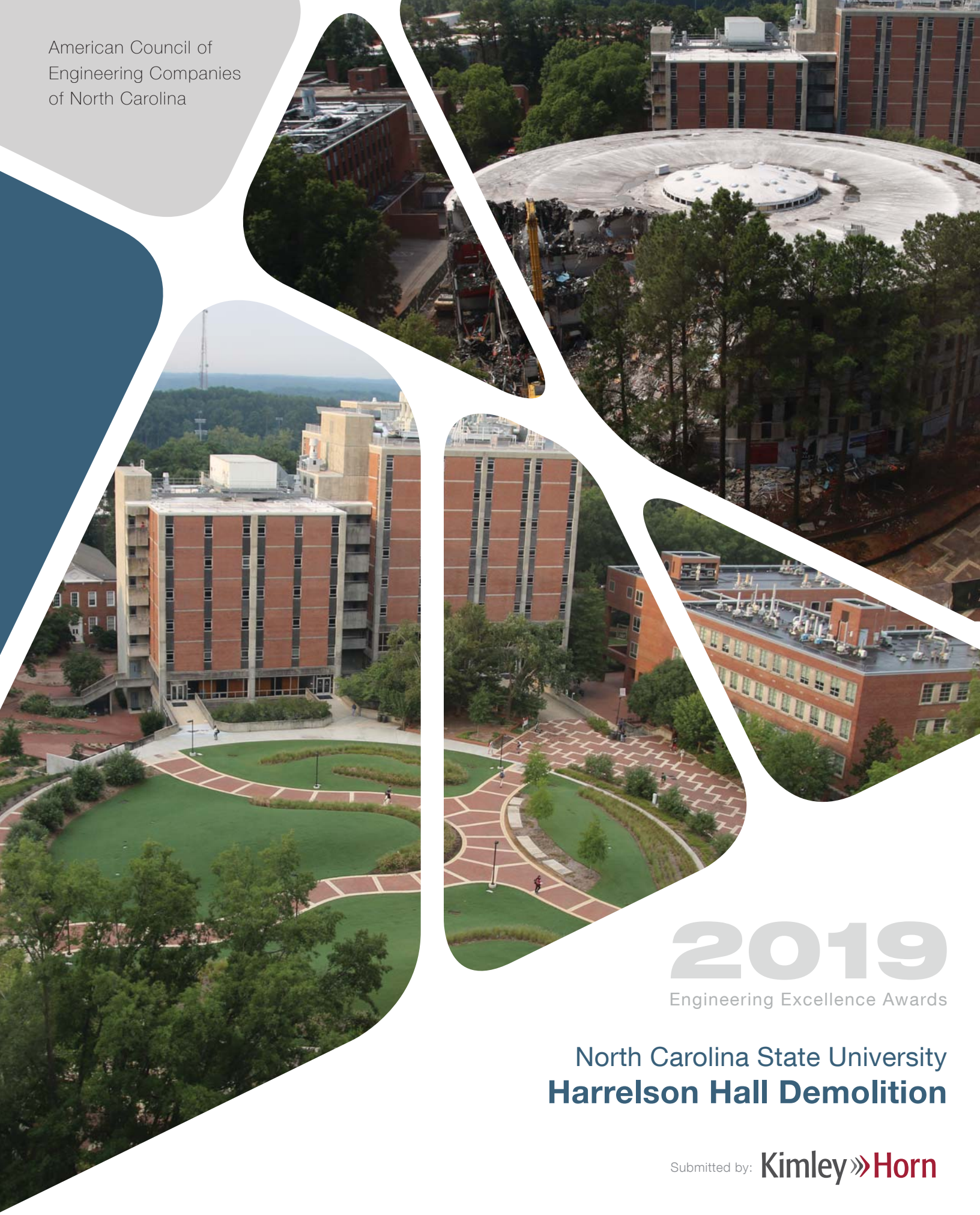
American Council of
Engineering Companies
of North Carolina



2019

Engineering Excellence Awards

North Carolina State University

Harrelson Hall Demolition

Submitted by: Kimley»Horn

October 2018

Kimley»Horn

Project Summary

Harrelson Hall was a four-story reinforced concrete structure located in the central part of North Carolina State University's campus. Kimley-Horn developed construction documents to illustrate the demolition of the structure, civil improvements, and the new landscape and hardscape for the site, which is adjacent to the prominent University Plaza. The project required close coordination with several stakeholders and groups within the University due to the proximity of surrounding structures and exposure to pedestrians on campus.

NC STATE UNIVERSITY

Office of Finance and Administration
Facilities
Capital Project Management

Campus Box 7520
2701 Sullivan Drive, Suite 331
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September 13, 2018

Kimley-Horn
Attn: Josh Griffin, PE
421 Fayetteville St., Suite 600
Raleigh, NC 27601

Mr. Griffin,

As Senior Director of the Capital Project Management (CPM) department here at NC State University, I am very excited to provide a letter of endorsement for your firm. This letter serves as approval for Kimley-Horn to enter NC State University's Harrelson Hall Demolition project in the American Council of Engineering Companies of North Carolina's 2019 Engineering Excellence Awards competition. We are pleased you are submitting our project and wish you the best of luck with your entry.

Kimley-Horn engineers served as the leaders of our team during the analysis, design and demolition of Harrelson Hall. Built in 1961, Harrelson Hall was an 110,000-GSF, four-story, cylindrical building used primarily for classrooms in the heart of north campus. The project scope included asbestos abatement, building demolition and isolation, termination and removal of major utilities (water, sanitary sewer, natural gas, chilled water, electrical and steam). The building structure consisted of an inner cast-in-place concrete core and a surrounding pre-cast/cast-in-place hybrid structure. The project also included site backfill, restoration, landscaping, and hardscape work.

Demolishing major buildings in the heart of campus is not common, which made this project unique and a construction logistics challenge. Kimley-Horn designed an excellent phasing plan that resulted in the structural demolition taking place during the summer months, minimizing impacts to campus activities. Detailed pedestrian and vehicular traffic control plans were developed to keep the site safe and efficient. The design also considered the sensitive research in adjacent buildings, so vibration monitoring was deployed to effectively manage expectations. A sustainability goal of 90% diversion rate for the project was achieved.

Kimley-Horn did an outstanding job on this project, evidenced by their attention to detail, responsiveness and collaboration. Harrelson Hall Demolition was a very successful project and is most deserving of an Engineering Excellence Award nomination.

V. Cameron Smith, PE, LEED AP
Senior Director, Capital Project Management
North Carolina State University

Kimley»Horn

Press Release

For Immediate Release

Date of Issuance: November 8, 2018

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NC STATE CAMPUS TRANSFORMATION BY DEMOLITION

Raleigh, NC — Kimley-Horn—an engineering, planning, and environmental consulting firm—has been recognized for its role in providing civil, landscape architecture, structural, and traffic consulting services for the demolition of Harrelson Hall, a four-story reinforced concrete building built in 1960 on North Carolina State University's (NC State) North Campus.

The building was a campus landmark due to its cylindrical footprint and unique circulation and functionality. After determining that Harrelson Hall was no longer functional as a classroom building due to the physical constraints of the structure, such as sloping floors and floor-to-floor heights, as well as the inability to bring the building up to current accessibility standards, NC State decided to demolish the building. Major components of the project included hazardous material abatement, structural demolition, and the construction of a new pedestrian plaza designed to be an extension of the Brickyard, which is directly adjacent to the project site.

The demolition and plaza construction were completed on schedule and approximately 15% under the appropriated construction budget. To protect workers and the environment, all hazardous materials were abated from the existing structure prior to razing the structural shell. NC State and the project team also set a sustainability goal of diverting a minimum of 90% of the project materials from a landfill. This ambitious goal was not only met, but exceeded by diverting approximately 95% of the demolition materials through a combination of salvaging by NC State, donating chalkboards and other classroom materials to third parties, reclaiming materials for incorporation into the new plaza construction, and recycling. Some of the most recognizable elements reclaimed from the building were limestone panels from the façade. Nearly 100 panels were selectively removed ahead of the demolition and incorporated into the finished landscape as paver transitions, landscape features, and seat walls.

The Harrelson Hall Demolition was successfully executed by the project team in an environmentally conscious manner to create a powerful transformation of the North Campus landscape. Carefully working around the critical campus infrastructure, the demolition and plaza construction have improved the pedestrian experience on campus while incorporating the history of this iconic building into its future.

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Photo 1

North Carolina State University
Harrelson Hall Demolition

Photo 1 Description

Following graduation weekend, the building was completely unoccupied and the contractor had full control of the building to complete utility termination, material salvage, interior and exterior asbestos abatement, select interior demolition, and building demolition and primary debris trucking. This photograph illustrates the excavator with a high-reach attachment demolishing the outer portions of the structure, revealing empty classrooms. Demolition materials were recycled and used in the new landscaping as paver transitions, landscape features, and seat walls.

Photo 2

North Carolina State University
Harrelson Hall Demolition

Photo 2 Description

The two primary priorities were identified early—pedestrian safety and schedule. Construction fencing and material workflows were established that maintained all life-safety requirements and egress passages for the surrounding occupied spaces. Kimley-Horn assisted the University with stakeholder engagement for occupants and users of the adjacent buildings to provide an understanding of what to expect. This photograph illustrates the universal processor attachment demolishing the construction at roof level.

Photo 3

North Carolina State University
Harrelson Hall Demolition

Photo 3 Description

A concrete band was incorporated into the new landscape design matching the size and location of Harrelson Hall's 206-foot diameter footprint. The limestone panels salvaged from the building are incorporated into various aspects of the hardscape to pay homage to the original structure in a sustainable manner.

North Carolina State University
Harrelson Hall Demolition

Project Description

Role of Entrant's Firm

In 2014, Kimley-Horn was selected by NC State to study the challenges associated with the proposed demolition of Harrelson Hall, a four-story, 110,000-square-foot classroom building in the central part of campus, originally constructed in 1960. Harrelson Hall was known for its circular footprint, quirky functional layout, and spiral pedestrian ramp around the central core. Kimley-Horn's 2014 Demolition Study Report paved the way for NC State to secure project funding and formally advertise the full design project.

In 2015, Kimley-Horn was awarded the Harrelson Hall Demolition project. As the prime design consultant, Kimley-Horn's role included:

- Assisting with stakeholder engagement
- Developing pedestrian and vehicular traffic routing plans
- Performing field investigation and testing for anticipated disruptions to surrounding activities due to demolition-induced vibration
- Developing the sustainability goal and material tracking requirements for the demolition scope of work
- Creating phasing plans and sequence of work to minimize disruption to campus activities
- Developing conceptual and final detailing for the layout and features within the pedestrian plaza
- Providing oversight of all design decisions and plan development for construction bid documents
- Assisting with project advertisement and bidding
- Providing construction administration for all phases of the work, including asbestos abatement, demolition, and plaza construction

Role of Other Consultants

- **Stanford White** provided electrical engineering services.
- **Terracon** provided asbestos abatement design and air monitoring services.
- **Contract Drilling and Blasting** provided vibration monitoring.

North Carolina State University
Harrelson Hall Demolition

Original or Innovative Application of New or Existing Techniques

A significant concern with demolishing such a large structure in the central part of campus was the impact to activities in surrounding buildings. NC State's campus is scattered with faculty and graduate students in buildings across campus performing research in various arenas. The buildings surrounding Harrelson Hall did not offer an exception to this condition. Through town-hall style forums, the researchers working in the surrounding buildings were engaged to understand how the demolition and accompanying vibration would affect the equipment they used and operated on a regular basis. These forums uncovered equipment that was regularly relied upon and could not be out of service for any extended period. The most significant and susceptible pieces of equipment discovered were electron microscopes and magnetic resonance imaging (MRI) equipment located in Polk Hall, directly east of Harrelson Hall, and in Cox Hall, directly south of Harrelson Hall. Both pieces of equipment required near vibration-free environments to successfully operate due to the high-resolution imaging that they produced.

To help the University assess the potential impacts to research operations and assist in communicating expectations to surrounding building occupants, Kimley-Horn developed a vibration monitoring program. The fundamental approach of the vibration monitoring program was to measure the vibration at critical points in the surrounding buildings from a week of regular activities during the design phase. The goal of this program was to two-fold. The first goal was to understand the level of ambient vibrations due to activities like minor renovation projects ongoing in surrounding areas, daily train traffic (from the rail line located approximately 500 feet south of the site), bus traffic, and trash trucks emptying dumpsters serving each of these buildings. The second goal was to qualitatively understand the dampening that was inherently occurring as ground vibrations migrated from their source outside of each building towards the interior of each building where the sensitive equipment was located.

With the data received from the field vibration measurements recorded by Contract Drilling and Blasting during design phase, the design team was able to advise the University on the vibration levels that would be anticipated during demolition due to concrete debris free-falling to the ground from the roof elevation and large demolition equipment tracking across the ground. The design phase predictions did not identify any anticipated disruptions to the existing research equipment. During the first week of structural demolition, the vibration instrumentation was re-mobilized to record actual results from the demolition activities and these readings validated the predictions. Throughout the structural demolition process, no impacts to the surrounding sensitive equipment or research activities were recorded. This process illustrates how existing techniques for monitoring ground motions was utilized to advise and predict impacts in a campus setting to ultimately facilitate communication and expectations across the campus community.

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Harrelson Hall Demolition

Harrelson Hall – circa 1960
Credit: NCSU Libraries Special Collections

Future Value to Engineering Profession

The Harrelson Hall demolition provides an example of circumstances to come as structures evolve. Kimley-Horn studied the existing movements and demands on the spaces surrounding the site to develop a phasing and sequence plan that minimized impacts to the surrounding areas.

Social/Economic and Sustainable Design Considerations

Since demolition and material removal was a primary part of the project scope, completing the work in a sustainable fashion was a primary consideration for NC State. Kimley-Horn worked with NC State to develop a 90% sustainability goal for the project. At least 90% of the non-hazardous material was desired to be diverted from the landfill and utilized in a way that would not create the same environmental impact. Upon completion, the contractor successfully diverted 95% of all materials, exceeding the goal established by the University.

Prior to demolition, several of the components were salvaged from the existing structure. Examples include:

- Removal of existing chalkboards and other classroom materials for donation to a local K-12 school
- Removal of mechanical, electrical, and fire protection components for use in other facilities
- Removal of limestone façade panels for incorporation into the new plaza design

More than 100 of the existing limestone façade panels were selected for use as architectural features in the new landscape design. These panels were incorporated into paver bands at transition areas, used as vertical fin features in landscape beds, and used to create pedestrian benches.

Complexity

The original timeline accounted for Harrelson Hall to be vacant at the beginning of the project, which consisted of a full-building asbestos abatement. However, construction of the new space to be used for relocating the remaining Harrelson Hall occupants was behind schedule. This required developing a phased demolition plan. This development meant that the building would be occupied for the spring semester, during the first four months of asbestos abatement.

North Carolina State University
Harrelson Hall Demolition

Selective asbestos abatement for renovation is often completed in partially occupied buildings, but full abatement preparing for structural demolition is rarely completed above occupied spaces. Kimley-Horn ultimately created a phasing plan that allowed the asbestos abatement to be completed on the upper floors, while the ground floors remained occupied, mitigating overlap between contractor personnel and students and faculty. Construction fencing and material workflows were established that maintained all life-safety requirements and egress passages for the occupied spaces.

The partial occupancy added to the complexity by constraining the timeline for structural demolition. Because the asbestos abatement could not be fully completed until the building was unoccupied, it shortened the amount of time for structural demolition since the goal for the demolition was for it to be completed during the summer months while there was significantly less pedestrian traffic on campus. Ultimately, due to the shortened timeline, the elevated structure was fully demolished and the debris was pulled to the central portion of the site prior to students coming back onto campus for the fall semester to eliminate the risk of completing overhead demolition adjacent to pedestrian pathways.

Exceeding Owner/Client Needs

The project was completed on schedule and 15% under budget. Throughout the project, Kimley-Horn assisted the University with stakeholder engagement to communicate realistic expectations and impacts. Providing stakeholders with a direct line of communication minimized the amount of dialogue and concerns received by University Construction Management personnel throughout the construction phase of the project.

The new plaza was constructed in an economical manner, not exceeding the budget, and satisfying the University's desire to create a space with a 5-10-year life-span to align with their plans to redevelop the site with a new classroom building.

Through creative engagement with the University Architect's office, the finished plaza also pays homage to Harrelson Hall. A concrete band was incorporated into the design matching the 206-foot diameter footprint of Harrelson Hall. While the structure and most of its remnants are removed, features like the banding and the limestone panels incorporated into the landscaping continue to offer memories to those who experienced the uniqueness of Harrelson Hall.