired a city block size surface parking lot one block from the Capitol which proved ideal for a geothermal well field. A two year planning and design phase fine-tuned the system and its installation. New fan coil units with the capability for individual office temperature control are being installed in most areas of the Capitol. Depending upon the need, the system will pull heat from or put heat into water circulating in a continuous closed loop from the Capitol to the well field. During the coldest months, the system will be backed up with steam from the state's natural gas steam plant near the Capitol.

Scope of Work

Several additional projects will accompany the HVAC work. Along with the installation of new fan coil units in offices, the original steam radiators in the Capitol at entrances, in corridors and in stairways will be reconditioned and reused. Key to the efficiency and energy savings of the project will be the repair and weatherstripping of the Capitol's windows. Because the project will require removing staff from every office in the building during the demolition and construction process, the Office of the Capitol Commission will improve the life safety system in the Capitol, installing a new fire alarm/emergency notification system and fire sprinklers where needed. A backup emergency generator has been installed off-site in space shared with the Office of the Chief Information Officer. During well field construction, footings able to accommodate a future parking garage and office building were installed to expand potential use of the well field site in the future.

Phase V Description

Phase V of the HVAC Project involves the tower of the Capitol which contains staff offices of all three branches of government. In Phase V the contractors will again install protection as needed, and repeat the process of removing all existing HVAC equipment and installing the new refrigerant lines and fan coil units. The tower presents numerous challenges for contractors, including access via the very small tower elevators or flights of stairs to the 13th floor. Tower construction varies slightly from other areas of the Capitol with a steel superstructure encased in concrete and brick masonry. The HVAC system will be routed vertically through chases rising up 150 - 200 feet into the tower. **The 14th floor observation decks and Memorial Chamber will be closed during Phase V.**

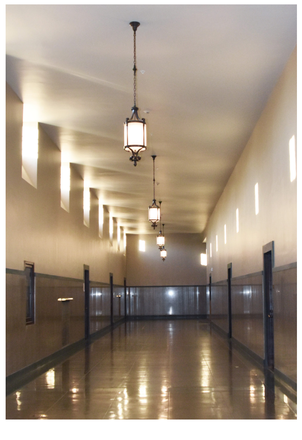


Above, the 1960's induction units were installed outside the window pockets and took up additional floor space. Below, the new units fit into the window pockets, enlarging usable office space.





Above: ceilings lowered to hide air ducts added in the 1960's upgrade are being removed in the first floor corridors during the project. Below: light fixtures restored to their original length are then re-hung in the project areas. Exposed clerestory windows increase available light and return corridors to original appearance. Corridor restoration will continue throughout the first four phases of the project.



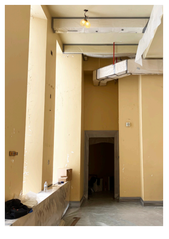
Project Timeline

2016 - 2018	=	Schematic Design & Design Development Construction Documents Contractor Pre-qualifications Design Bidding
2016 - 2019	=	Electrical and Generator Connections
2018 - 2019	=	Well Field Investigation & Construction Phase I--Southwest Quadrant
2020 - 2021	=	Phase II--Southeast Quadrant
2021 - 2022	=	Phase III--Northwest Quadrant
2023 - 2024	=	Phase IV--Northeast Quadrant
2025 - 2026	=	Phase V--Tower

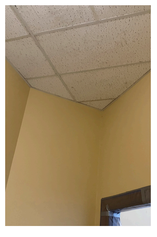




Initially tower floors were heated with radiators located on the narrow walls between the tower's ribbon windows. Above left, the windows allowed continuous light and views from floor to ceiling. The 1960's upgrade of the steam system to allow summer cooling with chilled water added wall to wall induction units which blocked the ribbon windows, above right. The new HVAC system will return heating and cooling units to the walls between the windows, notice the sample unit in the above right image . After the induction units are removed the floor to ceiling windows will be open again.



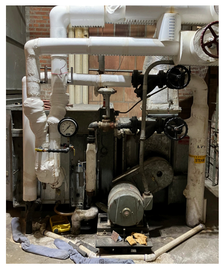
The tower work will remove ducts and induction units added in the 1960"s HVAC upgrade. Left, the induction units along the windows will be replaced with individual units, opening the floor to ceiling windows. The duct at the top of the photo was routed into a chase in elevator vestibule. Right, dropped ceilings and stud walls removed on each tower floor will allow the removal of the old equipment.





The mechanical (or M) floors occupy the areas surrounding the 2nd floor rotunda and house the mechanical equipment which moves all services, mechanical, electrical, communication, heating and cooling, and water, into the tower. Right, original water pumps will be replaced with modern repairable equipment. Far right, the steam equipment and air handlers will be replaced with the new system.

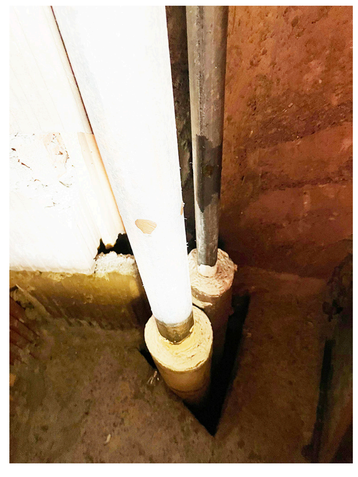






The Memorial Chamber and Observation Decks will be closed during Phase V.





During the 1922-32 construction of the Nebraska State Capitol engineers had to design ways to move domestic water and steam up into tower offices and move waste water down to the basement sewer system. In addition, fresh air ducts, electrical and telephone infrastructure needed to move up 150' into the tower. In each corner of the tower, chases or shafts, were installed to accommodate the pipes, wires and ducts. It is within these small vertical shafts that all the new HVAC infrastructure must pass. The top photo is a view up one of these chases as pipes rise 19' to the floor above, and the bottom photo shows pipes disappearing below the floor to the floor below. Contractors will remove the old and then install the new system in the 150' tall chases during the project making Phase V a most challenging part of the project.