The Capitol Infrastructure Upgrade & Heritage Hall Project

By Valerie R. Marvin
Michigan State Capitol Historian & Curator

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With the passage of the 2017/18 fiscal year budget, the Michigan State Capitol Commission (MSCC) officially began the Capitol Infrastructure Upgrade (CIU) project, a $70 million effort to repair and improve the failing electrical, mechanical, plumbing, fire suppression, and heating and cooling systems that are critical to the Capitol's operation and preservation. This project touched a multitude of spaces on Capitol Square and in the Capitol building, and ultimately paved the way for the construction of Heritage Hall, an underground visitor and event center.

The CIU project was, in many ways, a continuation of the 2014-2016 renewal project. (See *Renewing Michigan's Capitol: 2014-2016*.) Once the building's exterior was sealed, and water stopped leaking in from outside, the MSCC turned their attention to the Capitol's interior, which was served by nearly 30-year-old systems and infrastructure – some of which were failing. Alarmed, the Capitol hired a team of engineers, architects, and systems specialists to analyze the problems, recommend solutions, and create a road map for addressing potentially catastrophic failures before they occur.

Fixing these problems – which included corroded electrical boxes, leaking pipes, improper wiring, and heating and cooling units simultaneously blowing warm and cold air – wasn't easy. While some of the equipment is carefully concealed in hidden mechanical rooms, many aspects of the project touched the Capitol's most important and historic spaces, including the Senate and House Chambers, legislative offices, and the iconic dome.

The Geothermal Field

Once the initial analysis was done, project engineers proposed the installation of a new geothermal exchange system on the west side of Capitol Square. The U.S. Energy Information Administration defines "geothermal energy" as "heat within the earth" – from the Greek words geo (earth) and therme (heat). Geothermal exchange systems use the constant 54/55 degree temperature of the earth as a heat source in the heating season and as a heat sink for heat rejection in the cooling season.

A model showing the new geothermal wells located on the west side of Capitol Square.

Geothermal systems are, according to the U.S. Department of Energy and the U.S. Environmental Protection Agency, "the most energy-efficient, environmentally clean and cost-effective option available for heating and cooling." They are also self-contained and self-sustaining, providing unparalleled energy security and stability. And a well installed system can last between 50 and 100 years, making it a great choice for a building intended to stand for centuries.

The Geothermal System Wells

There are several critical components to the Capitol's geothermal system. One is the field of wells (or boreholes). The initial design for the new system called for a field containing 224 individual (vertical) wells, each measuring 500 feet deep. These wells were drilled on the west side of Capitol Square. They are positioned on a grid at 20-foot intervals.

Work on the geothermal field progressed at intervals throughout the bigger CIU project. The first phase, which included drilling (or boring) the first 224 wells and inserting looped piping and grout into them, took only about two months. The work of boring the wells was done using four large drilling rigs. On average, one rig was able to complete two wells a day. Workers began boring wells the second week in October and finished the initial phase of work on December 8, 2017.

Loops of piping were inserted into the wells as they were drilled. (See https://bit.ly/geopipe to watch this process.) Each loop installed is made of high-density polyethylene (HDPE) piping fused together in the factory. The pipes contain no seams, so there is no place for the solution to leak. The expected lifespan of the piping, which has been used by natural gas companies for decades, is anywhere from 50 to 100 years. The pipes are secured in place using grout, which protects the surrounding earth and aquifer from the threat of contamination and improves the thermal exchange conductivity rate.

Once the wells were all grouted into place, it was time to link them together via the installation of horizontal lateral pipes (also called headers). This required excavating long trenches and installing long laterals that were attached (or tied) to fourteen individual wells. Approximately half of the laterals were installed in late 2017 and early 2018.

The remainder of the laterals had to wait until 2020, as planning for Heritage Hall ramped up. Before construction on the Hall could begin, the boreholes located under its footprint were excavated, cut, and capped about 50 feet below grade. To compensate for this loss and ensure the system has adequate capacity for the additional 40,000 square feet of Heritage Hall, 48 additional wells were bored on the far west side of Capitol Square, bringing the total number to 272.

The Geothermal System Glycol Solution

The next major component of any geothermal system is the liquid solution that runs through all of the wells and pipes. The Capitol's system contains about 55,000 gallons of solution, which is comprised of 30% propylene glycol and 70% water. This solution cycles constantly through the wells, pipes, and in and out of the heater/chiller.

As the solution runs through each vertical geothermal well it is heated or cooled by the constant temperature of the earth around it. The solution then moves from the individual wells into 20 laterals (or mains), which all flow into an underground Central Utility Plant (also known as the CUP). Next, the solution goes into a very large heater/chiller, which operates much like a home air conditioning unit.

The Capitol has a three-loop system. In Loop A, the solution circulates through the heater/chiller and then goes back out to the field via return pipes. It cycles back into the wells and is once again heated or cooled by the earth around it.

The CUP is full of overhead piping that comprises part of the geothermal system.

Loop B consists of a set of pipes that run through, and provide cooling for, the first, second, and third floors of the Capitol. The solution in the heater/chiller cools the solution in Loop B to 45 degrees. Next, the solution in Loop B cycles through a set of pumps and pipes that run through the building.

Heating the building uses the same process, except the solution is heated to 135 degrees before passing through Loop C, a separate set of pumps and pipes.

Moving all of the solution through miles of wells and piping, located throughout the building and across several acres of Capitol Square, takes energy. The energy, or flow, is powered by a series of pumps, which are also located in the CUP. These electrically powered pumps run continuously.

All of the loops, piping, and pumps are tied into the same overall system whose point of interconnectedness and exchange is the heater/chiller. In other words, if you could mark one gallon of solution and watch it travel, it would eventually pass through every inch of piping in the building, through the heater/chiller, and then up and down every single one of the 272 geothermal wells.

When the system is on its lowest setting, that one gallon of solution would move from the CUP to the building and back to the CUP in about 25 minutes. When the system is moving at full capacity, that same gallon can pass from CUP to building and back in only 3 minutes.

The solution doesn't heat and cool the building by itself. As the solution moves through the Capitol, it feeds through 300 individual fan coil units located on the first, second, and third floors. These fan coil units are situated under the building's windows, in cavities in the brick walls that are covered by decorative grilles. Fresh outside air comes into these cavities through open joints in the stonework that were part of the Capitol's original design. The solution runs through the fan coils, which heat or cool the fresh air also passing through them. The fan coil then blows the warmed or cooled fresh air through a vent into the room. This vent is located at the top of the cavity, next to the marble windowsill.

If for some reason a room does not need to be heated or cooled, the valves on the fan coil units in that room can be closed. This means that the solution will cycle past that space, and onto somewhere else. The valves can be reopened, and heating and cooling resumed, at any time.

It's a pretty remarkable system that shares similarities with the original steam boiler scheme that likewise pumped hot water to hundreds of radiators tucked into those same under-window brick cavities, where it warmed fresh air drawn in through those same open joints. One can't help but suspect that Capitol architect and self-styled engineer E.E. Myers would admire the improvements made to the original system that he designed in the 1870s!

Central Utility Plant

Installing a geothermal system meant not only drilling hundreds of new bores – it also required building an underground structure to house the heater/chiller, multiple pumps, and other associated mechanical equipment.

The idea of placing equipment at the north and south ends of the Capitol originated during the building's construction in the 1870s. Architect Elijah E. Myers located five steel boilers (built by Brownell & Co. of Dayton, Ohio) under the Capitol's north and south steps to protect the structure and its occupants from potential explosions. These boilers were eventually removed in the early 20th century, when a local utility (now known as the Lansing Board of Water and Light) installed a massive steam heating system throughout downtown Lansing. Less expensive and more convenient than the individual boilers it replaced, this city steam system supplied the Capitol with heat for a century.

Once the boilers were removed, the vaults quickly became popular places to tuck many other things, including pipes, wires, and heating and cooling equipment. Haphazardly packed into the vaults and sub-basement, the accumulation of decades worth of equipment created potentially dangerous conditions.

To address this glut of material (much of which had already been decommissioned), and provide a better home for new equipment, architects recommended the construction of an underground Central Utility Plant. Known as the CUP, it was placed underground on the south end of the building.

The CUP measures 103'4" at its widest point from north to south, and 121'3" at its widest point from east to west. Linked to the Capitol via new south (sub-basement level) stairs, it houses all of the major mechanical equipment. Unlike the dark and sometimes dank sub-basement, the CUP is a modern, watertight, safe space where Capitol staff can easily access the equipment and pumps they maintain.

The piles (or posts) that comprised the ERS held back the earth around the construction site, preventing erosion.

The process of excavating the footprint of the new CUP proved to be complex. Because the area is closely bordered by a sidewalk, the geothermal field, the Capitol, and a historic tree, engineers recommended installing an earth retention system, or ERS. The ERS is composed of twenty-five feet deep auger cast piles filled with grout, and in some cases, steel beams. The piles form a protective barrier between the excavation site and the earth around it, minimizing any negative effects to the surrounding area. Walers (steel beams) were then installed along the ERS to provide additional support.

Once the ERS was completed, excavators began removing the rest of the earth in the footprint of the CUP down to a depth of twenty feet. A sump pit was excavated and installed, and concrete footings for walls and support columns poured.

When the wall footings had cured, a kicked block was installed to fill the space between the footings and the ERS. Next, exterior and interior walls and columns were formed and poured throughout the CUP, and sand backfilled between the exterior walls and the ERS piles. A massive roof deck was poured. And then, finally, once the structure was complete, it was time to install the new equipment in it.

The roof of the new CUP was poured in the first half of August in 2018, marking a major project milestone.

North Generator Vault & North Annex Addition

The CIU project also brought change to the Capitol's underground north annex, constructed in the 1970s. Originally designed for the House of Representatives as a Central Receiving Facility, it contained space for mechanical equipment, janitorial staff, vending machines, a new elevator (with equipment), a women's bathroom, a duplication center (with nearby dark room and paper storage), the House mail room, multiple unassigned storage rooms, and a small loading dock and receiving area. Not long after its late 1970s completion, a portion was also turned into offices for three House members.

The use of this space evolved quickly. When the Capitol's 1987-1992 restoration ended, the Representatives' offices were relocated elsewhere. Staff members of the newly formed Legislative Council Facilities Agency – tasked with caring for the Capitol – moved in.

The opening of the new Anderson House Office Building in 1999 brought the departure of the House duplication center and mail room. Likewise, the gradual closure of the Legislative Service Bureau document room from 2003-2005 saw old office space turned into make-shift storage.

As part of a larger security plan, the Michigan State Police officers who protect the Capitol moved into the annex in 1999. Internal politics complicated this venture, and after just a few years MSP relocated again to a small office in the Capitol's west wing.[1]

By the time the CIU project began, an expanded Capitol Facilities staff was struggling to make efficient use of the north annex space they'd gradually inherited. When project architects and engineers suggested expanding the annex westward for an electrical room and generator vault, the time seemed right to reimagine the annex completely, with an eye towards current and future needs.

The first part of the north annex expansion project called for building the underground structure out westward. This was where new electrical equipment and two massive generators (capable of powering the entire Capitol) would be located.

Excavations began along the west side of the annex in the early fall of 2017. Contractors built forms for concrete walls that would underpin, or reinforce and strengthen, the existing wall. An ERS was installed along the south side of the excavation site, and, after a spate of extremely cold weather that forced stoppages, the generator vault's mat slab was poured. (Sometimes called a "raft foundation," a mat slab is a thick, continuous slab that extends the entire footprint of a building.) This slab foundation contains roughly 23 tons of re-steel and over 200 yards of concrete.

The process of forming and pouring the rest of the electrical room and generator vault spanned the early months of 2018. By early March the walls were poured and in mid-April the roof was complete.

Next, hot applied waterproofing system was applied onto the exterior surfaces of the finished walls and roof. This two-part system is comprised of a fibrous reinforcement sheet and an asphalt rubber-based product that's heated in a kettle and spread across the sheet, sealing it to the concrete wall and forming a waterproof barrier. [1]

In order to get power from the CUP (located on the far south side of the building) to the new generator vault and electrical room (located on the far north end), the team designed and built an electrical duct bank. This large concrete bank contains twenty-two four-inch conduit sleeves, through which scores of wires are threaded, tying together the equipment

1. MSP later moved into a different office located in the east wing on the ground floor.

in the CUP and the generator vault and electrical room. Excavating for and building the duct bank (which runs through the west sub-basement), was a complicated and time intensive process that wrapped up in early 2019.[2]

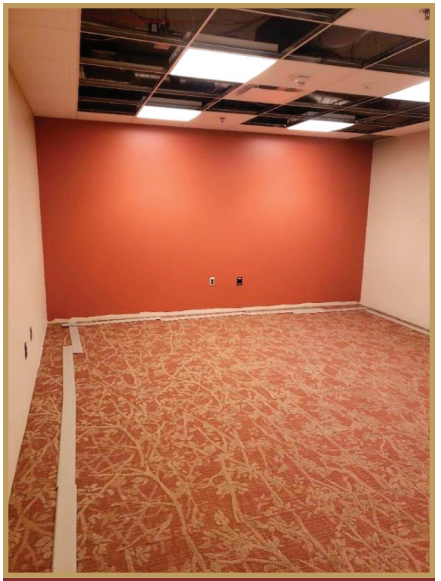
The generator vault houses two large natural gas fueled generators capable of providing electrical service to the entire Capitol building. They were installed in mid-March of 2019. Now, in the event of a grid failure or interruption, the Capitol's power will remain consistent, ensuring that the work of government can continue. This is a marked improvement over the previous situation, in which one small generator, capable of providing only a small portion of the Capitol's power, served as the only backup. The vault also provides additional security for the generators, both of which are located inside its strong concrete walls. In contrast, the previous generator sat exposed to the elements and possible interference and damage on the north loading dock.

New generators aren't the only pieces of equipment moved into the north annex area. During the CIU project several portions of the Capitol's electrical system were also upgraded and relocated from the sub-basement into annex spaces formerly used for offices, housekeeping, and equipment storage. In addition, new tool and paint rooms were located near the north loading dock.

Significant changes were also made on the east side of the north annex. The MSCC approved a 27-foot eastern addition that would provide much-needed office space for the Capitol facilities staff. Excavators began removing dirt in the spring of 2018, and new footings, wall foundations, and column forms were installed. A series of concrete pours followed,[3] and once the exterior was finished it was waterproofed and the surrounding area backfilled.[4] Slowly throughout the summer of 2018 the new space began to take shape. By October contractors were installing drywall and drop ceiling grid,[5] and the new restrooms were tiled.[6] Lighting, carpet installation, and painting followed in November.[7]

The Facilities staff moved into their newly expanded home at the end of 2018. The new space contains workstations and offices for Capitol Facilities management and support staff. Central Control, the heart of the Capitol's systems and security monitoring, was redesigned and upgraded with modern equipment, and a break room installed.

The additions to the north annex brought some additional project components, including the extension of the retaining wall that faces Ottawa Street.[8] The east and west ends of the wall were lengthened using concrete, then covered with waterproofing, and finally faced with sandstone. The wall also extended slightly upward to accommodate the new, higher grade of the lawn above the north annex.[9]



By late fall 2018, interior work in the newly expanded north annex was almost complete.

North and South Exterior Stairs

The north annex expansion necessitated the deconstruction and reconstruction of the north exterior (portico) stairs, which were expanded and rebuilt in the 1970s. This latest rebuild unfolded across many months in 2018 and 2019, with long pauses for the aforementioned north annex expansion, and the rewaterproofing of the oldest portion of the annex roof.[10] Following precedent set during previous stair restorations, an effort was made to retain as much of the extant ornamental stone as possible. When past wear and water damage required the incorporation of new stone, masons used Berea sandstone sourced from the Amherst formation for balustrades, and complementary limestone for the stair treads.

In the spring of 2019, the masonry team moved across the building, where they began deconstructing the south exterior stairs (portico) in order to gain access to the deteriorating brick vaults underneath. The process of disassembling and cataloguing the stone, building a new concrete understructure, and reassembling the stone, spanned many months. Once the exterior stairswere rebuilt and the understructure was again protected from the elements, new interior stairs leading from the ground floor to the CUP were poured to meet current code.

The old brick understructure of the south exterior stairs.

Interior Work

At the same time work was progressing on the exterior and underground, electricians, mechanical technicians, plumbers, plasterers, and painters began tackling the installation of new equipment in the Capitol's historic spaces. The first big area they tackled was the House Chamber and its adjacent rooms, which quickly transitioned into a construction site as soon as session recessed on June 12, 2018. A blended team of House, Senate, and Capitol staff quickly began moving furniture out of the Speaker's Office, the House Chamber, House Caucus rooms, and the offices behind the Chamber on the second and third floors in preparation for the next phase of work.

The House was one of the first places where Capitol staff began noticing problems several years before. Splitting (original walnut) desks, peeling ceiling paint, sagging portraits, and cracking plaster all indicated trouble with the Capitol's environmental controls. Then, in 2017, leaking pipes in the gallery caused original paint and plaster to fall on a member during session.

Installing a new fan coil unit in the Senate Galley in the spring of 2019.

Many of these problems stemmed from the Capitol's constantly fluctuating temperatures and humidity levels, which were addressed through a variety of means. In the House, and eventually throughout the building, new fan coil units (for heating and cooling) were inserted under every window and new, more efficient air handling units were installed in the attics. These attic units capture air from the roof, warm or cool it, and then push it into the Chamber. There are air ducts that move air into the

chambers, and others that draw air from it. Some of the air moves through the openings in the small domes visible in the Chamber ceilings. These domed openings were part of the original system of foul air shafts that Myers designed to move warm air up and out of the Chamber. Once again, it is fascinating to see bits and elements of his original design continuing to play a part in a modern system.

As part of the heating and cooling upgrade, new units that monitor and control the temperature were installed. The location of each panel and thermometer was carefully chosen, as power would need to be run to each one. In some places, a new thermometer simply replaced the old. In other places, the introduction of new units meant cutting into the plaster for new electrical runs.

Cutting plaster open to install a new electrical line is a relatively easy matter. Repairing that plaster chase – which requires the application and curing of plaster, and in-painting decorative elements – is more complicated. Installing the units and their wires took only a few days. Replastering and repainting took multiple weeks. But it is the right thing to do for the building. Happily, today most people have no idea that the walls ever had to be touched.

The thermostats and monitoring units weren't the only pieces of new wall or ceiling mounted equipment that had to be installed. The Capitol's fire detection and alert system also needed updating to meet current code. Again, great care was taken to make these additions as invisible as possible. New early warning aspirating

Installing new fire alarms required cutting channels into the plasterwork. Most were placed above switches near doorframes in an attempt to minimize the disruption to the room overall.

smoke detection sensors that measure less than one inch across were carefully inserted into the Chamber ceilings, concealed in the ring of the current sprinkler heads. Known as VESDA, these tiny units can detect minute levels of smoke, raising an alarm before a fire has time to escalate. Additional fire alert boxes and replacement sprinkler heads were likewise tucked into the building as needed, with great care paid to their location and visibility.

Another major part of the project involved retrofitting the Capitol's historic and reproduction fixtures with new LED bulbs. Care was taken to ensure that the new bulbs still gave off a warm yellow glow, to mimic the original gas. In some areas, the change was as simple as removing an old light bulb and screwing in a new one. In other areas, such as the House and Senate attics, the process was much more complicated. Rectangular custom LED lighting panels were designed, fabricated, and carefully installed over each tile in the Chamber laylights. These panels will provide more consistent and uniform light above the beautiful etched glass ceiling tiles. These modifications will reduce heat damage to the decorative plaster and tin Chamber ceilings while lowering the Capitol's electricity bill.

While none of these projects seem overly complicated, it is important to remember that much of this work was taking place in short windows of time, as the project moved from one space to the next. Work in the House Chamber took place in the summer of 2018,[11] with the process largely repeated in the Senate the following summer. During the months in between the same work was carried out in one office suite after another – which meant that each member and their staff had to be moved out of their suite, relocated in the House or Senate Office Buildings, and then moved back in a few weeks later. The entire process was a complicated and highly scheduled dance involving Capitol staff, dozens of contractors, Legislators, the Governor's Office, and House and Senate staff. Altogether, this interior portion of the CIU project stretched across much of 2018 and 2019.

The Fourth Floor

While most of the work on the first, second, and third floors followed the same model, the fourth and ground floors involved some different aspects. The heating and cooling on the fourth floor is provided using electric fan coil units that are separate from the geothermal system. The units heat or cool the air already circulating throughout the room, using a convection system. As a part of the project, all new electric units and thermostats were installed.

Installing a new window in S402.

As this was the first place touched during the 1987-1992 restoration, and as it was more "remodeled" than "restored," its inefficient windows had not been replaced with modern, efficient, replicas. This was rectified in 2019, when the House and Senate fourth floor committee rooms and corridors also received new windows.

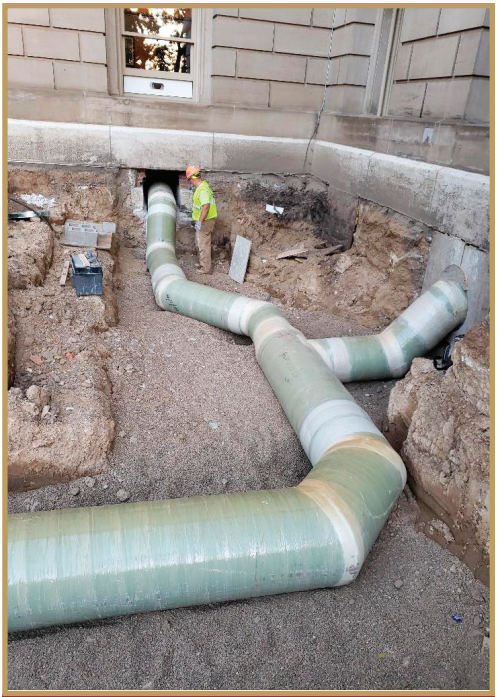
Likewise, as this was the first portion of the building woodgrained during the restoration, the quality of the grain didn't match the rest of the building. The Capitol's decorative art team launched a massive effort to rewoodgrain the fourth floor and all the trim and wainscotting for the ground floor offices.

The Ground Floor

House, Senate, and Executive's ground floors spaces experienced a combination of upgrades and changes during the CIU project. In general, the Senate spaces required the least work, as they receiveda higher degree of finish during the 1987-1992 restoration. Thus in these spaces, interventions were limited to the installation of new fancoils and other basic wiring, plumbing, and fire alarm system pieces.

Now, House leadership decided it was time to restore their spaces as well. Starting in 2018 and continuing into 2021, the House worked with the Capitol to both upgrade the systems in, and restore the appearance of, their north and west wing offices. As part of this project the brick ceiling vaults were exposed and replastered, as were the walls. In addition, the walls were repainted, and historically appropriate reproduction carpet and light fixtures were installed.

One of the most significant, but far less noticeable, changes was the creation of a new air intake system to service the fan coil units on the ground floor, called the DOAS (which stands for Direct Outdoor Air Supply). Unlike the previous system, which drew in air via vents located at ground level, the new system uses air pulled in via intakes in the roof. This air then moves down the building though a series of ducts and is heated or cooled by the ground floor level fancoil units.



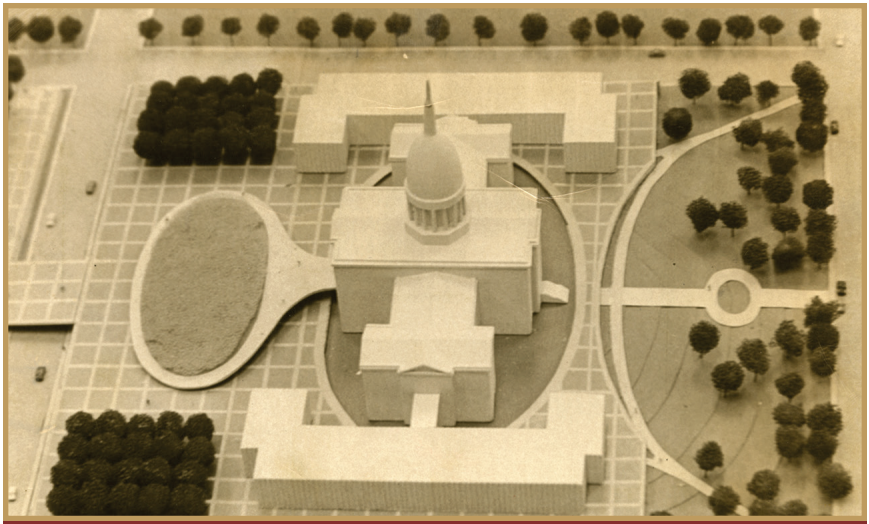
Installing DOAS ductwork.

The Historical Path to Heritage Hall

The idea of erecting an addition to the Capitol on its west side or façade is nearly as old as the building itself. Built to meet the needs of government in the early 1870s, the Capitol proved too small for the state's growing needs less than 20 years after opening. Lansing city directories show that the state had already located one new, small state bureau in the downtown State Office Block (located on the southwest corner of Washington and Allegan) by 1891, only 12 years after the present opened.

Cognizant that the building had already become an architectural icon whose classical eastern façade and lofty profile shouldn't be altered, Capitol caretakers approached building architect E.E. Myers about a possible extension to the back, or west side of the building in 1907. Myers, ever eager to sell another design, happily complied.[12] But the Legislature refused to fund the project, so gradual relocations continued.

As the years passed, a series of other modifications to the west side of the property (either in the form of an addition to the Capitol, or a separate building for the Supreme Court and Library facing Walnut Street) were discussed and rejected. Eventually the momentum for new construction shifted away from Capitol Square and into the neighborhood immediately to the west, where the 1922 State Office Building, the Mason Building, and the Capitol Complex were gradually constructed.



The model of the proposed Capitol wing expansion was photographed and published in the Detroit Free Press on February 4, 1966.

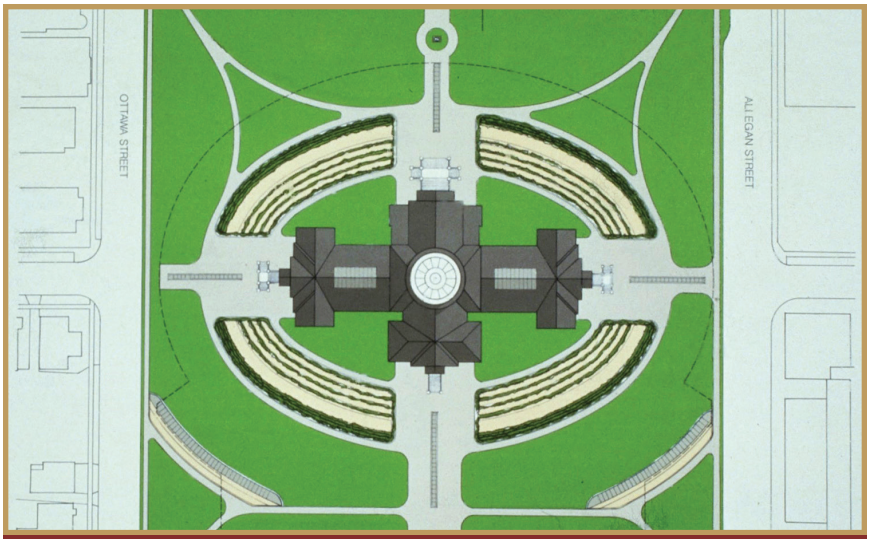
But the idea of building something on Capitol Square wouldn't stay dormant. In the 1960s a plan was proposed to add two large wing extensions onto the extant building. Intended to serve as new homes for the House and Senate, they would have dramatically extended the north/south axis of the Capitol. Within a few years, though, the conversation shifted instead to the construction of a totally different fourth Capitol, situated as a western anchor to the growing state mall.

For a variety of reasons, including very negative public response, Michigan's fourth Capitol was never constructed. But the need for office space – particularly for the Legislature – only increased. And as the last of the department executives and state officers moved out of the Capitol and into the complex, the Legislature started to get really serious about finding more office space wherever they could.

Because modern Legislators wanted their own offices (in addition to their traditional Chamber desks) the old departmental offices were sliced and diced into increasingly small and awkward spaces through the installation of overfloors (also called half floors or mezzanines). These horizontal subdivisions, combined with the introduction of the modern office cubical, led to the formation of spaces within spaces within spaces. But it still wasn't enough.

In the 1980s the Legislature decided to float a new idea. What if the best place to build new legislative offices was in the space beneath their feet? Soon a concept for an oval ring of underground offices cut into

Capitol Square began to circulate. Based on the 1979-1981 underground addition to the historic University of Michigan Law Library, the solution would have preserved the Capitol's historic envelope while – theoretically – preserving the basic slight lines across the east grounds to the building. But building underground was expensive, and there were other more pressing matters that needed urgent attention.



This plan could have created three floors of underground offices wrapping around the Capitol.

From 1987-1992 the Capitol underwent a two-phase, award-winning restoration that touched virtually every surface within the historic building. While some had hoped that the money would hold out long enough for a third phase, during which an underground office or parking facility (or both!) could be built, their hopes proved futile.

The end of the restoration brought a period of stagnation at the Capitol. The project was recent enough that most people assumed that everything was in good shape – which it largely was. But for those who had been involved with the restoration, there was still the lingering thought of the incomplete third phase – an underground structure.

Designing Heritage Hall

The idea for a new underground space – located solely on the west side of the Capitol, out of the traditional line of sight – was reborn with the creation of the Michigan State Capitol Commission in 2014. After addressing multiple projects including the Exterior Renewal and the

Capitol Infrastructure Upgrade Project, the Commission worked with the Legislature and the Governor's Office to fund the construction of Heritage Hall, an underground visitor and event center.[2]

As often happens with construction projects, the scale and design of Heritage Hall evolved over time. Early concept drawings for a new visitor and event center included one floor of public space and two floors of underground parking. When estimates for the project neared $70 million, the plan was hastily abandoned.

A few years later, Quinn Evans Architects of Ann Arbor created a new concept for a two-story visitor center that did not contain any parking. This design, which included a 600-seat auditorium, also proved to be too expensive, coming in at $55 million.

Ultimately, legislative leaders struck a deal with Governor Snyder during the lame duck session of 2020 to commit $40 million towards the project. The appropriation passed and was signed by Governor Snyder. In response to this, the MSCC unanimously passed a change in scope for the CIU project "to accommodate what is currently being called Heritage Hall" at their February 11, 2019 meeting.[13] While this money wasn't enough to do everything, it allowed the project design work to continue in earnest.

After months of discussion and design work, Quinn Evans prepared, and then reworked, the first bid package for release in late 2019. It included major site excavation, a significant earth retention system, some work pertaining to the geothermal system, and underpinning of part of the west side of the Capitol.

Underpinning a building, by excavating and then extending its foundation downward, is not unusual in the world of construction. The prospect of underpinning a nearly 150-year-old National Historic Landmark and working seat of government was an entirely different matter.

Quinn Evans' plan to underpin the building was reasonable, given the restrictions of the site. First, underpinning the Capitol's west side would have made it possible to dig a deep underground site immediately adjacent to the building. As no one knows exactly how deep the Capitol's foundations go, the underpinning process would be one part discovery, and one part reinforcement. Second, architects originally planned to join Heritage Hall to the Capitol via a combined staircase and elevator bank that would have come up under, and into, the westernmost rooms on the ground floor.

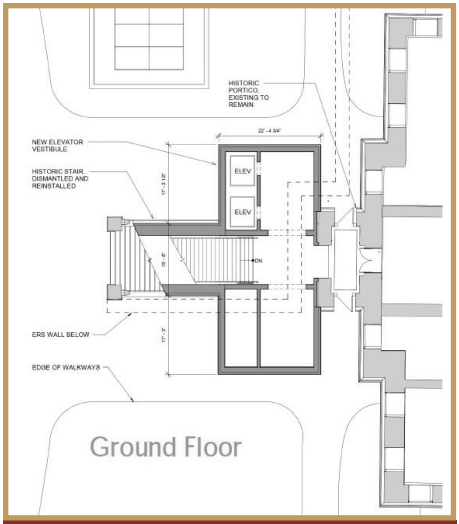
2. By this time the need for additional House and Senate offices no longer existed, as both bodies had acquired their own separate office buildings.

Meanwhile, the Commission continued to seek out the remaining $15 million needed for the $55 million project. But as the months passed and fiscal year 2019 drew to a close, it became clear that there would be no additional funding. Frustrated – but not defeated – the Commission asked the design team to scale back the project to fit the smaller $40 million budget.

Architects from Quinn Evans went back to the drawing board again and reduced the scale of the visitor and event center to roughly 40,000 square feet. This streamlined plan included a large multipurpose room capable of seating 300 people (as required for the Governor's annual budget presentation), an open atrium for large events formerly held in the Capitol's rotunda and first floor corridors, and new facilities for the tour and education service.

Early on, team members discussed moving the Governor's State of the State address into a new purpose-built Heritage Hall auditorium space. When the plan proved unpopular with elected officials, this piece of the design was scrapped.

This amended project also proposed taking a different approach to the west steps that wouldn't require underpinning – which is not only daunting, but also extremely costly. Instead, the idea of deconstructing the west portico and rebuilding it on a larger scale to contain the stairs and elevator shafts was discussed. This area could then be joined to the Capitol at the west wing – not underneath it.



The new west portico contains two elevators and the upper portion of the stairs that link Heritage Hall and the west wing.

There was some precedent for extending a Capitol portico in this fashion. The north portico was deconstructed and rebuilt on an expanded footprint in the 1970s as part of the construction of the north annex. In an era when the Capitol was considered old, but not yet truly historic, modifications of this nature were perfectly acceptable. Making a serious change to the exterior of a building listed as a National Historic Landmark was another matter.[3]

Working together, the design team of architects, engineers, construction managers, and MSCC representatives created a proposed rendering of an architecturally sensitively expanded west portico, for presentation to the Michigan State Historic Preservation Office. The SHPO officers met with the team and, after careful review, agreed that the propose expansion was permissible. Furthermore, in contrast to the general principal that new additions to historic buildings should reflect their own contemporary period, the SHPO officer concurred that the enlarged portico should blend seamlessly with the historic Capitol.

Striking the right tone with the design of the front of Heritage Hall (which faces onto North Ottawa Street) was also

The expanded west portico blends nicely with the historic building.

3. The Michigan State Capitol was named a National Historic Landmark in 1992.

critical. The new façade needed to simultaneously look contemporary while serving as a stylish, if subdued, complement to the historic Capitol, which is wholly visible from the top of the entry plaza.

The new entrance needed, as project architect Ben Telian said, to "celebrate the institutional and civicstature of the building that's behind it." Designed to be grand, it is large enough to welcome multiple tour groups arriving via the nearby bus drop-off. Approaching guests descend to the entrance level via either stairs or an ADA rated ramp and enter through three sets of glass double entry doors.

The entrance marries together two materials that are critical to its success: glass and stone. Large opaque laylights form a focused grid around the entrance, providing a sense of light and space the visitors prepare to go underground. These panels are flanked by simple Doric pilasters, which form a scaled down entablature. In a nod to the historic Capitol's base, the stone ashlars that comprise the façade walls are cut with thick false joints and laid in straight, regular courses.

By the time the interior plans were fully fleshed out, three distinct public, and two private, areas had been clearly established. Visitors entering the spacious north lobby would be greeted by a large hospitality style desk, with substantial public restrooms nearby. Tour groups would then proceed across the lobby to the far east side, where they'd sit in one of two new orientation rooms. Tours then proceed down the exhibit ramp, across the south lobby, and up the south stairs to the ground floor of the main building.

Event or meeting attendees could likewise enter through either the south or north lobbies and use restrooms before going down into the open atrium (located in the center of the space), or into either of the two State Rooms (on the west side of Heritage Hall).

The two private areas located on the far eastern and western ends of the public spaces would provide offices for the Tour and Education staff and Facility staff, space for mechanical and electrical equipment, storage for event furnishings, and archival space for the Capitol's historical collection.

Maintaining a sense of light and space throughout Heritage Hall would be absolutely critical. Inspired by a trip to the U.S. Capitol Visitor Center, the team decided to incorporate a series of four skylights into the design of Heritage Hall. These would provide a steady source of natural light and numerous views of the Capitol's lofty dome and elegant exterior. The skylights (which were installed in early 2022) are situated at the top of deep chamfered ceilings that angle outward towards the rooms below. Together they form a visual interior spine. Additionally, the light they provide shines into the atrium, while also benefiting the exhibit ramp and the State Rooms.

The architects created a materials palette that visually links the finishes in Heritage Hall with the historic Capitol.

Creating visual connections between Heritage Hall, a contemporary structure, and the almost 150-year-old Capitol, was critical. The architectural team put a great deal of thought into this facet of the design. Ultimately, they created these links via the use of similar finishes, including walnut wood veneers, antique bronze metalwork, and a terrazzo floor that becomes progressively darker as visitors move towards the ground floor juncture. By the time a visitor has climbed to the top of the south stairs, and is about to enter the west wing, the terrazzo matches that which is on the ground floor.

The team likewise incorporated a series of exposed, coated steel beams into the design, creating a modern colonnade that hints at the classical columns used in the historic Capitol. These beams are both structural supports for the roof (which is covered in dirt, sod, and grass and rated for pedestrians and some equipment usage) while providing a visual separation between the exhibit ramp and the atrium.

Constructing Heritage Hall (During a Pandemic)

By early 2020 excavators were busy moving dirt on the site. Then, suddenly, the project (and nearly all work at the Capitol) careened to a halt in March 2020. The novel coronavirus disease (also known as COVID-19) was spreading in Michigan, and the entire world was suddenly engulfed by a frightening, life-threatening pandemic.

Overnight the Capitol transformed from a busy workplace and construction site to a near ghost town, where a handful of State Police Officers, Central Control Operators, and Facility staff worked carefully orchestrated shifts. The only other people regularly coming to and using the building were Governor Gretchen Whitmer and a small number of staff, who held nearly daily pandemic briefings in the historical Executive Office.

After a six-week statewide shut down, work on outside construction sites resumed in early May 2020, with additional COVID precautions in place. The Christman Company implemented a new COVID-19 preparedness plan, while the excavators resumed moving dirt, and the geothermal contractor cut and capped the geothermal lines under the Heritage Hall footprint.

At the same time, the earth retention contractor set up a vibration monitoring system that included multiple monitoring prisms and stations across the west façade and throughout the north sub-basement.[14] This system monitored any significant movement in the Capitol's façade and sent out instantaneous warning alerts when dramatic changes were recorded. (While the system never recorded any serious problems, its readings revealed that the entire Capitol may naturally shift as much as half an inch throughout the course of Michigan's seasonal changes – far more than most buildings!)

The excavation site was secured using a concrete secant wall (as seen on the left of this image) and soldier piles with wooden lagging (as seen on the right). Together these enforced the Capitol's foundation and held back the dirt.

By early June crews were drilling piers (also called piles)[15] and pouring concrete around steel I-beams[16] to form a secant wall (a type of permanent earth retention system) along the east side of the Heritage Hall excavation, close to the Capitol building. In contrast, a less expensive, less permanent system of soldier piles (vertical members used to secure framework) and wooden lagging (horizontal wooden boards placed between piles) was built in preparation for concrete pours.[17]

A workman examines a layer of Acoustibilt finish on an angled wall beneath a skylight.

As summer turned to fall, contractors prepared the excavation site for concrete. Drain tiles were laid, waterproofing was placed along footings, and conduit sleeves were installed. By October the concrete contractor was preparing resteel for the walls,[18] and in November the structural steel contractor was erecting columns and beams in the floor slab area.[19] All of this paved the way for concrete to start flowing a few days before Thanksgiving 2020.[20] Slowly, steadily, one temporary form after another was built, rebar was placed within, and concrete poured. This lasted throughout late 2020 and more than halfway through 2021. The final concrete placement for the roof deck took place in late July 2021.[21]

As the outside of the building came together, the design team continued to refine and make decisions regarding the interior of Heritage Hall. Architects at Quinn Evans continued working remotely from their home offices throughout 2020 and into 2021, while the Christman and Capitol teams were back on site. Throughout this period many virtual and hybrid meetings (with some participants virtual and others in person) were held to settle the details of Bid Package 3, which covered the bulk of the interior work, including finishes. [22]

One potential issue that required a great deal of planning was sound mitigation. Like the historical Capitol, Heritage Hall is comprised of large, open spaces finished with primarily hard surfaces. As anyone who has ever spent time on the Capitol's ground floor knows, the foot traffic generated by tours and events creates an immense amount of noise that reverberates through the hallways and into ground floor offices.

The architects judiciously tackled this problem with an acoustician, a specialist in acoustical design. Together they decided to use a number of

sound-mitigating materials in the new structure, including both fabric and veneered acoustical wood panels in the north lobby. Additionally, a product called Acoustibuilt (which looks like traditional drywall but provides enhanced noise mitigation) was used to finish the chamfered light wells underneath the skylights. Produced by Armstrong, Heritage Hall is the first place that this relatively new product has been used on sloped ceilings. The installation process consisted of putting up a ceiling grid, attaching light 5'x5' panels, taping and finishing the joints, and then applying three to five layers of a proprietary spray paint.[23]

The silver framework that forms the center of the Skyfold partition looks like a giant metal pantograph.

Sound mitigation and amplification were both important factors in the design of the State Rooms. The State Rooms were intended to serve as two separate and distinct spaces that can be combined for very large meetings, presentations, and events. To achieve a soundproof and moveable barrier between the two spaces, the design team recommended installing a Skyfold acoustic, vertical folding, retractable wall. Unlike many lower grade partition systems, Skyfold walls are mounted in a specially designed ceiling storage pocket. Once its control panels (which are located on opposite ends of the singular open room/space) are engaged, the Skyfold descends from the ceiling downward to the floor. When the Skyfold is fully extended, the panels line up flush edge to edge, creating a remarkably tight, two-walled sound barrier that looks like a finished wall. The Skyfold partition in the State Rooms was mounted in late February 2022.

Great care was also exercised to pick a suitable glass wall assembly for the eastern wall of the State Rooms. The wall needed to have acoustical properties and provide visual separation between the rooms and the rest of Heritage Hall. The designers eventually settled on glass that is fully opaque at the floor level, and gradually fades to clear near the ceiling. This allows ambient light from the atrium skylights to filter through the top layer of glass, while screening out any distracting events or tour activity elsewhere in Heritage Hall. Due to the customized nature of the glass wall system, the component production and installation process took longer than anticipated. The system was finally installed in the late spring and early summer of 2022.

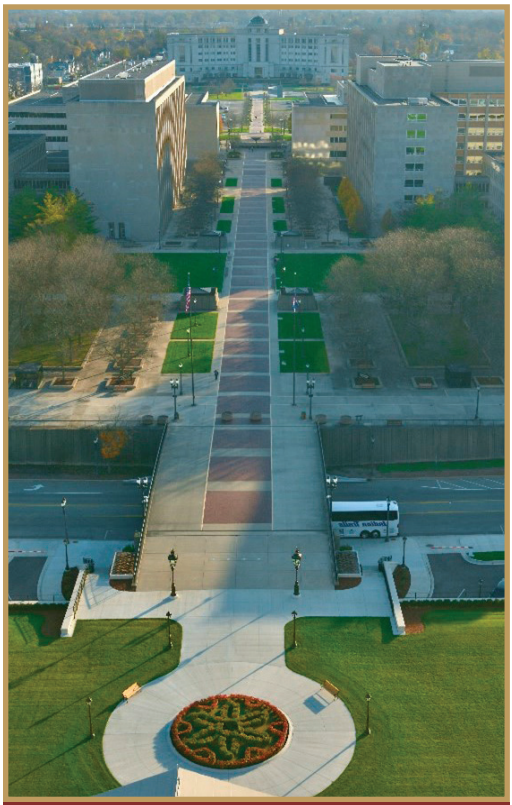
Significant thought was also put into the technology needed for future presentations, meetings, and events in the State Rooms. Members of the Legislative Service Bureau Information Technology staff, and the House and Senate media production specialists worked with the design team to develop a tech plan that anticipates multiple uses of these new spaces. The result is a collection of screens, projectors, adjustable lights, and a sound system that can be used for everything from talks and presentations to committee meetings and film screenings. Additionally, the feeds from the new cameras can be used to livestream House and Senate meetings via their respective websites.

Legislative committees are expected to meet frequently in the south state room, a quiet, up-to-date space equipped with a modern projection system. Note the Skyfold partition on the left, and the glazed glass wall on the right.

The first artifact treated in the new lab was a 160-year-old Civil War battle flag, carried by the 21st Michigan Infantry.

Particular technologies were likewise incorporated into the new conservation lab. Located on the eastern side of the exhibit ramp, the conservation lab was designed as a place where both Capitol portraits and Civil War battle flags could be treated onsite by trained staff members or outside contractors. Given the nature of the objects that will be handled within it, this area has independent climate control (temperatures are kept lower here than in the public spaces), additional security, and variable lighting that can be adjusted for both intensity and color.[24] The room is also home to two side-by-side powered tables that can be easily adjusted to the best height to accommodate different tasks.

A small portion of the conservation lab was carved out for an office exhibit. This area (designed in the tradition of museum period rooms) was carefully finished to recreate a departmental office in the historic building. The space contains a reproduction wool-blend carpet, decorative art (designed and executed by the Capitol's artists), and an original antique desk and vault door. It will be redressed annually to highlight the different departments that worked in the Capitol in the late 19th and early 20th centuries.



The redesigned west walk leads to the Frank J. Kelley walkway through the Capitol Complex.

The remainder of the exhibit cases in Heritage Hall are standalone, massive pieces of cabinetry that are anchored to the wall. Designed and built by two Michigan companies, the cases were largely assembled onsite in the spring of 2022. The graphics in the back of the exhibit cases, along the walls of the exhibit ramp, and in the orientation rooms are printed fabric. After numerous delays and complications, they were stretched and inserted into their metal frames in late May and early June. Finally, in August, a specialized exhibit installer spent two weeks working with the Capitol Registrar to carefully mount each object in its respective place. This work required an interesting blend of artistry and engineering, as mounts are generally specific to the piece and carefully designed to blend into the object and background graphics.

The spring and summer of 2022 likewise brought the relandscaping of the west grounds. As the days grew longer and the temperatures climbed, contractors laid new sod and planted trees along the perimeter sidewalk. A new center circle bed was added to mirror the east side's landscape. Within the circle, a parterre garden was created with hedged boxwood and barberry shrubs. Designed to be appreciated mostly from above, the intertwined pattern creates a rosette – a design element found throughout the Capitol's interior. Seasonal plants fill the voids within the hedge, adding visual interest all year.

The rosette in the new parterre garden nods to the Capitol's interior decorative art.

Significant modifications were also made to the western edge of Capitol Square, near Walnut Street. In an effort to provide a limited number of parking spaces for Legislative leaders (whose offices are located in the Capitol) two small parking lots (each designed to accommodate 16 vehicles) were built near the Walnut Street sidewalk. Both contain one electric vehicle charging station and are accessed via automated entry gates located near the north and south corners of the Square.

The restoration of the west grounds has truly brought the Capitol's Master Plan and three-phase restoration full circle. Now, for the first time in over 100 years, the western half of Capitol Square is once again a beautiful place to attend a rally or event, enjoy a musical performance, take a pleasant walk, or eat a picnic lunch after a tour.

Capitol Infrastructure Upgrade Project Contractors

Lead Contractors

EYP Architecture & Engineering – Washington, D.C.
Architecture and Historical Preservation

Loring Consulting Engineers – Washington, D.C.
Mechanical, Electrical, and Plumbing Systems

The Christman Company – Lansing, MI
Construction Management

Additional Contractors

Asbestos Abatement, Inc. – Lansing, MI
Building Controls Integrators – East Lansing, MI
Beckett & Raeder, Inc. (landscape architecture) – Ann Arbor, MI
BrandSafway Industrial Services (scaffolding) – MI
Building Conservation Associates – Philadelphia, PA
CASS Custom Architectural Sheet Metal Specialists, Inc. – Detroit, MI
Centennial Electric, LLC – Charlotte, MI
Christman Constructors, Inc. – Lansing, MI; Livonia, MI
Christman Facility Solutions – Grand Rapids, MI
Collaborative (Building Information Model coordination & planning) – East Lansing, MI
Couturier Iron Craft (architectural metal work) – Comstock Park, MI
Eagle Enterprise of MI, Inc. (metal fabricator) – Eagle, MI
Evergreene Architectural Arts – Chicago, IL
Gary Steffy Lighting Design, Inc. – Ann Arbor, MI
Hardman Construction, Inc. – Ludington, MI
Harris Rebar – Lansing, MI
Hoffman Brothers, Inc. (excavating) – Battle Creek, MI
Howard Structural Steel, Inc. – Saginaw, MI
Integrity Interiors, Inc. – Lansing, MI
International Test & Balance, Inc. – Southfield, MI
Jensen Hughes (construction engineering) – Baltimore, MD
John E. Green Co. (mechanical) – East Lansing, MI
Limbach Company, LLC (building systems) – Lansing, MI; Pontiac, MI
LBJ Inc. (engineering) – Okemos, MI
Master Craft Floors – Plymouth, MI
Master Mechanical Insulation – Troy, MI
Midwest Geothermal – Grand Rapids, MI
Murray Painting Co. – Freeland, MI

Quinn Evans Architects – Ann Arbor, MI
RAM Construction Services – Livonia, MI
Re-View Windows – North Kansas City, MO
Robert Darvas Associates (engineering) – Ann Arbor, MI
Schiffer Mason Contractors, Inc. – Holt, MI
Seelye Group LTD (flooring) – Lansing, MI
SME Soil & Materials Engineers, Inc. – Lansing, MI
Standard Electric Company – Lansing, MI
Summit Contractors, Inc. – Bath, MI
Synergy Consulting Engineers, Inc. – Belmont, MI
The Christman Company – Lansing, MI; Dallas/Fort Worth, TX; Detroit, MI; Grand Rapids, MI; Greensboro, NC; Knox, TN; Washington, D.C.
W.H. Canon, Inc. (landscaping) – Romulus, MI
William Reichenbach Company (plaster) – Okemos, MI
Wolverine Fire Protection & Alarm Systems – Mt. Morris, MI

Heritage Hall Project Contractors

Lead Contractors

Loring Consulting Engineers – Washington, D.C.
Engineering

Quinn Evans Architects – Ann Arbor, MI
Architecture and Historical Preservation

The Christman Company – Lansing, MI
Construction Management

Additional Contractors

Artisan Tile, Inc. – Brighton, MI
Building Controls Integrators – East Lansing, MI
Beckett & Raeder, Inc. (landscape architecture) – Ann Arbor, MI
Brigade Fire Protection – Belmont, MI
Calvin & Company, Inc. (glass) – Flint, MI
Centennial Electric, LLC – Charlotte, MI
Christman Constructors, Inc. – Lansing, MI; Livonia, MI
Christman Facility Solutions – Grand Rapids, MI
Cleveland Quarries – Vermilion, OH
Collaborative (Building Information Model coordination & planning) – East Lansing, MI
D.C. Byers Company (waterproofing) – East Lansing, MI
Davenport Masonry, Inc.– Holt, MI
Delta Steel, Inc. – Saginaw, MI
Eagle Enterprise of MI, Inc. (metal fabricator) – Eagle, MI
Fessler & Bowman, Inc. (concrete) – Flushing, MI; Charlotte, NC
Gardiner C. Vose Inc. (Skyfold wall) – Bloomfield Hills, MI
Gary Steffy Lighting Design, Inc. – Ann Arbor, MI
GHD Engineering – Farmington Hills, MI
Good Design Group, LLC (exhibits) – Midland, MI
Great Lakes Elevator – Williamston, MI
Great Oaks Landscape – Novi, MI
Harris Rebar – Lansing, MI
Hoffman Brothers, Inc. (excavating) – Battle Creek, MI
Ideation Orange (signage) – Hazel Park, MI
Ike Lea Photography – Lansing, MI
Integrity Interiors, Inc. – Lansing, MI
International Test & Balance, Inc. – Southfield, MI
Kirby Steel Inc. – Burton, MI
Lansing Glass Company – Lansing, MI
Lansing Tile & Mosaic, Inc. – Lansing, MI
Light & Breuning, Inc. (parking) – Lansing, MI

Limbach Company, LLC (building systems) – Lansing, MI; Pontiac, MI
Marc Dutton Irrigation, Inc. – Waterford, MI
Master Mechanical Insulation – Troy, MI
Meva Formwork Systems – Springfield, OH
Midwest Geothermal – Grand Rapids, MI
Morley Companies – Saginaw, MI
Murray Painting Co. – Freeland, MI
National Elevator Consultants – Lansing, MI
Presidio (digital technology) – Grand Rapids, MI
Pro-Tech Cabling Systems, Inc. – Clare, MI
Quality Re-Steel Inc. – Brighton, MI
RAM Construction Services – Livonia, MI
Robert Darvas Associates (engineering) – Ann Arbor, MI
Schnabel Foundation Company – Cary, IL
Schuler & Shook (audio design) – Chicago, IL
Seelye Group Ltd. (flooring) – Lansing, MI
Silman (structural engineering) – Ann Arbor, MI; Washington, D.C.
SME Soil & Materials Engineers, Inc. – Lansing, MI
Soundcom Systems, Inc. (audiovisual) – Lansing, MI
Spec Solutions, Inc. (doors and hardware) - MI
Standard Electric Company – Lansing, MI
Strategic Energy Solutions, Inc. – Berkley, MI
Summit Contractors, Inc. – Bath, MI
Superior Labor Solutions – MI
Synergy Consulting Engineers – Belmont, MI
The Christman Company – Lansing, MI; Dallas/Fort Worth, TX; Detroit, MI; Grand Rapids, MI; Greensboro, NC; Knox, TN; Washington, D.C.
VDA, Inc. (elevator consulting) – Detroit, MI
W.H. Canon, Inc. (landscaping) – Romulus, MI
Wiss, Janney, Elstner Associates, Inc. (waterproofing design) – Detroit, MI
Wolverine Fire Protection & Alarm Systems – Mt. Morris, MI

End Notes

1 The Christman Company. *"Weekly Construction Manager's Report May 7, 2018 through May 11, 2018."*

2 The Christman Company. *"Weekly Construction Manager's Report March 4, 2019 through March 8, 2019."*

3 The Christman Company. *"Weekly Construction Manager's Report April 13, 2018 through April 20, 2018."*

4 The Christman Company. *"Weekly Construction Manager's Report July 2, 2018 through July 6, 2018."*

5 The Christman Company. *"Weekly Construction Manager's Report October 1, 2018 through October 5, 2018."*

6 The Christman Company. *"Weekly Construction Manager's Report October 22, 2018 through October 26, 2018."*

7 The Christman Company. *"Weekly Construction Manager's Report November 5, 2018 through November 9, 2018."*

8 The Christman Company. *"Weekly Construction Manager's Report, July 9, 2018 through July 13, 2018."*

9 The Christman Company. *"Weekly Construction Manager's Report August 27, 2018 through August 31, 2018."*

10 The Christman Company. *"Weekly Construction Manager's Report, July 16, 2018 through July 20, 2018."*

11 The Christman Company. *"Weekly Construction Manager's Report August 27, 2018 through August 31, 2018."*

12 "Addition to Michigan's Capitol Boon to Scattered Departments." *The Detroit Free Press*. January 30, 1907.

13 *Michigan State Capitol Commission Minutes*. February 11, 2019.

14 The Christman Company. *"Weekly Construction Manager's Report May 7, 2020 through May 22, 2020."*

15 The Christman Company. *"Weekly Construction Manager's Report May 25, 2020 through June 5, 2020."*

16 The Christman Company. *"Weekly Construction Manager's Report June 8, 2020 through July 3, 2020."*

17 The Christman Company. *"Weekly Construction Manager's Report July 20, 2020 through July 31, 2020."*

18 The Christman Company. *"Weekly Construction Manager's Report October 12, 2020 through October 23, 2020."*

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20 The Christman Company. *"Weekly Construction Manager's Report November 16, 2020 through December 4, 2020."*

21 The Christman Company. *"Weekly Construction Manager's Report July 26, 2021 through July 30, 2021."*

22 Quinn Evans Architects. *Michigan State Capitol Heritage Hall Bid Package 3. Volumes 1 & 2*. November 11, 2020.

23 Email from Steven Taschner to Valerie Marvin. November 8, 2022.

24 Email from Cambray Sampson to Valerie Marvin, November 10, 2022.

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