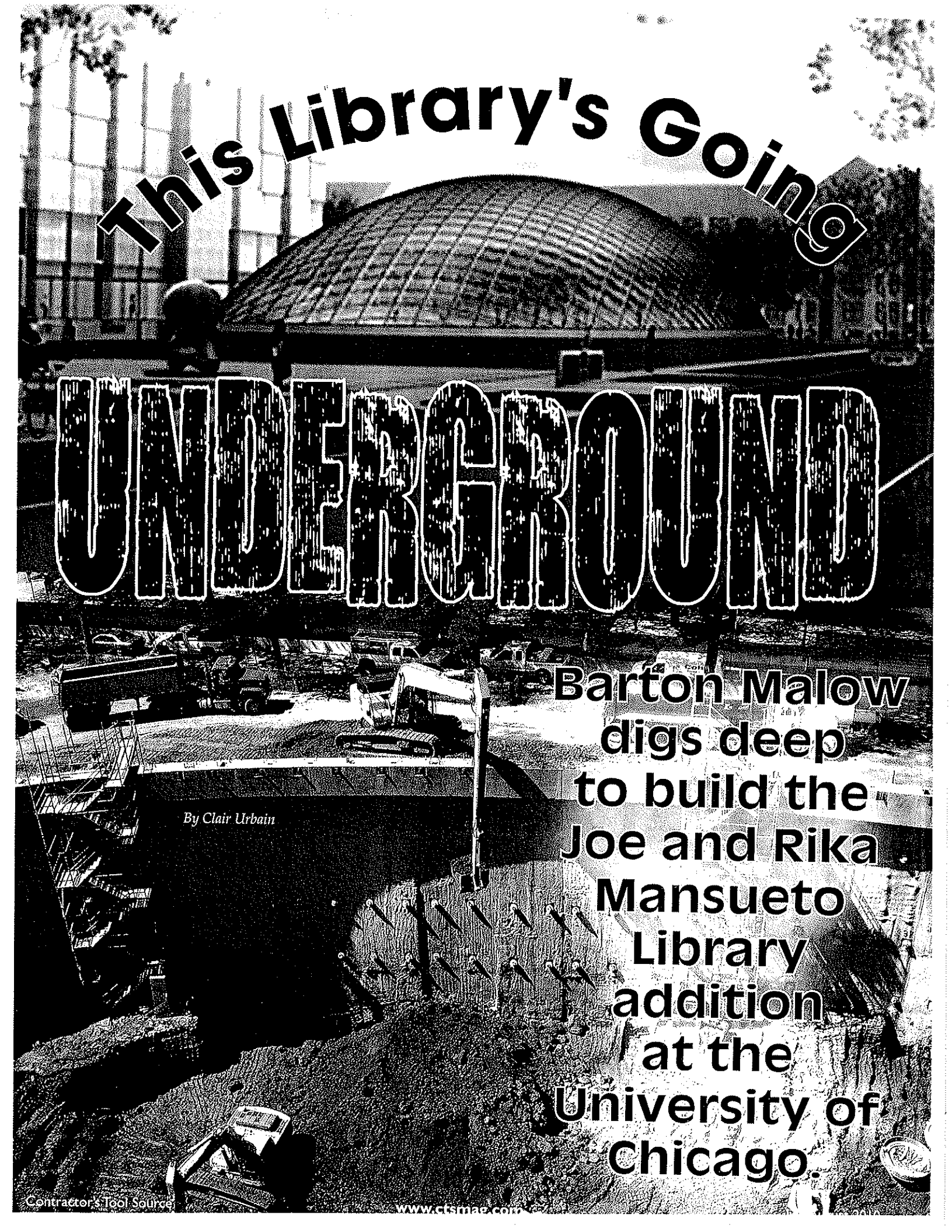
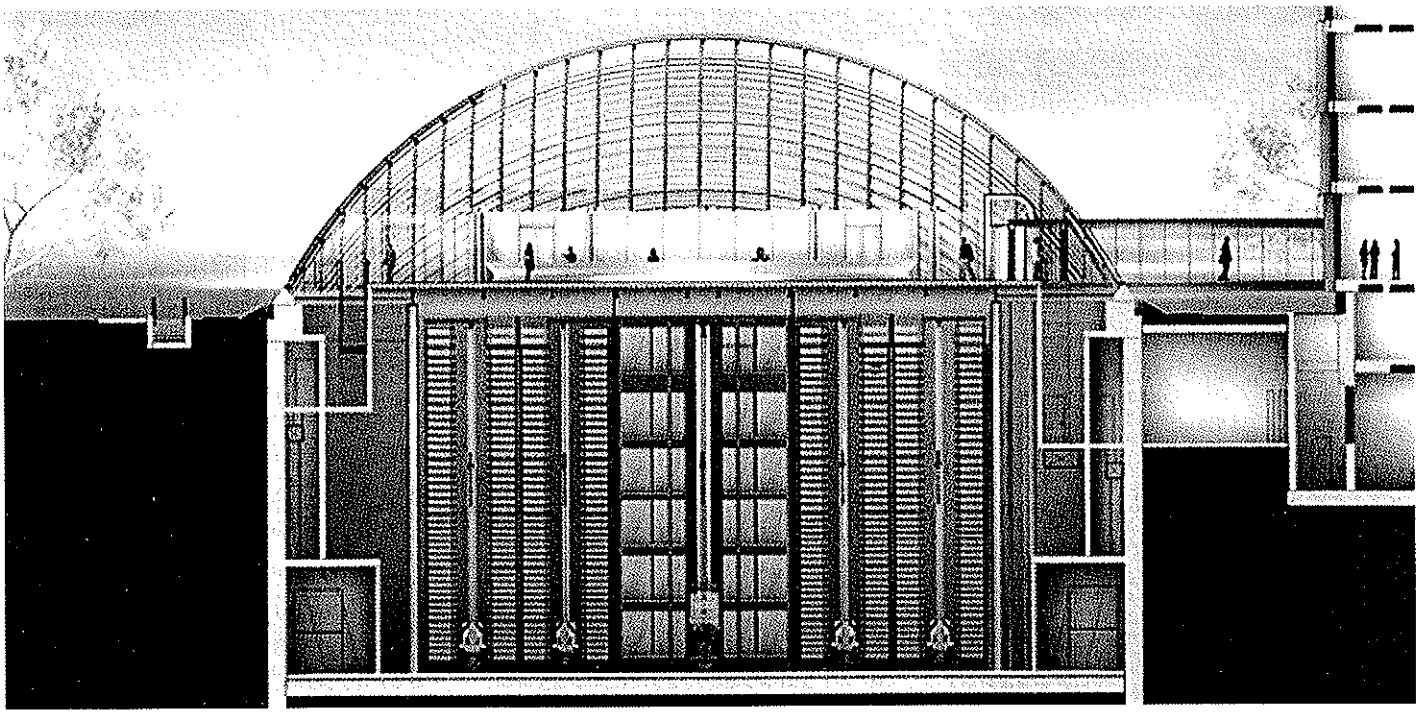


This Library's Going UNDERGROUND

Barton Malow digs deep to build the Joe and Rika Mansueto Library addition at the University of Chicago

By Clair Urbain



Photos by the author; University of Chicago

Instead of narrow aisles and tall shelves, the facility will store volumes in high-density storage bins below ground. On command, an Automatic Storage Retrieval System (ASRS) will direct one of five robotic cranes to retrieve books or other archived material requested by patrons.

University libraries conjure up images of stately buildings that rise up on a distinguished location on campus. Once inside, visitors are swallowed up by canyons of books and reading areas bathed in fluorescent light.

Forget those images when it comes to the Joe and Rika Mansueto Library addition on the University of Chicago campus. Opening in the Spring, 2011, this mostly underground facility literally turns the library experience upside down.

Instead of a stately, square building that contains stacks of books in stories of space, this library addition is an elliptical space that descends 55' deep and topped with an egg-shaped glass dome. The new facility will allow the university to house its complete book collection on site, making it the only university in the country to do so. The storage space for 3.5 million volumes should accommodate the university's storage needs until 2029.

Instead of narrow aisles and tall shelves, the facility will store volumes in high-density storage bins below ground. On command, an Automatic Storage Retrieval System (ASRS) will direct robotic cranes to retrieve books or other archived material requested by patrons.

Work continues at a brisk pace on the site, under the direction of construction manager, Barton Malow, says Laura Leber, project manager.

"This is a very tight work site. The building's footprint is 120' x 240' and butts right up to streets and sidewalks of the campus. We have only been able to close one lane of traffic on two sides of the site, so getting materials on and off the site takes some very good coordination," Leber says.

Going down

The oval facility, located next to the Regenstein Library on campus, required the excavation of 53,000 cu. yd. of soil. But unlike other building projects where the soil is excavated, then the foundation is formed, this project poured the foundation before the site was totally excavated.

"This building has a slurry wall foundation. First, guide walls were constructed that outlined the perimeter of the 3'-thick foundation walls. A clamshell bucket precisely excavated soil 60' deep between the guide walls and a bentonite-based flowable fill was pumped into the excavation to support the earthen walls.

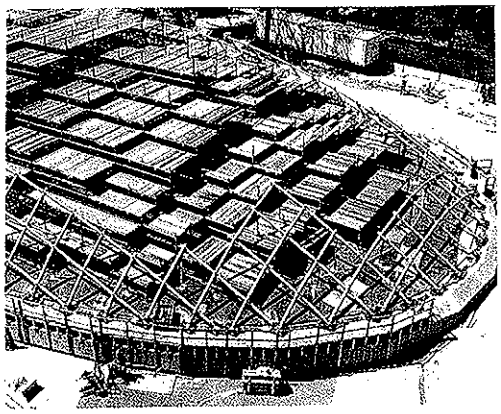
"The slurry walls were poured in 25'-wide sections. Prefabricated rebar cages were inserted into the bentonite slurry and as concrete was pumped into the section, the slurry was displaced, removed and recycled," she says.

The 3'-thick x 60'-deep perimeter wall was constructed from December 2008 to March 2009, in some of the coldest temperatures in recent Chicago history. "There was additional effort required in flushing out the slurry pipes so that they would not freeze," she says.

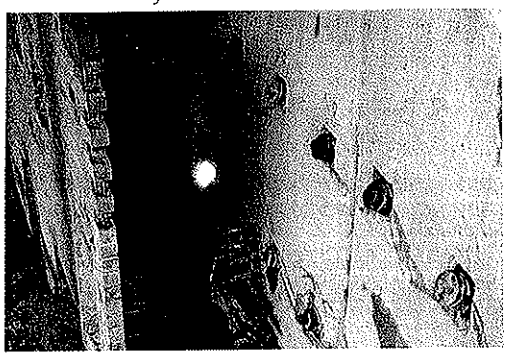
Once the perimeter wall was in place, a concrete perimeter ring cap was installed. Measurements were checked thoroughly to assure the glass dome, which was being built in Germany while excavation was taking place, would fit precisely on the foundation.

Excavation inside the perimeter wall began in one of the wettest periods on record. "Groundwater has been a perennial problem on this site. We didn't have to go too deep to hit groundwater. We drilled two temporary wells – one on the north and one on the south sides of the site

continued on page 6

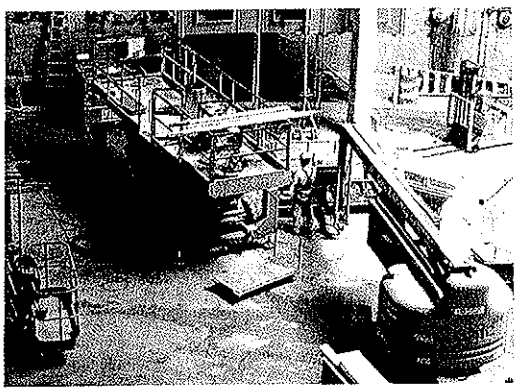


An elaborate scaffold system supports the dome frame construction.



An inner wall built in the elliptical lower level provides a space for air-handling equipment and offers another layer of moisture protection to archived materials that will be stored in the Mansueto addition.

"There is not much space down there to stage materials or equipment, so we have to plan very carefully and schedule segments of activities so work can continue," says Laura Leber, Barton Malow project manager.



With almost all mechanical systems being installed 55' from the base of the building, all subcontractors work from aerial lifts. Many components are preassembled and simply lifted into place for installation.

– to dewater the site so soil removal could proceed. Once the hole was excavated, sumps were installed to collect water from tile that drains water from around and under the building," she says.

To excavate the lower level, an excavator inside the pit moved soil to a central area where a long-reach excavator at ground level loaded it onto waiting trucks. "The campus is in a residential area in Hyde Park which has a noise ordinance, so work could only proceed from 8 a.m. to 8 p.m. The landfill taking the spoil was open only until 3 p.m., so we hauled the spoil to a temporary site where it could be loaded out to the landfill when it was open," she says.

As the excavation progressed, tie-back anchors were put in place to secure the walls of the building. Each 25' wall section has between 10 and 14 tie-back anchors installed at 6' to 12' intervals.

"Excavation couldn't proceed until the tie back anchors were drilled, installed, grouted and tested. Pockets of sand in the soil profile affected some anchors' holding capacity and had to be regrouted," she says.

Once the excavation reached 60' deep, the area's drainage system and mud mat were installed. The structural slab was further waterproofed and installed over the mat slab, resulting in a finished depth of 55' from the structural slab to the bottom of the ground floor.

To further handle groundwater infiltration through the walls, a trench drain was installed around the inside base of the building to carry any seepage to the sump where it's pumped into the storm sewer.

An inner perimeter wall, built with a vapor barrier, separates the foundation from the building's interior. Several air handling units will help maintain the storage area's temperature at an archive-friendly 74 F and 45 percent relative humidity.

"This work has to be completed a section at a time. The mechanical contractor hangs some of the ductwork and piping, then the drywall contractor installs the inner wall with the vapor barrier. The contractors have to work together to sequence their work properly," she says.

The mechanical mezzanine sits below grade along the east side of the oval-shaped facility. At 25' below grade, the space is still very tight for equipment installation. "Many of the overhead mechanicals had to be installed before air handlers were moved in and installed. It was done in reverse when compared with other building projects. The ductwork and piping above the air handlers was installed first; then air-handling units were rolled in below that work, then tied into the overhead piping and ducts," she says.

The floor is the roof

With the bulk of the building below ground, that makes the ground floor the roof during construction until the glass dome is complete.

"The ground floor caps the facility. It's a concrete on metal deck slab covered with a temporary rubber roofing membrane to keep out as much rain as possible during construction. To maintain access below grade, a 23'x29' opening allows materials to be lifted into and out of the building.

"There is not much space down there to stage materials or equipment, so we have to plan very carefully and schedule segments of activities so work can continue," she says.

All mechanicals for the domed reading area, offices and book renovation department must feed through the floor of the building. Conduit and other penetrations were laid out and double-checked

for correct location before the floor was poured.

"All of the ground floor's mechanicals are being installed 55' in the air, under the ground floor," says Leber. "All subcontractors have their own scissor or boom lift in the lower level. Many of the mechanicals are coming in as modular components that are being lifted and bolted into place."

Dome construction

The self-supporting dome comes on the site in pieces and then is assembled into sections that are lifted into place. An elaborate scaffold system supports the dome during construction and provides worker access to dome components. The dome's sections will be outfitted with aluminum inserts that will hold the glazing in place and by the end of July, the dome steel erection will be complete. That's when the majority of the mechanical work must be completed and rack components are staged in the lower level before the 23'x29' access hole is sealed. "Once that access area is sealed, there will only be a small opening in the north end and a small passenger elevator to move anything in and out of the lower level. Some equipment will have to be disassembled and taken out piece by piece," she says.

Once the access opening is sealed, the final pieces of the dome's structure can be installed and become self-supporting, so the scaffold can be removed.

In the meantime, a glass bridge from the Regenstein Library is being built to connect it to the Mansueto addition. "That will be the only public access to the addition," says Leber.

Once the glass dome's panels are in place, finish work, including installing hardwood floors, wall partitions and desks, can be completed.

"We are on schedule to meet our Spring, 2011 opening," Leber concludes. ◆

The robotic cranes for the ASRS had to be delivered into the lower level early in the project. Although they will be one of the last components installed, they were some of the first units staged in the space.