Harrelson Hall

Renovation and Replacement Study

DRAFT

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Harrelson Hall
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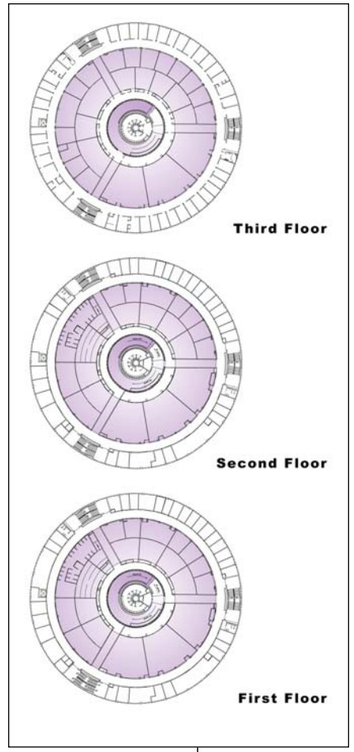
Harrelson Hall, completed in 1960, is a general Classroom and Office building serving a large portion of NC State students. 84% of all NC State undergraduate students are assigned classes in Harrelson Hall during their career at NC State and 54% take a class in the building annually [1] The building houses 59 classrooms of 5 different arrangements and capacities. The majority of classrooms have sloped floors that are connected by a series of ramps. The total classroom seating capacity is 2,912 seats [2] There are also 9 laboratory classrooms. The building comprises 105,730 Gross Square Feet and 59,820 Net Assignable Square Feet for an efficiency rating of 56% (Note: new classroom buildings have an efficiency rating of 63% to 68%). The outer perimeter of the building contains 112 narrow offices that are limited to a depth of 16 feet (or one office deep). There are inaccessible (non-ADA compliant) toilets serving each floor from the center ramp; however, women's toilets are found only on the third floor. The circular building is supported above grade on columns and is served by one passenger elevator opening directly to the outside, open-air concrete plaza under the building. The ground level plaza has been partially enclosed to create a computer lab.

1 *NC State Registration and Records*
2 Atepa PA, *2001 Harrelson Hall ADA/Building Code Survey Analysis,* 1 July 2003, p. 3



Sloped Floors
The building structure combined with the sloped floors (shaded in the plans below), "fan-shaped" classrooms, and circular floor plan pose significant design, technical, and budget challenges for the renovation.

Summary of Renovation Issues

As part of the 2000 Capital Bond Program, funds were allocated for the renovation of Harrelson Hall to correct state building code and Americans with Disabilities Act (ADA) deficiencies, to replace aging mechanical and electrical systems, and to meet NC State classroom capacity and quality standards. In the summer of 2001, a Facilities Condition Analysis and in the spring of 2003, a Building Code Survey Analysis was completed to determine the scope and feasibility for renovation of the building. The studies revealed that due to the unique construction of Harrelson Hall, a complete renovation to correct these deficiencies would result in a 35% reduction of current classroom seating capacity, (from 2,912 seats to 1,930), a loss of office space, and an overall reduced building efficiency. [3] Furthermore, although portions of the building can be made accessible with renovation, much of the building cannot be renovated to meet ADA requirements due to the limitations imposed by the structure of the building. [4] The building structure combined with the sloped floors, "fan-shaped" classrooms, and circular floor plan pose significant design, technical, and budget challenges for the renovation.

Renovation to the aging building systems can be accomplished and some code deficiencies corrected but due to the unique structure of the building:

Only 40% of classrooms would be wholly compliant with the Americans with Disabilities Act,

Offices would be lost by new mechanical closets or accessible toilets,

Mechanical system replacements and improvements would lower the ceiling height in classrooms, which would limit visibility.

35% of the classroom seats will be eliminated as a result of the renovation and the remaining teaching spaces will be substandard and inflexible.

Renovating the structure while occupied may not be feasible and there is not a resource or funding to provide swing space to vacate the building during renovation, and

The building efficiency after renovation would be reduced to about 52%.

3 Atepa PA, *2001 Harrelson Hall ADA/Building Code Survey Analysis,* 1 July 2003, p. 3,4.
4 Atepa PA, *2001 Harrelson Hall ADA/Building Code Survey Analysis,* 1 July 2003, p. 11.

ADA/NC Accessibility Code

Requirements for accessibility as mandated by the North Carolina State Accessibility Code (Vol. I-C of the North Carolina State Building Code)(NCSBC) and the ADA were developed subsequent to the construction of Harrelson Hall and contain very explicit requirements. The application of these requirements to Harrelson is extremely problematic due to the number of level changes per floor and a structural frame that is difficult to modify. Many of the conditions such as: sloping corridors that exceed acceptable slope distances; sloping classroom floors; ramps; and doorways can not be brought into compliance due to structural and floor to ceiling height limitations. Some other non-compliant code conditions can be corrected, but not without great technical challenge and costly construction. [Refer to Section Drawing]

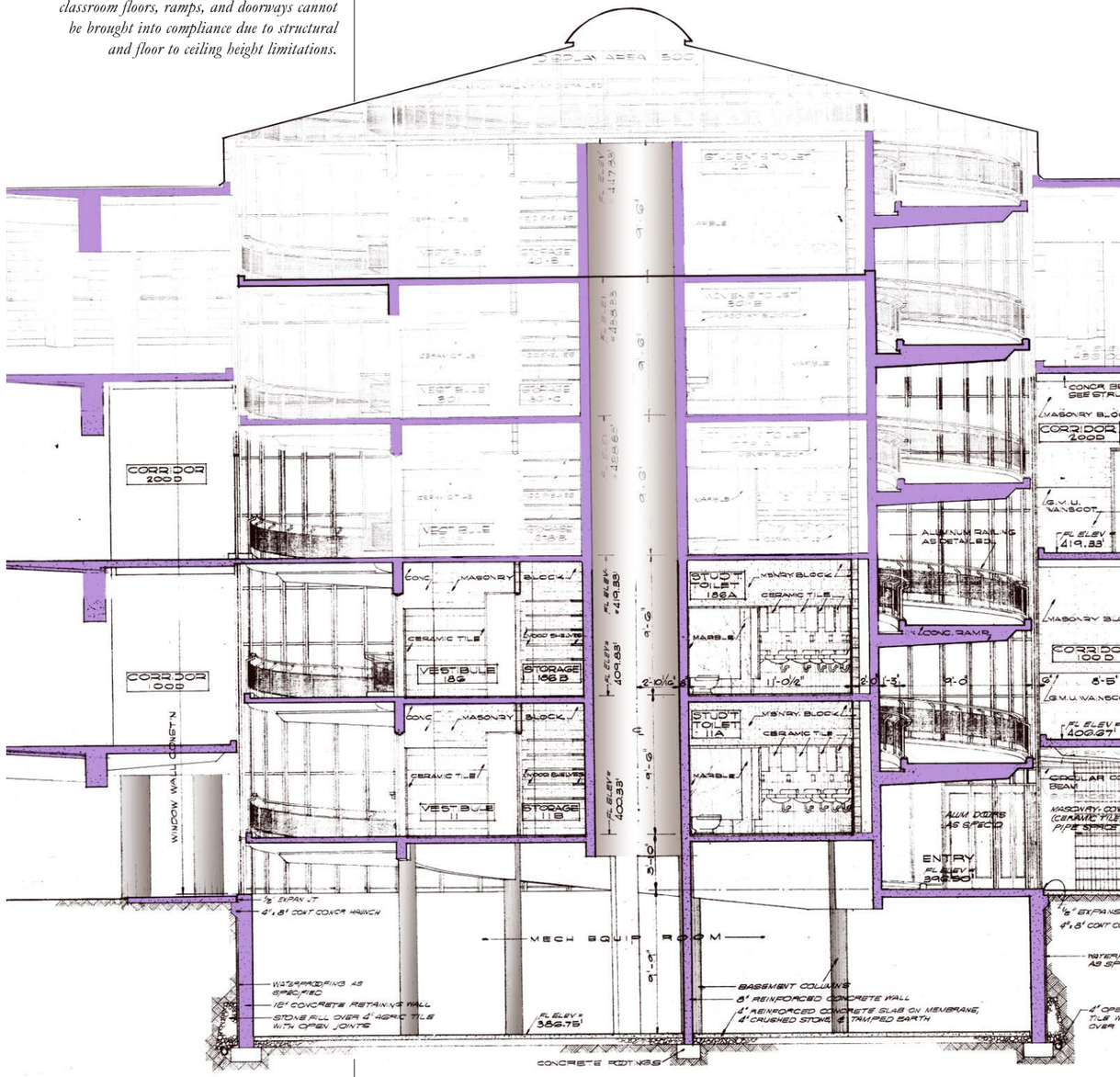
Harrelson Hall has 59 classrooms, eight large lecture halls with rear entry, 22 smaller rooms with entry at the front of the class, and 29 smaller rooms with entry at the rear. After significant structural modifications, only the 29 rear-entry classrooms would be wholly compliant with the Americans with Disabilities Act (ADA). The eight large lecture rooms would be only partially compliant, since it would be impossible to provide the access to the instructional space at the front of the room to meet the ADA requirements. The 22 front-entry smaller rooms would remain non-compliant due to the inaccessible route to these rooms. It is possible that the structural modifications cannot be accomplished, in which case only 37 of the rooms could be made partially compliant, and none would be fully compliant with the ADA. This is contrary to the intent of the bond program.

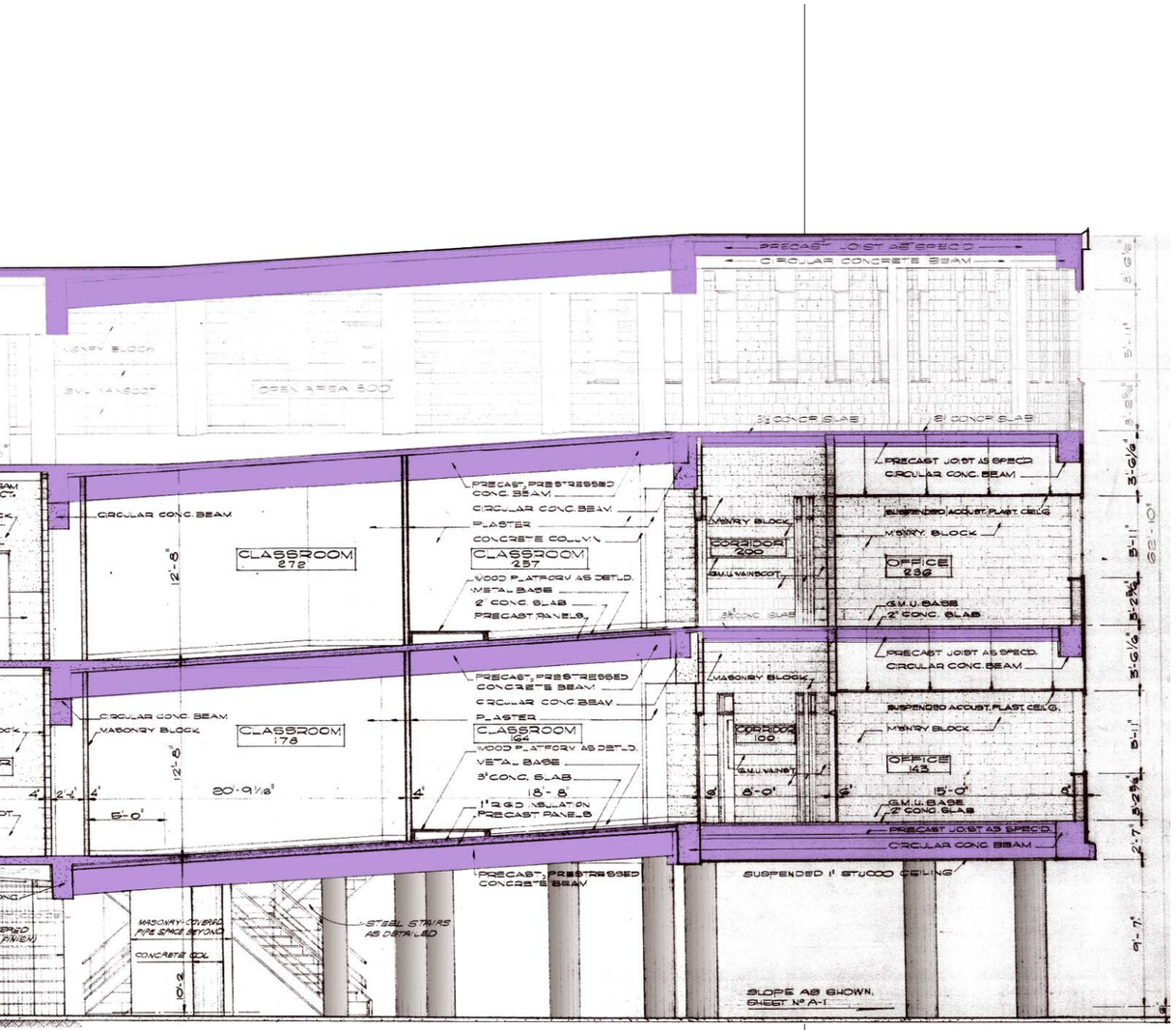
Women's toilets must be added to each floor in the building to meet ADA and NCSBC Vol. 1-C accessibility codes. The existing men's toilets at the central core can be modified to meet these codes but, because the curved, sloped ramps cannot be modified to provide a compliant accessible route to the toilets, new accessible women's and men's toilets must be added in the outer perimeter ring of the building. This will result in a reduction of office space.

Accessibility
Women's toilets must be added to each floor in the building to meet ADA and NCSBC Vol. 1-C accessibility codes.

Building Cross Section

Many of the conditions such as sloping corridors exceeding acceptable slope distances, classroom floors, ramps, and doorways cannot be brought into compliance due to structural and floor to ceiling height limitations.





CROSS SECTION THRU BUILDING
SECTION CUT AT BASE LINE
SCALE: 1/4" = 1'-0"

Ceiling Heights
Lower ceilings will be problematic in the classrooms as students' visibility to boards and screens will be restricted.

Fire Safety Issues
(top) To eliminate these possible fire propagation areas, the existing glass curtain wall system lining the ramp would have to be replaced by solid, non-glass fire rated construction.

2000 NC Building Code

The 2000 NC Building Code mandates that vertical fire separation be maintained between floor levels. The curving ramp of the interior circular core linking floors of Harrelson Hall is not in compliance with this code as there are openings between the floors at each level. To eliminate these possible fire propagation areas, the existing glass curtain wall system lining the ramp would have to be replaced by solid, non-glass fire rated construction. [5] The resultant central ramp space would be visually isolated from the corridors it serves, as views from the ramp would be entirely obscured by the new walls. The slope of the curving ramp and the spacing of level landings also exceeds the allowable distances that are stipulated in the code. The ramp is integral to the structure of the building and replacement or modification is not financially possible.

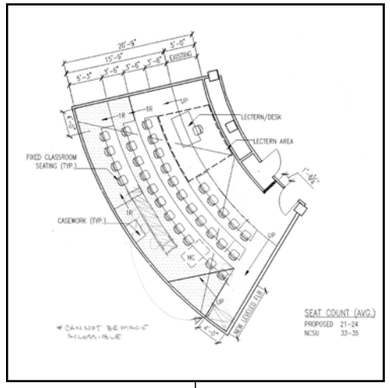
Utility Systems

A new heating and cooling system is required to provide code-mandated amounts of fresh air to the building. The building's existing floor-to-floor height of 12'-8" is minimal. In order to accommodate the installation of a fire protection system, and mechanical systems, a reduction to the existing ceiling height is necessary. Lower ceilings will be problematic in the classrooms as students' visibility to boards and screens will be restricted due to the inability to mount the boards and screens high enough for a clear sightline of the entire screen from the rear of the classroom. Space necessary for the system's new mechanical rooms will displace offices on the outer perimeter. [6]

[5] ISES Corporation, *Harrelson Hall Facility Condition Analysis,* July 30, 2001, p. 1.1.4.
[6] Atepa PA, *2001 Harrelson Hall ADA/Building Code Survey Analysis,* 1 July 2003, p. 14.

Classroom / Teaching Quality

Preliminary studies indicate that modifying the classrooms to meet current code regulations, where possible, will result in a 35% average reduction in classroom seating capacity in the building, a reduction of 982 seats. The space required to provide accessible stations, pathways, and instructional areas eliminates seats in many classrooms. Applying proper sightline criteria to the existing seating layouts further reduces seat count, as does providing adequate space for instructional equipment. These modifications still will not produce a completely code compliant facility that provides a flexible, quality environment for a variety of teaching styles and technology. Documentation of the building's various teaching quality deficiencies is given in a paper prepared by the Mathematics Department.



Classroom Wheelchair Access
The sloped floors cannot be leveled to accommodate wheelchair access and moveable tables and chairs due to the limited floor to ceiling height.

The fan-shaped, sloped floor arrangements of the classrooms in Harrelson Hall limit viewing angles to projection screens and marker boards, and restrict the number of class seats with proper viewing access to these teaching tools. Interactive small group activities and multiple screen presentations common in today's teaching methodology are not possible.[7] The sloped floors cannot be leveled to accommodate wheelchair access or utilize moveable tables and chairs, due to the limited floor-to-ceiling height in the large classrooms. In addition, the existing structure may not support the additional weight of floor leveling material. Further structural investigation is required, however, no funds are available for the structural modifications or floor leveling.

Sloped Floors
Interactive small group activities and multiple screen presentations common in today's teaching methodology are not possible due to the sloped floors and room configuration.

The outer ring of perimeter offices opens directly to the narrow main corridor ring that services the majority of the classrooms. The lack of student study areas or common areas causes hallway congestion and noisy disruptions to activities in faculty offices when students queue before class.[8] Similarly, the narrow, restrictive office ring eliminates the possibility of office suites with a progression from public space to private office areas buffered from public noise and congestion.

[7] R.E. Fornes, C. D. Meyer, M. Shearer, et. al., *New Building Proposal Rev 6.17,* NCSU Department of Mathematics, June 2003, p. 3-5.

[8] R.E. Fornes, C. D. Meyer, M. Shearer, et. al., *New Building Proposal Rev 6.17,* NCSU Department of Mathematics, June 2003, p. 4.

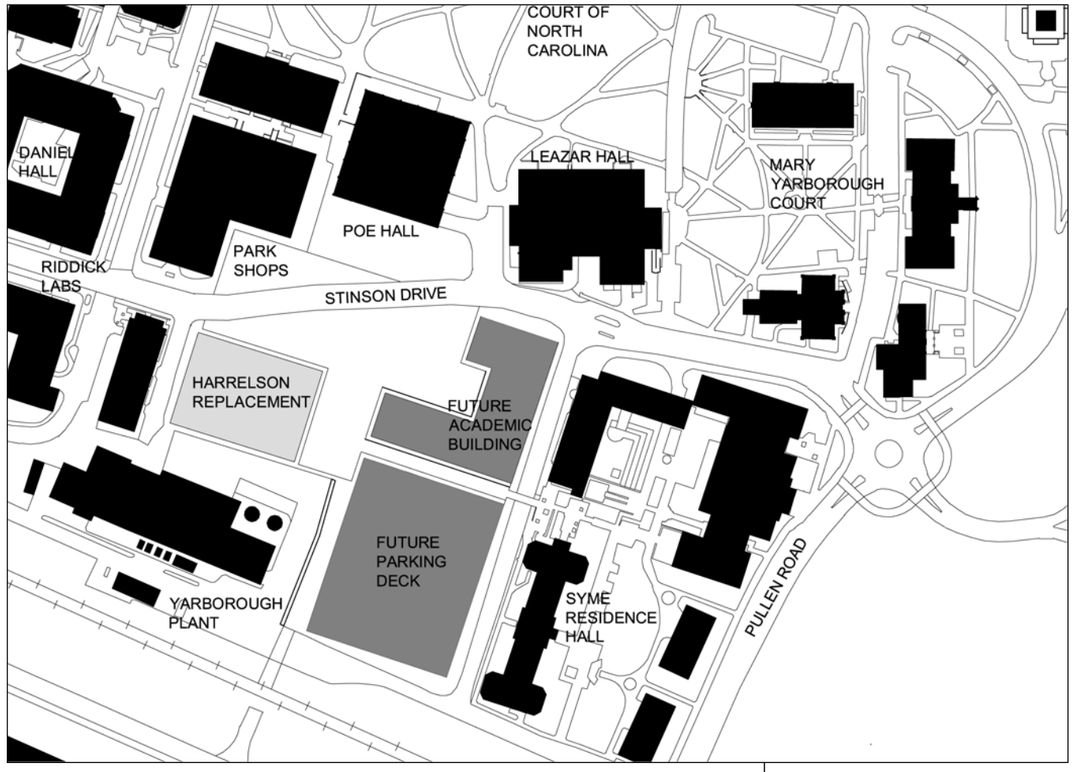
Swing Space / Construction Schedule

Renovation of Harrelson Hall is further complicated by the lack of available space to totally relocate the classes and offices during the renovation. A renovation schedule of 36 months has been proposed, due to the need to renovate the building while partially occupied on a floor-by-floor basis. The noise and disruption of construction will further reduce teaching quality. Approximately 50,000 net assignable square feet would be required to totally vacate Harrelson during the renovation. Additional funding would be required to provide this resource. At a minimum, 25,000 net assignable square feet would be necessary to partially vacate the building so that a phased renovation could occur.

Renovation Costs

The preliminary scope and budget study shows that renovating Harrelson Hall would result in a renovated building with reduced building efficiency, fundamental teaching inadequacies, and remaining building code and ADA deficiencies due to the un-modifiable structure and arrangement of the interior of the building. The current funding for the renovation of Harrelson Hall can replace aging mechanical and electrical systems, address fire and life safety issues, improve ADA/NC Building Code toilet issues, and refresh some interior finishes, but cannot correct fundamental structural issues that restrict the ability to improve teaching quality or accessibility to teaching spaces, which are the fundamental purposes of the building. The current funding does not allow for a much-needed seating replacement or for essential classroom equipment upgrades.

Construction Costs ($83.30/gsf)	=	$ 8,747,000
Contingency & Reserve (5%)	=	$ 464,833
CM @Risk (4%) Commissioning	=	$ 549,880
Design Fees (10%)	=	$ 976,150
Escalation (to const. mid-point)	=	$ 2,222,828
Resource Support Fee (5%)	=	$ 648,024
Total ($129.61/GSF)	=	$13,608,715



New Classroom Facility
NC State University has concluded that the funds allocated for Harrelson Hall renovation would be more effectively utilized if used for a new classroom facility.

Replacement Option

The numerous issues associated with Harrelson's renovation, which would result in the failure to improve the instructional environment, and concerns for the effective application of public funds have caused NC State to study options for constructing a new classroom building to replace Harrelson Hall as an alternative to a partial renovation.

Site

The location for this new building would be on the present site of Riddick Stadium and the Morris Building. Both of these structures will be vacated as part of the 2000 Capital Bond Program. This site is an ideal location for a classroom building because classroom utilization data suggests this region of campus has the greatest need for additional classroom space.[9]

[9] *NC State University Classroom Planning Study,* November 2002.

Various sizes of buildings were studied, but the option viewed as most successful is a four-story building having 86,000 gsf. A building of this size and scale fits into the context of the existing academic and residential buildings in this neighborhood and provides the same amount of assignable square footage and same classroom seat count that the university would realize if Harrelson Hall were renovated.

Building Codes

As a new construction, this building would be designed to adhere to the requirements of the current NC Building Code as well as the ADA/NC Accessibility Codes.

Utility Systems

Connecting to the central utility systems would be possible since this site is adjacent to the expanded Yarborough Steam and Chiller plant. The new classroom building design would address any issues of sound transmission from the plant.

Classroom/Teaching Quality

The new classrooms would be designed to fully comply with the NC State University Classroom Standards to provide the most effective teaching environment. By contrast, Harrelson Hall would only be minimally compliant with these standards after renovation. Classrooms in a new building can be designed with a variety of seating capacities and flexible arrangements to meet the University's instructional needs. Preliminary studies anticipate approximately 45 classrooms ranging in capacity from 25 to 250 seats and configured for maximum flexibility.

Swing Space / Construction Schedule

The construction phase of this new facility would take approximately 20 months. Harrelson Hall would continue to be used for classes until the new facility is complete. This would eliminate the need to identify swing space for the classes currently being taught in Harrelson and the need for swing space funding. The disruption to instruction caused by renovating Harrelson while occupied would be eliminated. Less expensive and more expedient construction methods could be utilized in the construction of the new building than those required for the renovation.

Life Cycle Issues - Replacement vs. Renovation

A new, more efficient classroom building design will result in 22% less gross square feet to be heated, cooled, and maintained over the lifetime of the building. This would produce an immediate average annual operating cost savings of $85,233 per year over the life of the new building.[10] As all parts of the building would be new, a full operating life of at least 50 years could be anticipated. The reduction in building efficiency by the renovation will increase operating cost ratios for the remaining life of the existing building, as the space not available for programs must still be heated, cooled, and maintained. Even after refurbishment, the majority of the renovated building will still be in excess of 40 years old.

Replacement Cost

The projected cost of building a new 86,000-gsf facility is $18,621,000, broken down as follows:

Construction Costs ($125/gsf)	=	$ 10,741,000	
Contingency & Reserve (20%)	=	$ 2,100,000	
Design Fees (11%)	=	$ 1,400,000	
Furniture, Fixtures and Equipment	=	$ 2,880,000	
Demolition - *Harrelson, Morris, and Riddick Stadium*	=	$ 1,500,000	
Total	=	$ 18,621,000	($217/SF)

This option exceeds the $13,621,255 proposed bond fund allocation for Harrelson Hall, however, it produces a fully functional and accessible facility that will be less expensive to operate.

Recommendation

As this study has indicated, the renovation of Harrelson Hall will cause a loss of usable space and classroom seating capacity, and still not achieve the goals of correcting accessibility deficiencies, and improving classroom capacity and quality standards. NC State University recommends removal and replacement of Harrelson Hall with a new, 100% code-compliant general classroom building that meets the current instructional needs of NC State's faculty, and students and is designed to be flexible to better meet the needs of the classroom of the future. Since a new facility will remedy many of the problems that the renovation cannot and this option will have a longer life, it is recommended that the current funding allocated to the renovation be applied to the replacement option and efforts to identify the additional funding required to construct an 86,000 gsf facility be initiated rather than continuing efforts to renovate Harrelson Hall.

Comparison of Options

Value Item	*Renovation*	*Replacement*
Gross Square Feet (GSF)	105,730	86,000
Assignable Square Feet (ASF)	54,980	55,900
Efficiency	52%	65%
Swing Space Required (ASF)	25,000 (min.)	0
Swing Space Cost	$ 900,000[11]	$ 0
Accessible Classrooms	40%	100%
Classroom Quality Compliance	0%	100%
Classroom Technology Compliance	5%	100%
Project Cost	**$13,608,715**	**$18,621,000**

[10] *NC State Facilities Operations 1998-2003 Average FY Operating Costs*

[11] *Swing Space Cost estimated at $15/sf/annum for 3 years.*