THE UNIVERSITY OF NORTH CAROLINA SYSTEM

Systemwide STEM Capital Planning Study

Final Report

August 2020

JMZ architects | planners

mcmillan pazdan smith architecture

Systemwide STEM Capital Planning Study

August 2020

University of North Carolina System Office
Division of Finance and Administration
910 Raleigh Road
Chapel Hill, North Carolina 27514

THE UNIVERSITY OF NORTH CAROLINA SYSTEM

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Executive Summary

Background

In response to North Carolina Senate Bill 99, the UNC System STEM Planning Task Force retained two consultants to prepare an analysis of STEM jobs, enrollment, and space. MGT Consulting Group completed the STEM job growth and enrollment study in July 2019. JMZ Architects and Planners completed the STEM space study in July 2020.

This Executive Summary is intended to present the conclusions of these studies at a high level. Detailed information about the process, timeline, methodology, and results at a regional and institutional level can be found in the ***Systemwide STEM Program Needs Assessment (MGT)*** and ***STEM Capital Planning Study (JMZ).***

STEM Jobs

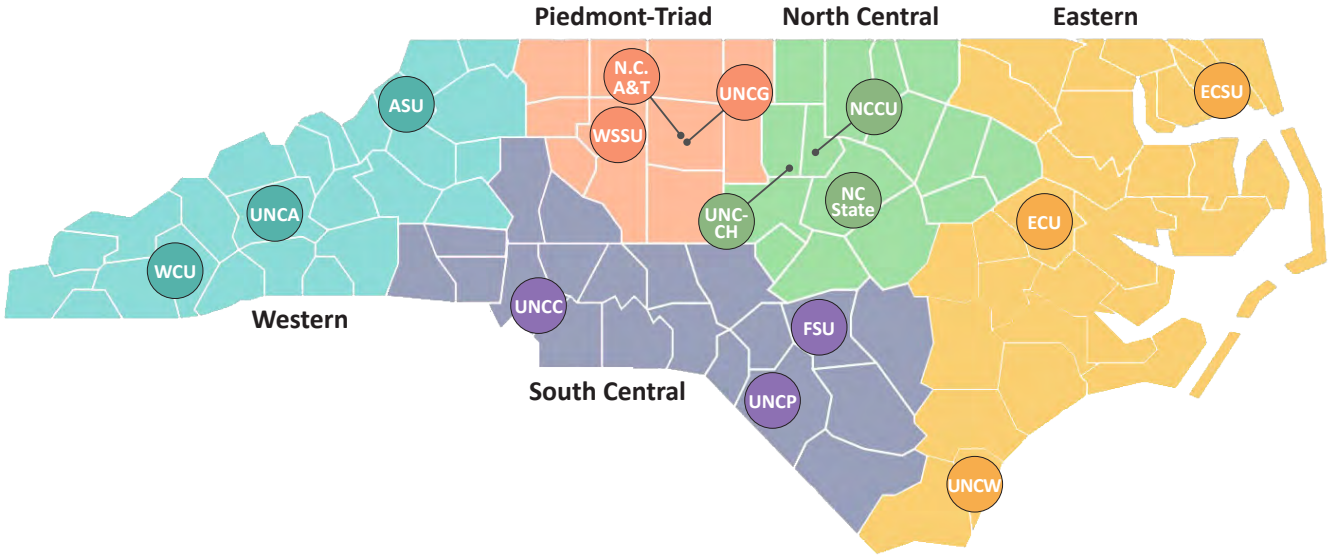
By 2026, there will be 36,545 new STEM jobs in North Carolina. Geographically, the South Central Region is anticipated to have the greatest number of new jobs (35.6 percent of statewide growth). Of the five STEM categories used in the analysis, Health Science is expected to generate the most jobs (33.0 percent of statewide growth).

Job Growth by STEM Category 2018-2026

Annual Projected Openings by Standard Occupational Classification
Data prepared by MGT from NC Department of Commerce 2019 reports

STEM Category	Western	Piedmont-Triad	North Central	South Central	Eastern	Statewide Growth	% Statewide Growth
Engineering	608	791	2,454	2,378	647	6,878	18.8%
Other STEM*	814	1,126	2,970	3,997	1,003	9,910	27.1%
Health Science	1,423	1,804	3,569	3,533	1,740	12,069	33.0%
Math	86	140	357	592	103	1,278	3.5%
Technology	298	427	2,864	2,501	320	6,410	17.5%
Statewide Growth	**3,229**	**4,288**	**12,214**	**13,001**	**3,813**	**36,545**	
% Statewide Growth	*8.8%*	*11.7%*	*33.4%*	*35.6%*	*10.4%*		

*Includes Hard Science and STEM occupations that do not fit one distinct STEM category.



Enrollment

STEM Enrollment

In 2018, the UNC System enrolled 40,572 STEM Upper Division Undergraduate Majors. To meet the projected job demand, the UNC System will need to add 23,707 STEM Upper Division Undergraduate Majors (58 percent more) by 2030. This represents an annual growth rate of 3.9 percent. Assuming all other enrollment remains at 2018 levels, systemwide STEM enrollment will reach 64,279 by 2030 if projections are met. Three universities – UNC Charlotte, UNC Chapel Hill, and East Carolina University – are expected to contribute the most additional enrollment (47 percent combined).

Upper Division Undergraduate STEM Enrollment

		Upper Division Undergraduate STEM Enrollment			
Region	Institution	2018	2030 Projection	*Difference*	*Annual Percent Change*
Western	Appalachian State University (ASU)	3,100	4,946	*1,846*	*4.0%*
	University of North Carolina at Asheville (UNCA)	712	1,013	*301*	*3.0%*
	Western Carolina University (WCU)	1,949	3,016	*1,067*	*3.7%*
Western Subtotal		**5,761**	**8,975**	***3,214***	***3.8%***
Piedmont-Triad	North Carolina A&T State University (N.C. A&T)	2,316	4,271	*1,955*	*5.2%*
	University of North Carolina at Greensboro (UNCG)	2,108	3,360	*1,252*	*4.0%*
	Winston-Salem State University (WSSU)	1,240	1,679	*439*	*2.6%*
Piedmont-Triad Subtotal		**5,664**	**9,310**	***3,646***	***4.2%***
North Central	North Carolina Central University (NCCU)	579	869	*290*	*3.4%*
	North Carolina State University (NC State)	7,157	9,081	*1,924*	*2.0%*
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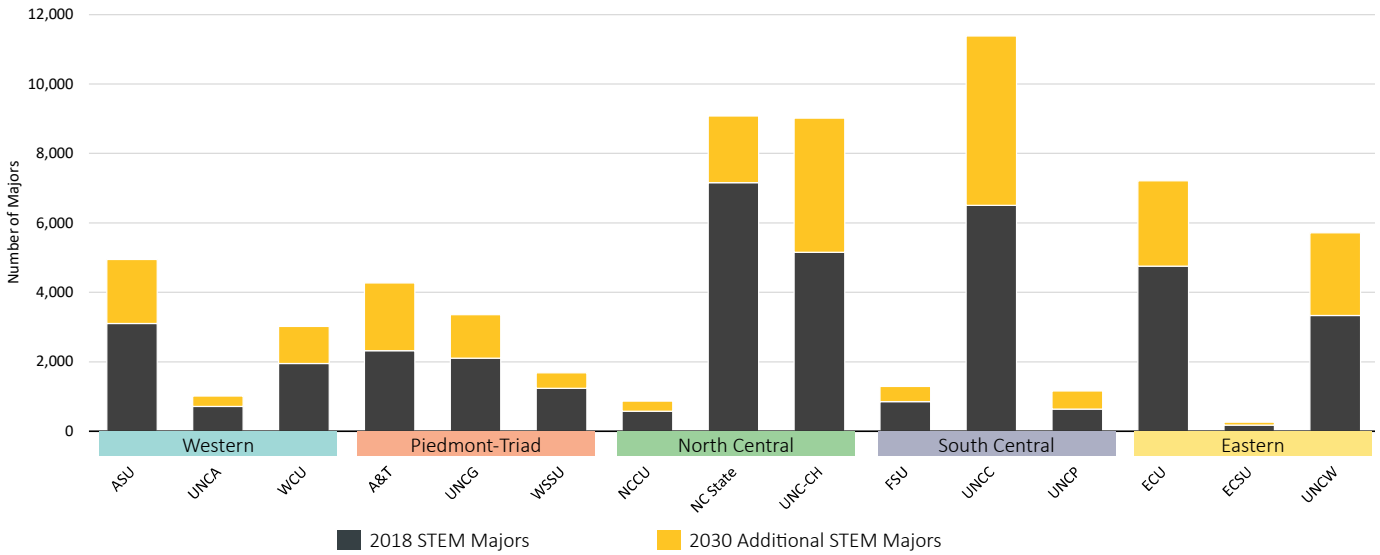
South Central	Fayetteville State University (FSU)	850	1,293	*443*	*3.6%*
	University of North Carolina at Charlotte (UNCC)	6,505	11,383	*4,878*	*4.8%*
	University of North Carolina at Pembroke (UNCP)	641	1,163	*522*	*5.1%*
South Central Subtotal		**7,996**	**13,839**	***5,843***	***4.7%***
Eastern	East Carolina University (ECU)	4,751	7,209	*2,458*	*3.5%*
	Elizabeth City State University (ECSU)	176	264	*88*	*3.4%*
	University of North Carolina at Wilmington (UNCW)	3,334	5,712	*2,378*	*4.6%*
Eastern Subtotal		**8,261**	**13,185**	***4,924***	***4.0%***
System Total Upper Division Undergraduate STEM Enrollment		**40,572**	**64,279**	**23,707**	***3.9%***

Enrollment Growth by University



Space Quantity

Quantity of STEM Space

In 2017, 4.045 million assignable square feet (ASF) was dedicated to STEM education, systemwide (excluding research space). Eight universities had construction underway at the time of this study. The new STEM space was treated as if it were in place in 2017. Space to be demolished was subtracted from the 2017 STEM inventory.

By 2030, if established utilization targets are met in existing STEM instructional space, the UNC System will need to dedicate an additional 1.4 million ASF to accommodate projected STEM enrollment. Space needs may be offset by improving utilization or repurposing existing space before new construction is necessary.

An institution's capacity to deliver instruction was based on the number of seats in a given instructional space type (e.g. Math labs), the number of weekly hours available for instruction, and the application of nationally-accepted space utilization targets. The resulting capacity for instruction, measured in weekly student clock hours (WSCH), was compared to the projected demand for instruction in 2030. Future instructional space demand was based on projected 2030 STEM instruction with all non-STEM instruction held constant at its fall 2017 level. A need for additional space was tabulated if the projected demand exceeded capacity. General classroom space is not dedicated to STEM; it is used by all disciplines. Therefore classroom capacity was assessed in aggregate (the total number of seats on a campus). Class lab capacity was assessed on a lab-by-lab basis. If an individual lab was projected to exceed capacity by 2030, an additional lab of the same seating capacity was enumerated as a space need.

The 2030 office projections represent space needed to house additional STEM faculty and staff if 2018 student:faculty and faculty:staff ratios are maintained. Some universities may have surplus offices in STEM or other departments that could be reassigned to offset the calculated office space need.

Space projection methodology is presented in more detail in section two of this report, Systemwide Analysis.

STEM Space Need Projections

		2017 STEM Inventory and Projects Underway (ASF)		2030 Calculated Additional Space Needed to Meet STEM Demand* (ASF)				2030 Total STEM Space Need (ASF)
Region	Institution	2017 STEM Inventory	Net New STEM Construction	Classroom	Class Lab**	Office	2030 STEM Space Need	
Western	ASU	330,255	0	0	101,562	29,880	131,442	461,697
	UNCA	77,921	0	0	20,294	7,340	27,634	105,555
	WCU	162,996	27,195	0	58,584	13,737	72,321	262,512
Western Subtotal		**571,172**	**27,195**	**0**	**180,440**	**50,957**	**231,397**	**829,764**
Piedmont-Triad	N.C. A&T	274,073	29,888	0	43,020	30,399	73,419	377,380
	UNCG	223,721	21,262	0	7,161	50,222	57,383	302,366
	WSSU	89,151	47,266	0	4,368	1,300	5,668	142,085
Piedmont-Triad Subtotal		**586,945**	**98,416**	**0**	**54,549**	**81,921**	**136,470**	**821,831**
North Central	NCCU	124,300	0	0	17,996	9,850	27,846	152,146
	NC State	1,322,217	76,421	0	98,820	21,375	120,195	1,518,833
	UNC-CH	428,720	0	0	22,428	0	22,428	451,148
North Central Subtotal		**1,875,237**	**76,421**	**0**	**139,244**	**31,225**	**170,469**	**2,122,127**
South Central	FSU	78,837	0	0	12,266	5,020	17,286	96,123
	UNCC	373,282	39,111	13,568	85,147	51,913	150,628	563,021
	UNCP	62,096	0	0	13,008	11,800	24,808	86,904
South Central Subtotal		**514,215**	**39,111**	**13,568**	**110,421**	**68,733**	**192,722**	**746,048**
Eastern	ECU	237,676	9,591	0	100,330	64,955	165,285	412,552
	ECSU	66,131	0	0	2,400	2,670	5,070	71,201
	UNCW	193,637	42,219	0	66,247	0	66,247	302,103
Eastern Subtotal		**497,444**	**51,810**	**0**	**168,977**	**67,625**	**236,602**	**785,856**
Systemwide Total STEM Space		**4,045,013**	**292,953**	**13,568**	**653,631**	**300,461**	**967,660**	**5,305,626**
						Space Need for Potential Graduate Student Growth	433,762	
						2030 Additional STEM Space Need	**1,401,422**	
						2030 Total STEM Space Need		**5,739,388**

* Space needs may be offset by improving utilization or repurposing existing space before new construction is necessary.

** Calculated space need may be low due to universities' possible underreporting of Health Science lab use.

Space Quantity

2030 Additional Class Lab Projections by STEM Category

While classrooms and offices can be created through renovation or new construction at moderate expense, class labs have specialized features and equipment that typically come at a higher cost. Station sizes in class labs are also much larger than classrooms. Lab station sizes vary between 33 ASF and 108 ASF per station, according to System guidelines. By comparison, the recommended classroom station size is 18 ASF to 24 ASF depending on configuration.

Calculated 2030 class lab space needs are shown in the table below, separated by university and STEM category. Health Science will need over 50 percent of the projected additional class lab space. Engineering labs, which require 108 ASF per station, constitute over 20 percent of the need.

Many existing class labs have station sizes that are smaller than the System standard. For labs to meet current pedagogical needs, many will require larger rooms. The space required to upgrade station sizes in existing STEM class labs was not included in the projected space need. Initiatives to update class lab configurations for modern instruction could prompt STEM capital projects independent of instructional demand.

2030 Additional Class Lab Projections by STEM Category

		2030 Calculated Additional Lab Space Needed to Meet STEM Demand* (ASF)					
Region	Institution	Engineering	Hard Science	Health Science**	Math	Technology	Total STEM Labs
Western	ASU	19,699	42,504	25,368	4,871	9,120	101,562
	UNCA	5,832	8,568	0	2,534	3,360	20,294
	WCU	37,584	10,248	10,752	0	0	58,584
Western Subtotal		**63,115**	**61,320**	**36,120**	**7,405**	**12,480**	**180,440**
Piedmont-Triad	N.C. A&T	19,700	21,260	0	2,060	0	43,020
	UNCG	0	0	7,161	0	0	7,161
	WSSU	0	0	4,368	0	0	4,368
Piedmont-Triad Subtotal		**19,700**	**21,260**	**11,529**	**2,060**	**0**	**54,549**
North Central	NCCU	0	7,140	2,184	8,672	0	17,996
	NC State	12,847	79,716	0	2,297	3,960	98,820
	UNC-CH	0	22,428	0	0	0	22,428
North Central Subtotal		**12,847**	**109,284**	**2,184**	**10,969**	**3,960**	**139,244**
South Central	FSU	0	4,116	4,032	4,118	0	12,266
	UNCC	20,218	28,401	14,700	1,188	20,640	85,147
	UNCP	0	6,048	0	0	6,960	13,008
South Central Subtotal		**20,218**	**38,565**	**18,732**	**5,306**	**27,600**	**110,421**
Eastern	ECU	27,216	67,738	0	2,376	3,000	100,330
	ECSU	0	0	0	0	2,400	2,400
	UNCW	0	49,812	0	6,415	10,020	66,247
Eastern Subtotal		**27,216**	**117,550**	**0**	**8,791**	**15,420**	**168,977**
Systemwide Total STEM Space		**143,096**	**347,979**	**68,565**	**34,531**	**59,460**	**653,631**

* Space needs may be offset by improving utilization or repurposing existing space before new construction is necessary.
** Calculated space need may be low due to universities' possible underreporting of Health Science lab use.

Space Quality

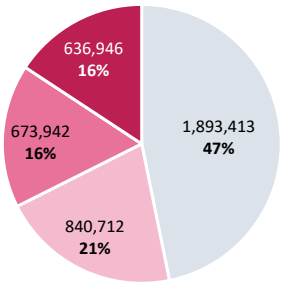
Quality of STEM Space

In 2017, 2.15 million ASF (53 percent) of the System's STEM academic space needed remodeling. If no additional space is created and no investments are made in existing space by 2030, building conditions will deteriorate and the amount of space in need of remodeling will grow to 3.98 million ASF (92 percent of STEM space). Therefore, building conditions alone could be the impetus for some STEM capital projects.

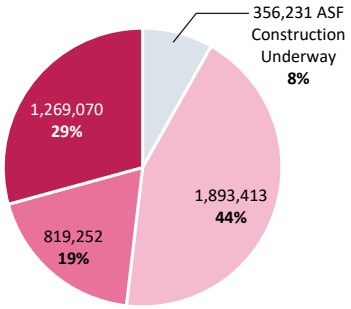
By considering space needs and building conditions in tandem, as shown in the bar chart below, the UNC System can begin to identify challenges and opportunities.

Additional planning tools can be found in the Systemwide Analysis chapter of this report.

Actual 2017
4,045,013 ASF



Progression to 2030
4,337,966 ASF



Building Condition

- 1- Satisfactory
- 2- Remodeling A
- 3- Remodeling B
- 4- Remodeling C

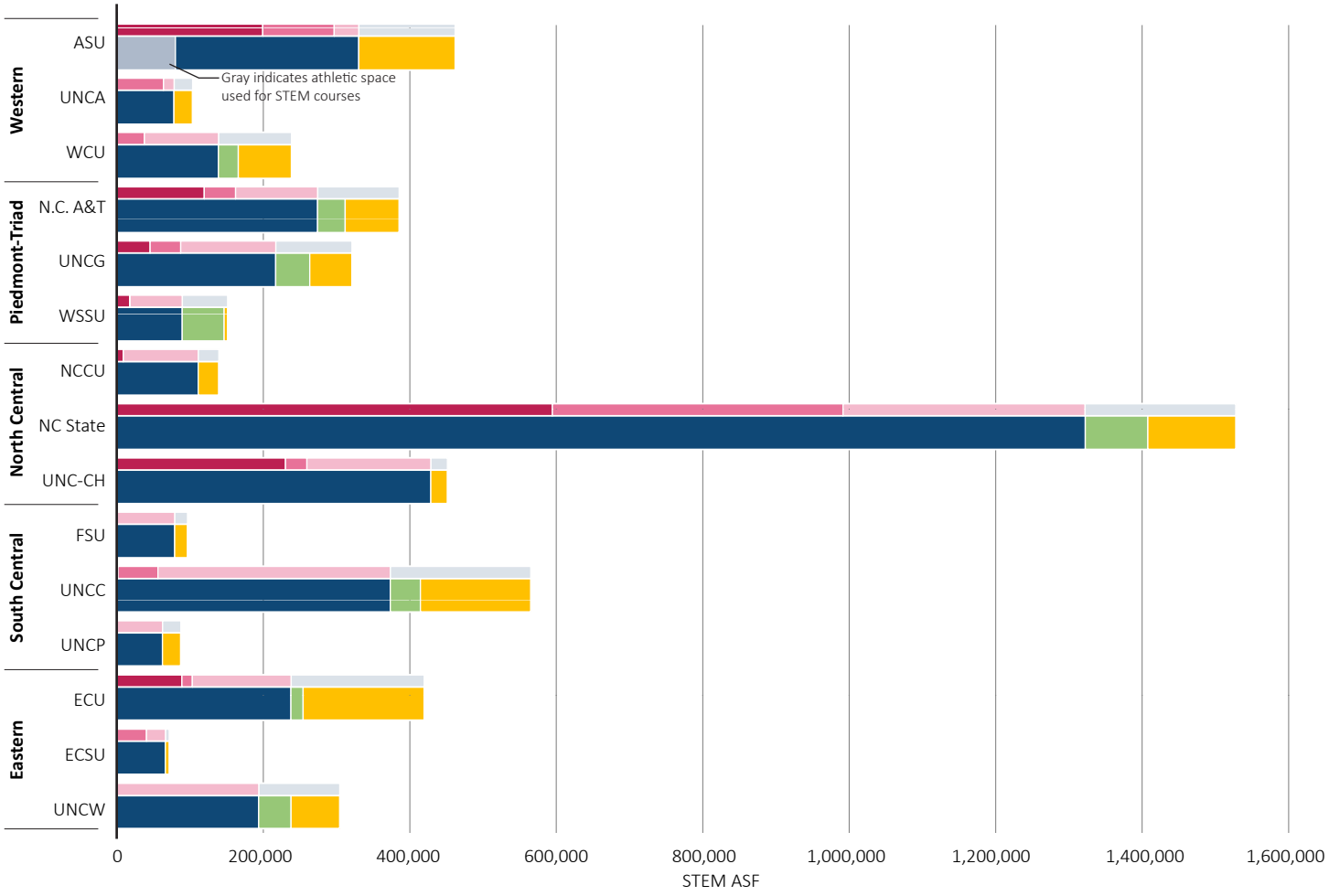
Renovation Cost as percent of Replacement Cost

- No Renovation Needed
- Less than 25%
- Between 25% and 50%
- More than 50%

Building Area (ASF)

- Existing STEM (2017)
- Projected STEM (2030)
- Net Additional New STEM after Construction/Demolition

2030 STEM Space Projection and Building Condition



Conclusions

Requested STEM Capital Projects

In response to Senate Bill 99, the proposed Brody School of Medicine at East Carolina University and the UNC Applied Physical Science and Institute for Convergent Science at UNC Chapel Hill were evaluated based on available information.

While still in the planning stages, the proposed new Brody School of Medicine will approach 200,000 gross square feet (GSF) and will replace a substantial portion of the existing 480,279 GSF building. The existing building was constructed in 1982 and renovated in 1999. The 38-year-old facility is in fair to poor condition (UNC System building condition code 3). If it were to be fully renovated to address building condition alone, a significant amount of specialized swing space would be required. Such swing space is not available; therefore, it is likely that some or all phases of a future Brody School of Medicine capital project would include new construction. Significant investment in Brody School of Medicine is justified.

At UNC Chapel Hill, the proposal for an Institute for Convergent Science as a home for the Applied Physical Sciences responds to a need for interdisciplinary instruction and research space. The initiatives described in the Institute's fundraising campaign (https://campaign.unc.edu/funding-priority/institute-convergent-science/) require science and engineering facilities that are unlike Chapel Hill's existing instructional and research labs. The University uses dedicated space for separate science and engineering disciplines spread across campus in different buildings of varying condition. Having consolidated, centralized space for Convergent Science is essential to support the intended interdisciplinary collaboration. Construction of new facilities for Applied Physical Sciences and the Institute for Convergent Science will allow old, outdated facilities to be retired or repurposed for other uses. Whether through new construction, comprehensive renovation, or a combination thereof, creation of a facility for Convergent Science is justified.

For other universities requesting STEM capital project funding, their University Analysis chapter of the STEM Capital Planning Study provides baseline analysis for further discussion.

Conclusions

- Statewide, most new STEM jobs are projected to be added in Health Science. However, growth in all STEM occupations will require graduates with science, technology, engineering, and math knowledge.
- STEM enrollment is projected to grow 3.9 percent annually to meet the projected 2030 employment demand.
- An additional 1.4 million assignable square feet (ASF) of classrooms, class lab, and office space will be needed to accommodate 2030 STEM enrollment. Class labs represent 653,631 ASF (47 percent) of the 1.4 million ASF total need.
- In addition to the space needed to accommodate anticipated enrollment growth, existing STEM space in fair to poor condition will require investment to preserve its usefulness. If no space quality improvements are made in the next decade, 3.98 million ASF of existing STEM space will require renovation in 2030.
- This study provides capital planning tools to help the System evaluate STEM enrollment, building condition, space inventory, instructional demand, and space needs simultaneously.
- In some cases, there may be existing underutilized space that can be dedicated to STEM use. Similarly, capital projects prompted by STEM space needs may address other campus space needs at the same time. These opportunities should be studied at the university level before initiating STEM capital projects.

Systemwide Analysis

Introduction

In June 2018, North Carolina Senate Bill 99 (excerpted below) was passed. The bill established the UNC Board of Governors STEM Planning Task Force to guide the creation of a systemwide STEM capital improvement plan. This report documents the analysis requested by the Task Force to inform its work.

> *"The Task Force shall conduct a systemwide analysis of the capital needs of the campuses of each constituent institution in relation to the Science, Technology, Engineering and Mathematics (STEM) subject area, taking into account the strengths, weaknesses, opportunities, and needs of each institution, and any regional similarities and differences. The Task Force shall also consider the impact of any relevant programmatic planning elements being currently utilized that could be implemented as a best-practice among other similar programmatic areas to encourage systemwide efficiencies. In particular, the Task Force shall consider the capital needs relating to the Brody School of Medicine at East Carolina University, the UNC Applied Physical Sciences and Institute for Convergent Science in Chapel Hill, and other STEM Projects to determine where capital funds may be used more efficiently and effectively. The Task Force shall use the information gathered…to compile a UNC System Plan."*

Purpose of the MGT Report

In March 2019 the UNC System engaged MGT Consulting Group to prepare a ***Systemwide STEM Program Needs Assessment.*** The assessment answered the following questions:

- What is the outlook for STEM jobs – nationally, by STEM category, and in North Carolina?
- How much of the System's current undergraduate upper division enrollment is in STEM majors?
- How much will that enrollment grow by 2030?
- Where is the growth expected – by region, institution, and STEM category?

MGT's STEM categories, enrollment projections, and regional distinctions are the foundational datasets of the ***Systemwide STEM Capital Planning Study.*** The full MGT report was issued to the UNC System in summer 2019. Key findings and summary graphics are provided here for the reader's convenience.

Purpose of the JMZ Report

In July 2019 JMZ Architects and Planners was retained by the UNC System to build upon the MGT report and prepare a ***Systemwide STEM Capital Planning Study*** that answered the following questions at the system and university levels:

- How much space is currently dedicated to STEM education?
- How well utilized is STEM classroom and class lab space?
- How much STEM academic space will be needed by 2030 to accommodate projected STEM enrollment growth?
- Is there enough existing STEM space – including space already under construction – to absorb the projected STEM enrollment growth?

Using the data presented in the MGT and JMZ reports, the UNC System will consider if there are opportunities to increase access to and enhance STEM education (and the associated facilities needed to deliver that education) among the 15 STEM degree-granting institutions in an effort to address the state's need for STEM graduates to fill high-demand jobs.

Population and Job Outlook

Population and STEM Job Outlook

MGT's work combined North Carolina Prosperity Zones into five Study Regions – Western, Piedmont-Triad, North Central, South Central, and Eastern. Academic programs, degrees, and job prospects were grouped into five STEM categories – Engineering, Hard Science, Health Science, Math, and Technology. By region, MGT assessed future employment opportunities for STEM bachelor's degree holders and anticipated population change.

The population of each of the five regions is projected to increase between eight percent and 16 percent from 2020 to 2030. Two regions, Piedmont-Triad and Western, are expected to lose population in the 18 to 24 year-old age group while gaining residents in other age groups.

STEM job opportunities are expected to increase through 2026 in all regions. South Central, which has the highest population, is projected to add the most jobs in STEM occupations (over 13,000). Health Science, which includes Nursing and other Health Science jobs, is estimated to lead growth in all regions.

The category "Other STEM" includes Hard Science occupations and STEM occupations that do not easily fit into a single STEM category. Earning a bachelor's degree in Hard Science is often a precursor to employment or continued study in another field. There are few Hard Science job openings listed, though Biology, Chemistry, and related degrees are some of the highest-enrolled programs in the System.

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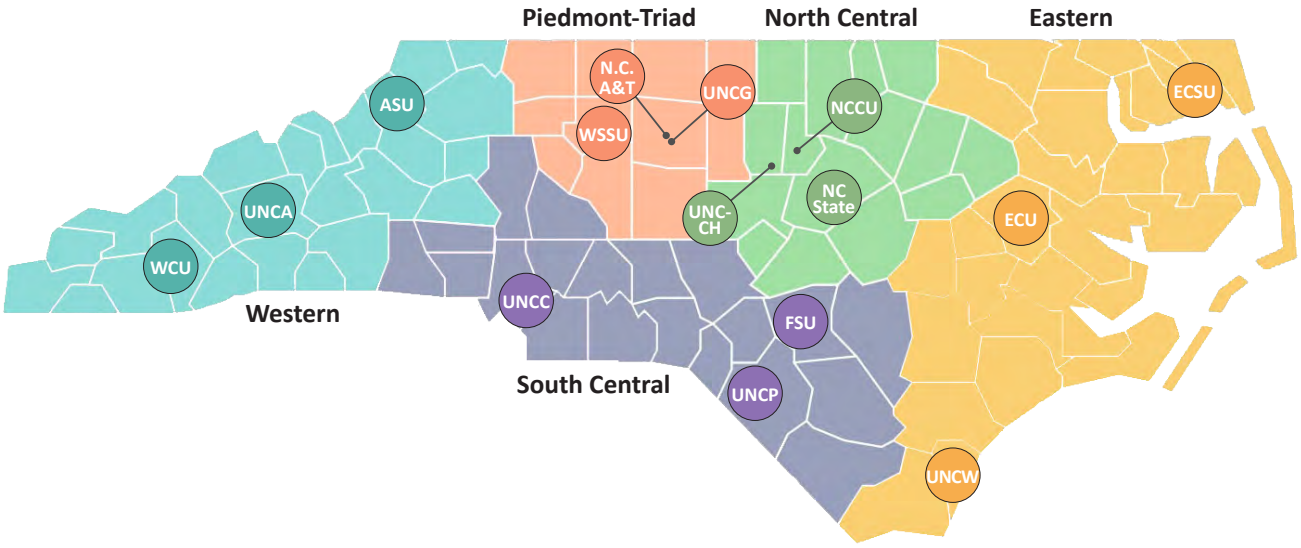


Enrollment Projections 2018-2030

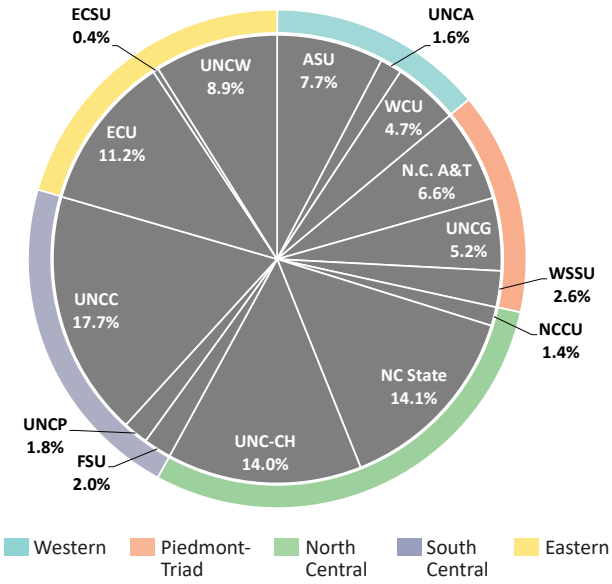
STEM Enrollment Projections

MGT's enrollment analysis projected 2018 to 2028 enrollment growth of STEM upper division majors only. All non-STEM enrollment was held constant at 2018 levels. JMZ extrapolated STEM enrollment projections to 2030 using the MGT enrollment growth rate for the 2023-2028 period with some minor adjustments from the UNC System.

Overall, STEM upper division undergraduate enrollment is projected to grow by 23,707 (58 percent) from 40,572 in 2018 to 64,279 in 2030.

The North Central and South Central regions had the most STEM upper division enrollment in the system in 2018. Combined, these regions will comprise over 50 percent of the STEM enrollment by 2030 if projections are met. The chart at right shows the anticipated systemwide distribution of STEM upper division majors.

2030 STEM Enrollment Distribution



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	Elizabeth City State University (ECSU)	176	264	*88*	*3.4%*
	University of North Carolina at Wilmington (UNCW)	3,334	5,712	*2,378*	*4.6%*
Eastern Subtotal		**8,261**	**13,185**	***4,924***	***4.0%***
System Total Upper Division Undergraduate STEM Enrollment		**40,572**	**64,279**	**23,707**	***3.9%***

Enrollment Projections 2018-2030

STEM Enrollment by University

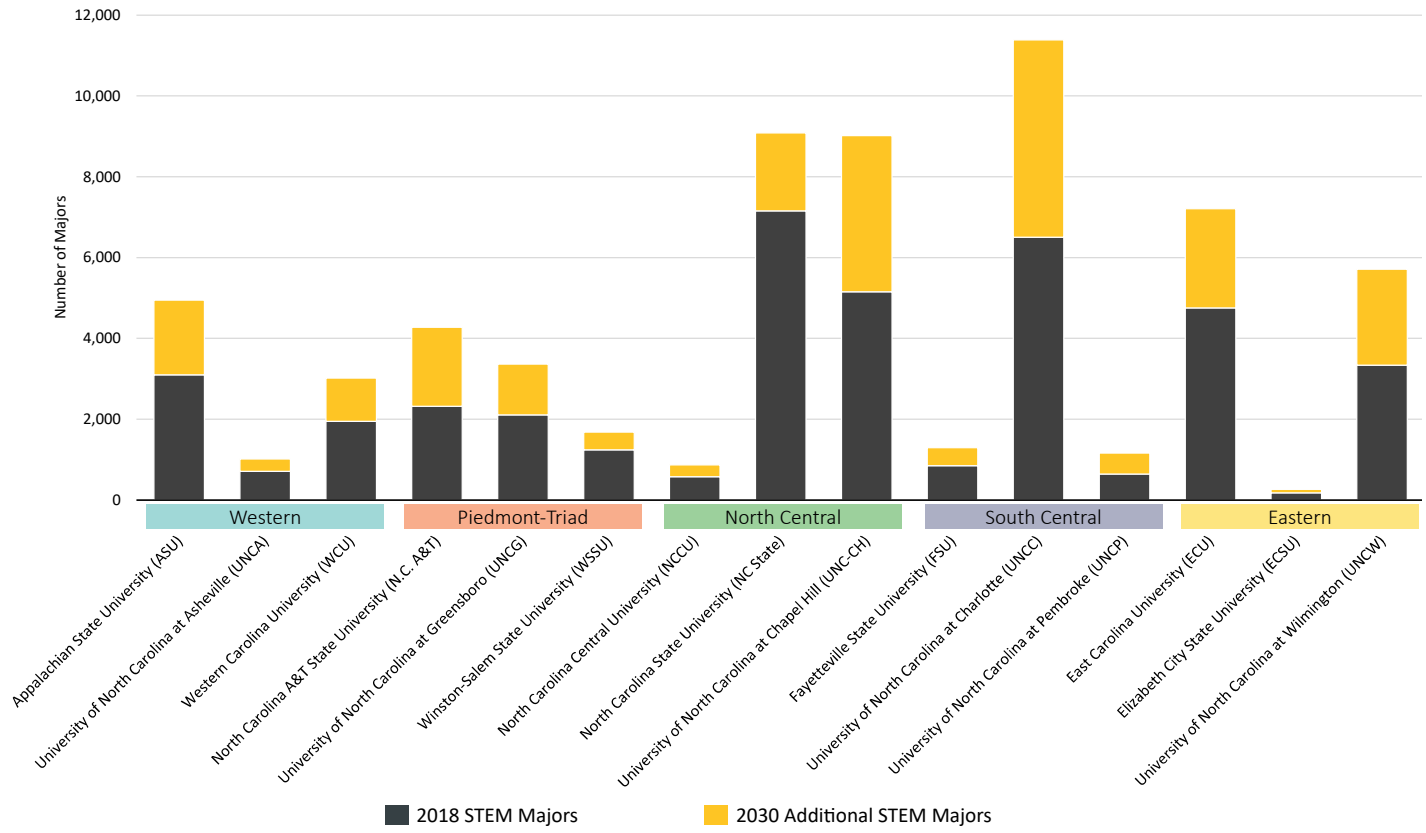
Projected STEM growth by university is shown in the column graph below. UNC Charlotte's STEM enrollment is expected to grow the most (4,878 majors) in the next decade. UNC Charlotte will eventually have the largest STEM enrollment in the System if projections are met.

NC State had the largest STEM upper division enrollment in 2018 (7,157) but will see the smallest percentage increase in the system (27 percent) if 2030 projections hold true.

The university with the highest percentage of expected STEM enrollment growth by 2030 is North Carolina A&T (84 percent) in the Piedmont-Triad region, followed by UNC Pembroke (81 percent) in the South Central region.

Enrollment projections by region, university, and STEM category are included in Appendix A of this report. Each university's actual enrollment growth and associated space needs may vary depending on strategic initiatives, growth or decline in non-STEM programs, and external factors that could not be predicted or quantified at the time of the MGT report.

2030 STEM Enrollment Growth by University



Enrollment Projections 2018-2030

Enrollment Growth by STEM Category

The table below shows systemwide enrollment growth by STEM category. Health Science is expected to contribute more new STEM majors in the next decade than any other STEM category. By 2030, it will surpass Hard Science to become the highest enrolled of the five STEM categories.

UNC Charlotte and UNC Wilmington are expected to draw the largest number of additional Health Science students and, combined, will make up over 50 percent of the systemwide enrollment growth in this STEM category.

Technology is projected to experience the largest percentage increase (89 percent) if 2030 enrollment projections are achieved. Combined, UNC Charlotte and UNC Chapel Hill are expected to contribute 50 percent of the overall Technology enrollment growth in the system. Each will add over 1,000 students by 2030.

While Math enrollment is expected to increase 63 percent between 2018 and 2030 – a growth rate nearly equivalent to Health Science – it will have the fewest new majors of the five STEM categories.

Regional STEM Distribution

The North Central region is anticipated to generate the largest number (6,080) of additional upper division STEM enrollments by 2030. If achieved, this region will account for 26 percent of the total systemwide STEM enrollment growth and nearly 30 percent of the System's STEM majors. More than half of the new North Central STEM majors (3,866) are expected to enroll at UNC Chapel Hill.

The South Central region is projected to add the second largest number of STEM upper division enrollments (5,843) by 2030. Health Science programs will contribute most to this region's STEM growth.

2030 Enrollment Growth by STEM Category

		Projected Upper Division Undergraduate STEM Enrollment Growth 2018-2030					
Region	Institution	Engineering	Hard Science	Health Science	Math	Technology	Total
Western	Appalachian State University (ASU)	56	489	473	246	582	1,846
	University of North Carolina at Asheville (UNCA)	167	82	24	6	22	301
	Western Carolina University (WCU)	424	147	408	33	55	1,067
Western Subtotal		**647**	**718**	**905**	**285**	**659**	**3,214**
Piedmont-Triad	North Carolina A&T State University (N.C. A&T)	679	157	591	35	493	1,955
	University of North Carolina at Greensboro (UNCG)		523	272	14	443	1,252
	Winston-Salem State University (WSSU)		118	281	4	36	439
Piedmont-Triad Subtotal		**679**	**798**	**1,144**	**53**	**972**	**3,646**
North Central	North Carolina Central University (NCCU)		90	67	26	106	290
	North Carolina State University (NC State)	1,079	435		97	313	1,924
	University of North Carolina at Chapel Hill (UNC-CH)		1,482	304	404	1,676	3,866
North Central Subtotal		**1,079**	**2,007**	**371**	**527**	**2,096**	**6,080**
South Central	Fayetteville State University (FSU)		68	320	8	47	443
	University of North Carolina at Charlotte (UNCC)	434	568	2,318	192	1,365	4,878
	University of North Carolina at Pembroke (UNCP)		356	60	24	82	522
South Central Subtotal		**434**	**992**	**2,698**	**224**	**1,494**	**5,843**
Eastern	East Carolina University (ECU)	1,087	304	446	35	586	2,458
	Elizabeth City State University (ECSU)	9	21		5	53	88
	University of North Carolina at Wilmington (UNCW)	112	520	1,413	58	275	2,378
Eastern Subtotal		**1,208**	**845**	**1,859**	**98**	**914**	**4,924**
	Total Upper Division Undergraduarte STEM Growth	**4,047**	**5,360**	**6,977**	**1,188**	**6,135**	**23,707**

STEM Space Assessment

Methodology

JMZ Architects and Planners used the results of the MGT report as the springboard for this ***Systemwide STEM Capital Planning Study.*** Three primary factors influenced the analysis of the UNC System's current and future STEM instructional and office space needs.

- STEM academic space allocation and building condition (measured in assignable square feet, or ASF).
- Fall 2017 instructional utilization of scheduled classrooms, STEM class labs, and STEM open labs. Instructional space utilization analysis reveals whether recommended hourly and seat fill targets were met and, if not, where capacity may exist to absorb future enrollment.
- Increased demand for STEM instruction associated with the 2030 projected enrollment growth (by STEM category) established by MGT.

In some cases, building condition alone could become the impetus for a capital project, regardless of the other factors. When all factors are considered in tandem, future space needs could be met by reassigning or repurposing existing space, thereby improving building conditions and offsetting the need for new construction.

While lower division and graduate STEM students were not included in MGT's enrollment projections, JMZ accounted for their use of instructional space. In addition, a separate analysis was conducted of space needs resulting from potential enrollment growth in graduate STEM programs.

2017 Systemwide STEM Space Allocation

Space Category	2017 STEM Space (ASF)	Percent of STEM	Percent of System
Class Labs and Open Labs			
Engineering	410,182	*10.1%*	*1.9%*
Hard Science	811,471	*20.1%*	*3.8%*
Health Science	188,190	*4.7%*	*0.9%*
Math	52,546	*1.3%*	*0.2%*
Technology	64,493	*1.6%*	*0.3%*
Labs Subtotal	1,526,882	*37.7%*	*7.1%*
Office	1,898,798	*46.9%*	*8.9%*
Support Space	619,333	*15.3%*	*2.9%*
Systemwide STEM Space	**4,045,013**		***18.9%***
Systemwide Total Assignable Space	21,399,665		

STEM Academic Space Allocation

In 2017, 4,045,013 assignable square feet (18.9 percent) of the UNC System's 21.4 million ASF of overall space was dedicated to STEM academic programs. Appendix B lists the UNC System space category codes that were considered STEM.

STEM Spaces

STEM class labs (FICM code 210) are intended, first and foremost, for instruction. While they house other uses such as skills practice, student projects, and research, they are considered instructional space in this study in accordance with System and national space use guidelines.

STEM open labs (FICM code 220) are not typically scheduled for instruction, but many universities scheduled courses in open labs in fall 2017. Open labs were considered part of STEM lab inventory for this study, and all instruction that took place in open labs was analyzed. However, seats in rooms coded as open labs were excluded from instructional capacity calculations to preserve these spaces for out-of-class work.

All offices dedicated to STEM departments – along with STEM-dedicated office support spaces like conference rooms, reception areas, and storage – are referred to as "office" in this study (FICM codes in the 300s).

Support spaces are non-instructional, non-research, STEM-dedicated facilities that directly support undergraduate instruction (FICM codes in the 400s, 500s, and 600s). Existing and under-construction STEM support spaces were tabulated as STEM, yet calculations for future support spaces were not included because these facilities are typically sized based on a university's entire student body.

Non-STEM Spaces

Classrooms, even if dedicated to a STEM department, can be used for lecture instruction in any subject. For this reason, classrooms and their support spaces (FICM codes 110 and 115) were not counted as STEM-dedicated space. The impact of increased lecture instruction associated with 2030 STEM enrollment growth was included in the study, with all other lecture instruction held constant.

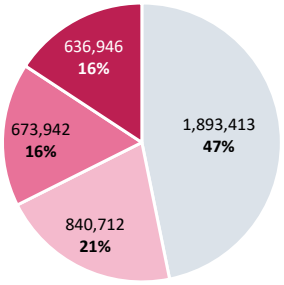
Because STEM enrollment projections were limited to undergraduates, non-instructional spaces that do not directly support delivery of undergraduate STEM degrees were excluded from analysis: research spaces (FICM codes in the 250s); facilities support and storage (FICM codes in the 700s); and, residence halls (FICM codes in the 900s).

STEM Space Assessment

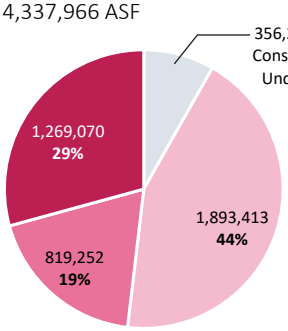
Systemwide STEM Building Condition

Universities self-report building condition data to the UNC System every year. The pie charts below reflect the 2017 reported conditions of STEM academic space and the deterioration that could occur if no substantial facilities improvements are made in the next decade. New construction totaling 356,231 ASF is currently underway and will be in satisfactory condition in 2030. An anticipated 63,278 ASF of existing space in varying conditions will be demolished. By 2030, over 1.8 million ASF more existing STEM space will need remodeling than in 2017.

Actual 2017
4,045,013 ASF



Progression to 2030
4,337,966 ASF



Building Condition	Renovation Cost as percent of Replacement Cost
1- Satisfactory	No Renovation Needed
2- Remodeling A	Less than 25%
3- Remodeling B	Between 25% and 50%
4- Remodeling C	More than 50%

Used to order universities in the table below

University STEM Building Condition

The table below, 2017 STEM Building Condition Code by University, shows universities' overall STEM space allocation ordered by amount of space in remodeling groups B and C. The STEM space allocation by condition code is included in the central columns of the table. See Appendix D for further evaluation of STEM space by condition code for each university.

- NC State has the most STEM-dedicated space, more than three-times the STEM space at UNC Chapel Hill. Nearly 75 percent of NC State's STEM space was reportedly in need of remodeling in 2017, and will be further deteriorated by 2030 if no substantial facilities improvements are made.
- Over 60 percent of STEM space at UNC Chapel Hill was reportedly in need of remodeling in 2017.
- At Appalachian State University, nearly 90 percent of STEM space was in need of remodeling in 2017.
- Eight universities reported little or no space in remodeling groups B or C. However, many universities have updated or are in the process of updating their reported building condition data. Building conditions should be independently verified before any capital projects are formulated.

2017 STEM Building Condition Code by University - Ranked by Condition Codes 3 and 4

		2017 STEM Building Condition Code (ASF)				
	Institution	(1) Satisfactory	(2) Remodeling A	(3) Remodeling B	(4) Remodeling C	Institution Total (ASF)
Sum of Condition Codes 3 and 4 ▲ MOST	North Carolina State University	330,806	396,907	350,625	243,879	1,322,217
	UNC Chapel Hill	169,643	29,207	204,937	24,933	428,720
	Appalachian State University	33,829	97,593	17,127	181,706	330,255
	North Carolina A&T	112,326	42,813	37,025	81,909	274,073
	East Carolina University	134,990	14,336	11,816	76,534	237,676
	UNC Greensboro	130,009	41,804	33,502	18,406	223,721
	Winston-Salem State University	71,635	222	8,425	8,869	89,151
	North Carolina Central University	115,915	0	8,385	0	124,300
	UNC Charlotte	317,522	54,557	1,203	0	373,282
	Western Carolina University	101,539	60,560	897	0	162,996
	Elizabeth City State University	26,115	39,377	0	639	66,131
	UNC Asheville	14,514	63,336	0	71	77,921
	UNC Wilmington	193,637	0	0	0	193,637
	Fayetteville State University	78,837	0	0	0	78,837
▼ LEAST	UNC Pembroke	62,096	0	0	0	62,096
	Building Condition Code Total (ASF)	**1,893,413**	**840,712**	**673,942**	**636,946**	**4,045,013**

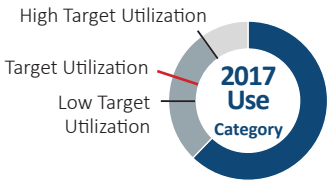
STEM Space Assessment

Instructional Space Utilization

Analysis was conducted to determine how classrooms (general) and class laboratories (coded/dedicated to STEM) were used for instruction during the fall 2017 semester, the most recent fully vetted course scheduling data available at the time of the study.

The study considered the number of seats occupied and the number of daytime hours scheduled during a 45-hour week. The nationally-accepted Association for Learning Environments (A4LE) seat fill and hourly utilization criteria were applied as adopted by the UNC System for this study. These criteria focus on daytime use, which constitutes most scheduled instruction in the UNC System. A4LE seat fill targets are slightly higher than the UNC System targets. If met, A4LE seat fill criteria would result in better utilization of classrooms and class labs. While the adopted targets are ideal, a utilization range of five percent below or 10 percent above each target is considered reasonable.

Reading the Results



Darkest tone: Fall 2017 space use (hourly or seat fill)

Middle tone: Remaining capacity within target range

Lightest tone: Remaining capacity above target range; use at this level is not expected

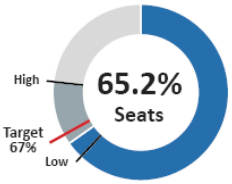
Systemwide, seat occupancy in classrooms nearly met the recommended target but hourly use was below target, as shown at right. This suggests that there was capacity in the system (in aggregate) to offer more course meetings in classrooms during daytime hours in fall 2017.

Seat occupancy in laboratories dedicated to Math instruction exceeded target utilization; Hard Science and Health Science met or approached the low target; and Engineering and Technology laboratories did not meet the lowest seat occupancy target.

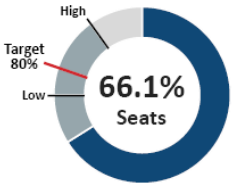
The hourly use target was not met for laboratories in any of the STEM categories. Health Science lab hourly utilization is frequently underreported due to the variable schedules of students' clinical assignments and skills practice.

The results of the systemwide space utilization study should not be interpreted to mean that all universities fell short of recommended targets. The results vary widely at the university level as indicated in the individual University Analysis chapters.

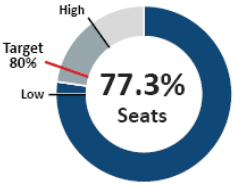
Classrooms



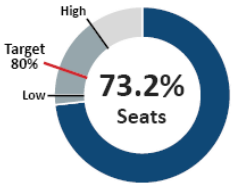
Engineering Labs



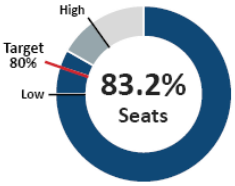
Hard Science Labs



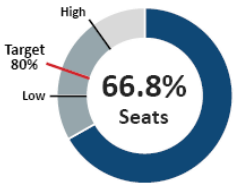
Health Science Labs



Math Labs



Technology Labs



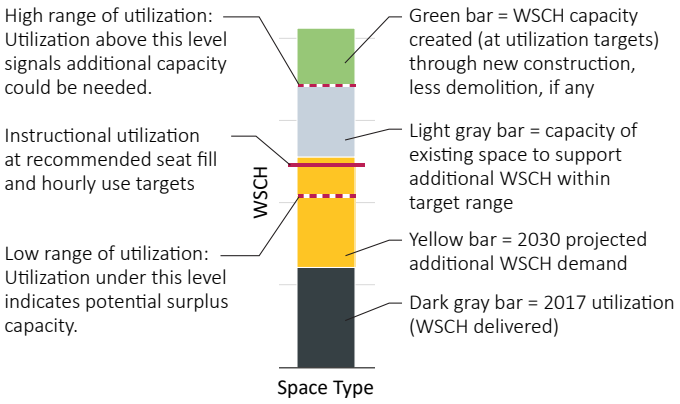
STEM Space Assessment

Instructional Space Capacity

STEM enrollment growth through 2030 will drive demand for additional weekly lecture and lab instruction. Non-STEM majors will continue to need STEM courses to meet general education requirements and prerequisites to admission in STEM programs. The six charts on this page and the following pages illustrate the System's capacity to hold instruction in classrooms and STEM class labs in 2017 and 2030 if utilization targets are met.

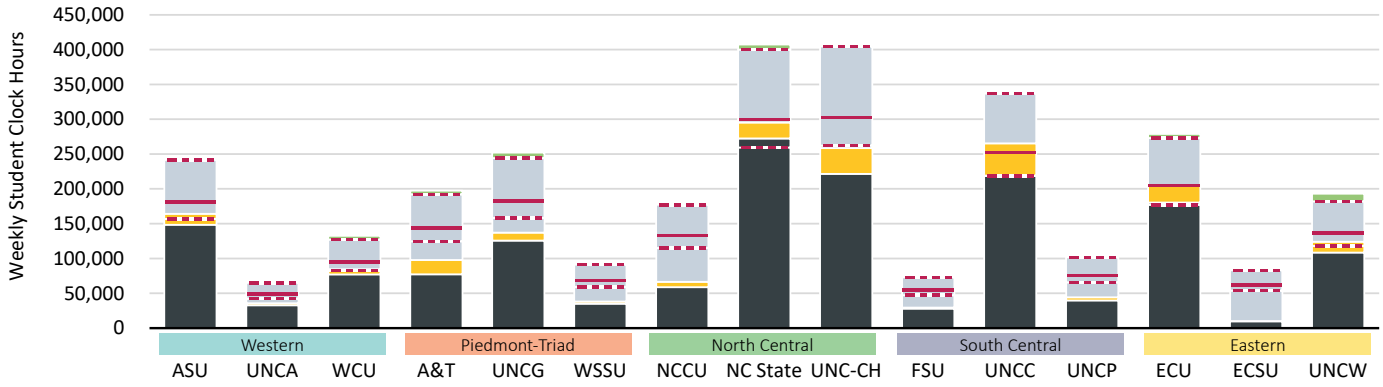
An institution's capacity for instruction is measured in weekly student clock hours (WSCH). One WSCH equals one student occupying one station for one hour.

Legend



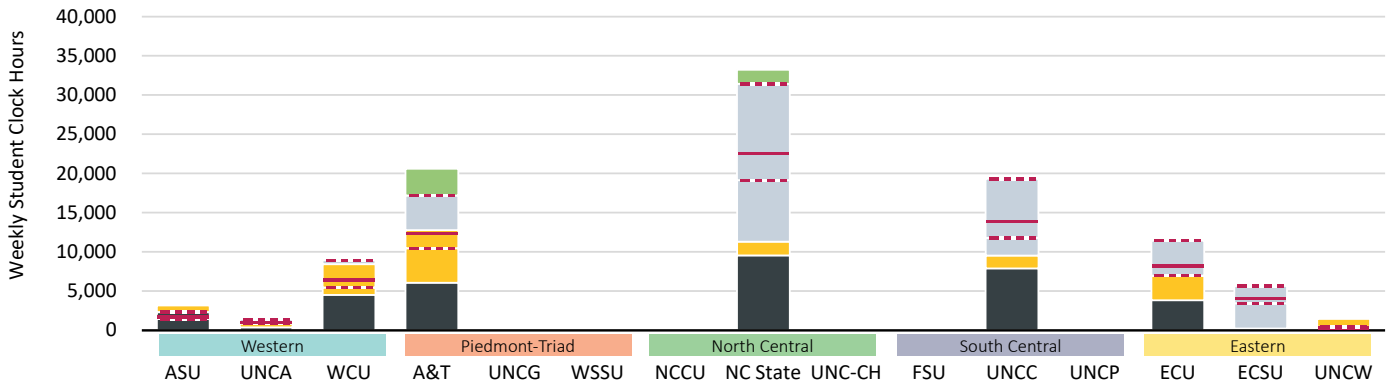
Classrooms

A classroom can be used by any discipline to deliver lecture instruction. Below, universities' total fall 2017 lecture demand (STEM and non-STEM) is shown in dark gray. The yellow bar indicates increased lecture demand as a result of STEM growth through 2030. Most universities will be able to accommodate the 2030 STEM lecture demand in existing classrooms if space utilization targets are met.



Engineering Labs

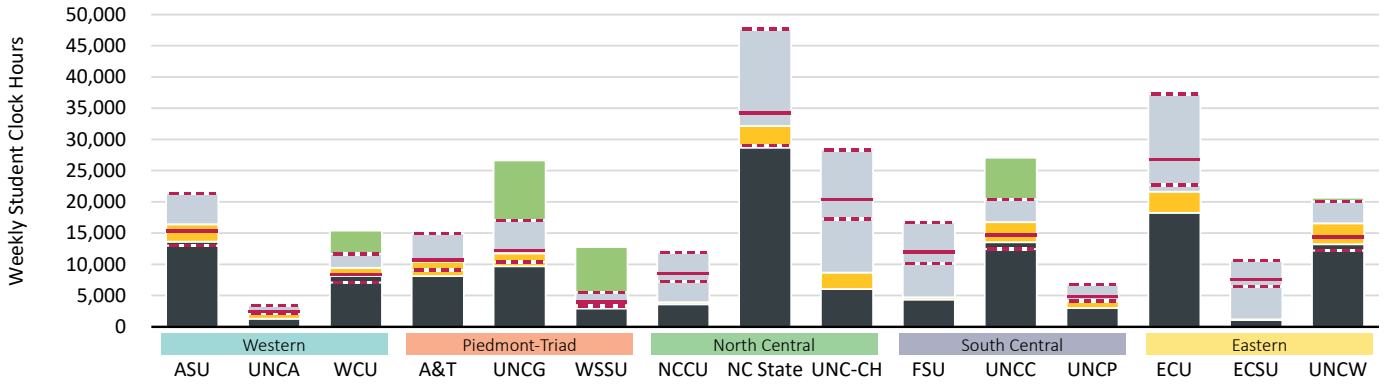
Engineering space is dedicated to a broad range of engineering subjects, including hands-on technical instruction related to Engineering programs. Most Engineering class labs are dedicated to specific uses, such as coastal engineering or aviation. Though there may be an apparent surplus of Engineering capacity at some universities, underutilized specialized labs may not be suitable for use by other Engineering disciplines.



STEM Space Assessment

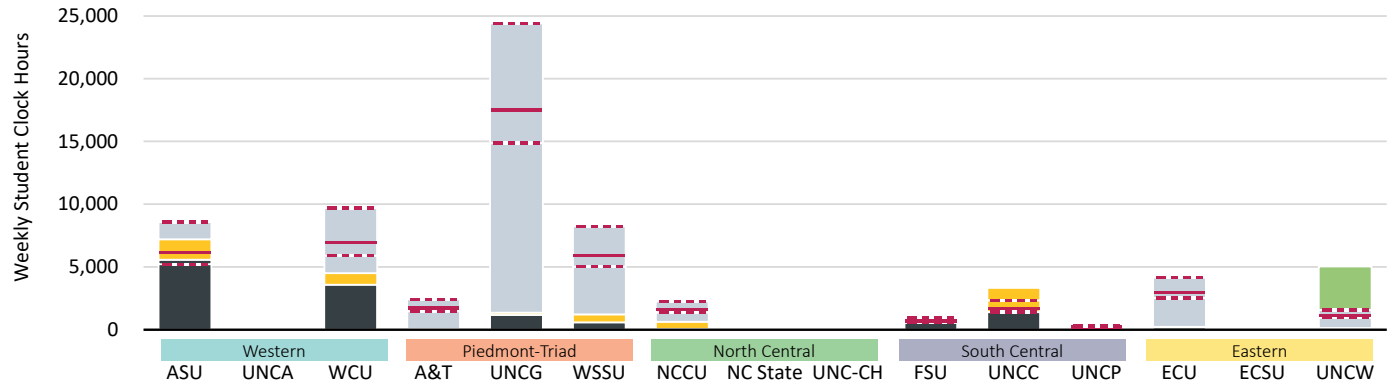
Hard Science Labs

Hard Science space houses lab-based sciences such as biology, chemistry, physics, geology, and anatomy and physiology. Social sciences are excluded. Hard Science labs at many campuses will approach or exceed their target instructional capacity by 2030. While an individual university may have adequate aggregate Hard Science lab capacity, not every lab can accommodate instruction in multiple subjects. Additional capacity may be required in specialized disciplines.



Health Science Labs

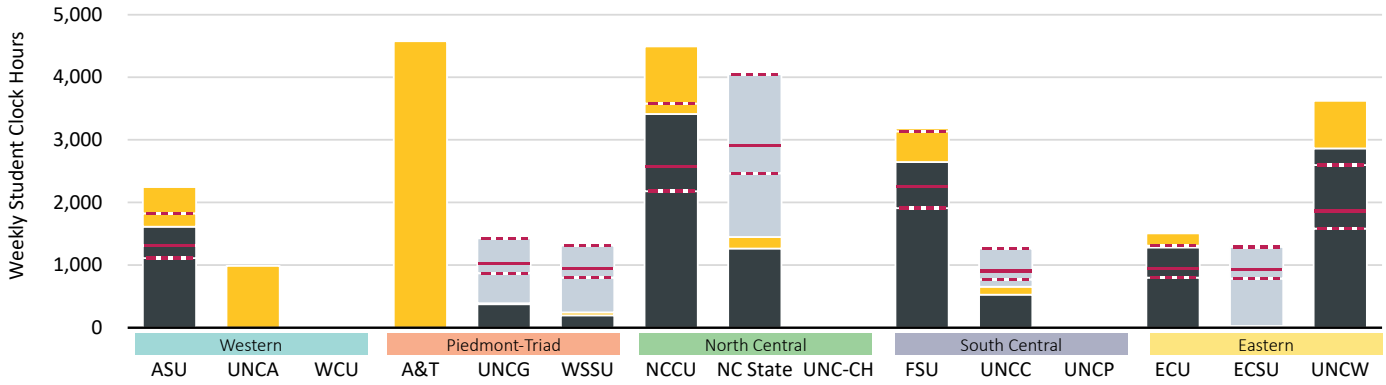
Health Science space is dedicated to clinically-oriented, non-research health studies such as nursing and occupational therapy. Medical and veterinary schools are excluded. Few of the System's universities are projected to exceed their calculated Health Science lab capacity by 2030. Labs for many Health Science disciplines are highly specialized; and, Health Science course schedules are variable throughout the academic year due to clinicals and skills practice. For these reasons, Health Science departments often schedule these specialized labs independent of the university registrar. Additional study at the university level should be conducted to verify existing Health Science lab utilization and capacity to accommodate 2030 enrollment.



STEM Space Assessment

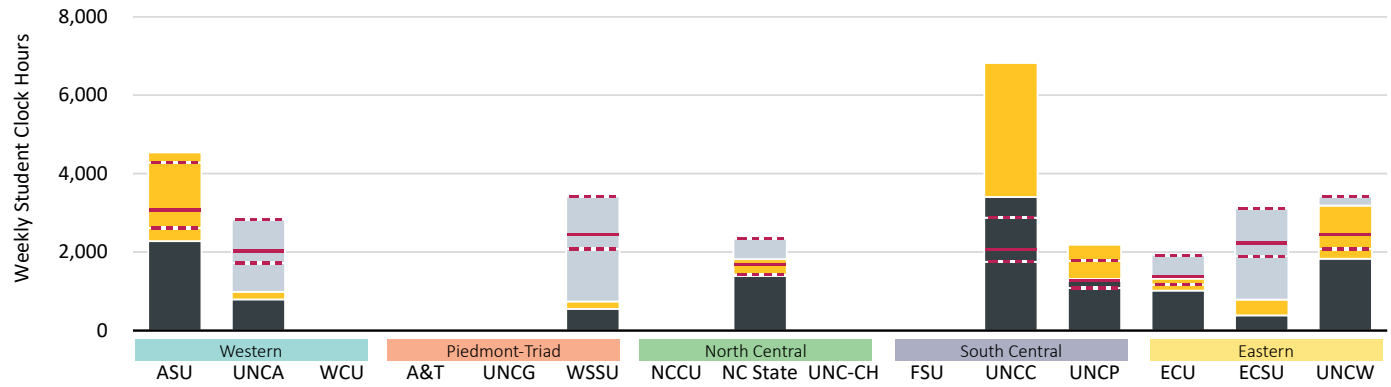
Math Labs

Math labs support all Math instruction. Additional Math lab capacity will be needed at eight universities. Some universities teach Math in general use classrooms, so their Math instructional demand was recorded as a lecture need. Every campus that has dedicated Math class labs will exceed the instructional capacity of those labs by 2030. Universities without dedicated Math class labs may consider allocating lab space for Math to better track needs in the future. At universities where all Math lab instruction was delivered in open labs in fall 2017, the 2030 demand is shown below without any existing class lab capacity to absorb it. In some cases, this imbalance could be corrected by recoding open labs as class labs where appropriate.



Technology Labs

Technology space accommodates instruction in computer science and data analytics. Some universities teach Technology in general use classrooms, so their Technology instructional demand was recorded as a lecture need. Several universities will need additional Technology lab capacity for new and expanding programs.



Projected Space Needs

Space Projection Methodology

The projected demand for instructional capacity (measured in WSCH) was translated into space (ASF) by determining how many additional student stations will be required in 2030. The space need projections assume that universities will schedule classrooms and labs to meet nationally accepted A4LE utilization targets.

A classroom is, by definition, a general use instructional space that is not customized for specific disciplines. For this reason, classroom capacity was assessed in aggregate (the total number of stations on a campus, regardless of room configuration or location). Considering STEM growth alone, all universities but one are projected to have surplus classroom seats in 2030.

Class labs are specialized spaces with equipment and configurations that support specific disciplines. The reported space data did not reveal characteristics of individual labs, so each lab was assumed to be a unique and integral part of a university's STEM inventory. If any individual lab was projected to exceed capacity by 2030, an additional lab of the same seating capacity was tabulated as a space need.

The UNC System recommends a range of 33 ASF to 108 ASF per station in STEM class labs, depending on discipline. Many labs, especially those in older buildings, have station sizes far smaller than System recommendations. A new 24-station lab is likely to be larger than an existing 24-station lab for most disciplines on most campuses.

The 2030 office projections represent space needed to house additional STEM faculty and staff if 2018 student:faculty and faculty:staff ratios are maintained. Some universities may have surplus offices elsewhere on campus that could be reassigned to offset the calculated office space need.

Detailed assessment of existing space that could be repurposed is beyond the scope of this study. Further analysis will be required at the university level to determine if 2030 STEM needs could be met through renovation or better utilization of existing space before new construction is necessary.

STEM Space Need Projections by University

Projected enrollment growth in the five STEM categories could result in a need for up to 967,660 ASF of additional classroom, class lab, office, and associated support space by 2030. When graduate enrollment growth is considered, the space need could increase by an additional 433,762 ASF for a systemwide total of 1,401,422 ASF.

The table on the following page shows 2017 and projected 2030 STEM space by university and space type.

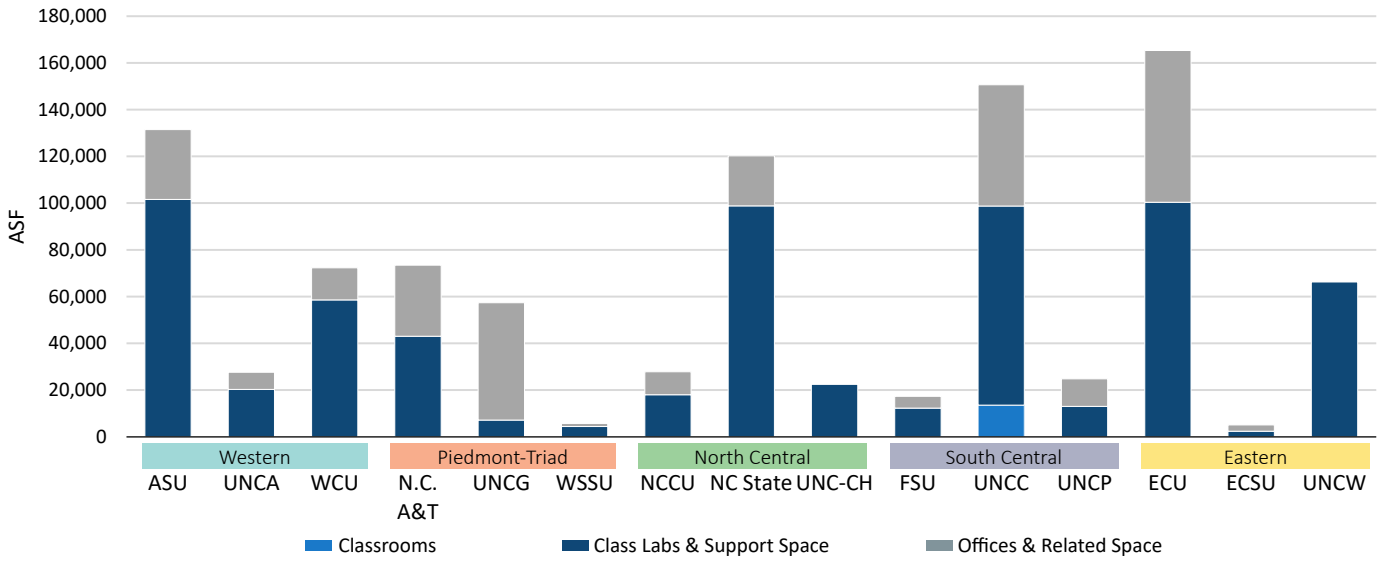
- Classrooms represent less than one percent of the additional instructional space needed to accommodate 2030 STEM demand.
- More than 650,000 ASF of STEM class lab space will be needed by 2030. This accounts for two-thirds of the overall 2030 STEM space need in the UNC System.
- Most universities will need to allocate additional STEM office space by 2030. Growth in graduate admissions will increase office space needs.

Projected Space Needs

STEM Space Need Projections by University

		2017 STEM Inventory and Projects Underway (ASF)		2030 Calculated Additional Space Needed to Meet STEM Demand* (ASF)				2030 Total STEM Space Need (ASF)
Region	Institution	2017 STEM Inventory	Net New STEM Construction	Classroom	Class Lab**	Office	2030 STEM Space Need	
Western	ASU	330,255	0	0	101,562	29,880	131,442	461,697
	UNCA	77,921	0	0	20,294	7,340	27,634	105,555
	WCU	162,996	27,195	0	58,584	13,737	72,321	262,512
Western Subtotal		**571,172**	**27,195**	**0**	**180,440**	**50,957**	**231,397**	**829,764**
Piedmont-Triad	N.C. A&T	274,073	29,888	0	43,020	30,399	73,419	377,380
	UNCG	223,721	21,262	0	7,161	50,222	57,383	302,366
	WSSU	89,151	47,266	0	4,368	1,300	5,668	142,085
Piedmont-Triad Subtotal		**586,945**	**98,416**	**0**	**54,549**	**81,921**	**136,470**	**821,831**
North Central	NCCU	124,300	0	0	17,996	9,850	27,846	152,146
	NC State	1,322,217	76,421	0	98,820	21,375	120,195	1,518,833
	UNC-CH	428,720	0	0	22,428	0	22,428	451,148
North Central Subtotal		**1,875,237**	**76,421**	**0**	**139,244**	**31,225**	**170,469**	**2,122,127**
South Central	FSU	78,837	0	0	12,266	5,020	17,286	96,123
	UNCC	373,282	39,111	13,568	85,147	51,913	150,628	563,021
	UNCP	62,096	0	0	13,008	11,800	24,808	86,904
South Central Subtotal		**514,215**	**39,111**	**13,568**	**110,421**	**68,733**	**192,722**	**746,048**
Eastern	ECU	237,676	9,591	0	100,330	64,955	165,285	412,552
	ECSU	66,131	0	0	2,400	2,670	5,070	71,201
	UNCW	193,637	42,219	0	66,247	0	66,247	302,103
Eastern Subtotal		**497,444**	**51,810**	**0**	**168,977**	**67,625**	**236,602**	**785,856**
Systemwide Total STEM Space		**4,045,013**	**292,953**	**13,568**	**653,631**	**300,461**	**967,660**	**5,305,626**
						Space Need for Potential Graduate Student Growth	433,762	
						2030 Additional STEM Space Need	**1,401,422**	
						2030 Total STEM Space Need		**5,739,388**

2030 Additional STEM Space Need*



* Space needs may be offset by improving utilization or repurposing existing space before new construction is necessary.
** Calculated space need may be low due to universities' possible underreporting of Health Science lab use.

Projected Space Needs

Class Lab Space Needs by STEM Category

Systemwide, the greatest need for additional class labs will be in Hard Science. Nearly 350,000 ASF (53 percent of the total class lab projection) will be needed if 2030 enrollment projections are met.

Engineering labs, which are typically highly-specialized and can require station sizes in excess of 100 ASF, are expected to need an additional 143,096 ASF, or 22 percent of the total class lab projection.

Health Science labs are calculated to need over 68,000 ASF of additional lab space by 2030. However, this figure may be low due to universities' possible underreporting of Health Science lab use.

An additional 59,460 ASF of Technology lab space will be needed. In this fast-growing STEM category, new and emerging academic programs could prompt needs for discipline-specific Technology labs that were not anticipated by this study.

Eight universities are projected to need additional Math lab space, totaling nearly 35,000 ASF systemwide.

The factors that contribute to formulating capital projects, such as projected STEM enrollment, laboratory space need by category, and building condition, are tabulated in Appendix D of this report to guide further discussions with each university.

2030 Additional Class Lab Projections by STEM Category

		2030 Calculated Additional Lab Space Needed to Meet STEM Demand* (ASF)					
Region	Institution	Engineering	Hard Science	Health Science**	Math	Technology	Total STEM Labs
Western	ASU	19,699	42,504	25,368	4,871	9,120	101,562
	UNCA	5,832	8,568	0	2,534	3,360	20,294
	WCU	37,584	10,248	10,752	0	0	58,584
Western Subtotal		**63,115**	**61,320**	**36,120**	**7,405**	**12,480**	**180,440**
Piedmont-Triad	N.C. A&T	19,700	21,260	0	2,060	0	43,020
	UNCG	0	0	7,161	0	0	7,161
	WSSU	0	0	4,368	0	0	4,368
Piedmont-Triad Subtotal		**19,700**	**21,260**	**11,529**	**2,060**	**0**	**54,549**
North Central	NCCU	0	7,140	2,184	8,672	0	17,996
	NC State	12,847	79,716	0	2,297	3,960	98,820
	UNC-CH	0	22,428	0	0	0	22,428
North Central Subtotal		**12,847**	**109,284**	**2,184**	**10,969**	**3,960**	**139,244**
South Central	FSU	0	4,116	4,032	4,118	0	12,266
	UNCC	20,218	28,401	14,700	1,188	20,640	85,147
	UNCP	0	6,048	0	0	6,960	13,008
South Central Subtotal		**20,218**	**38,565**	**18,732**	**5,306**	**27,600**	**110,421**
Eastern	ECU	27,216	67,738	0	2,376	3,000	100,330
	ECSU	0	0	0	0	2,400	2,400
	UNCW	0	49,812	0	6,415	10,020	66,247
Eastern Subtotal		**27,216**	**117,550**	**0**	**8,791**	**15,420**	**168,977**
Systemwide Total STEM Space		**143,096**	**347,979**	**68,565**	**34,531**	**59,460**	**653,631**

* Space needs may be offset by improving utilization or repurposing existing space before new construction is necessary.
** Calculated space need may be low due to universities' possible underreporting of Health Science lab use.

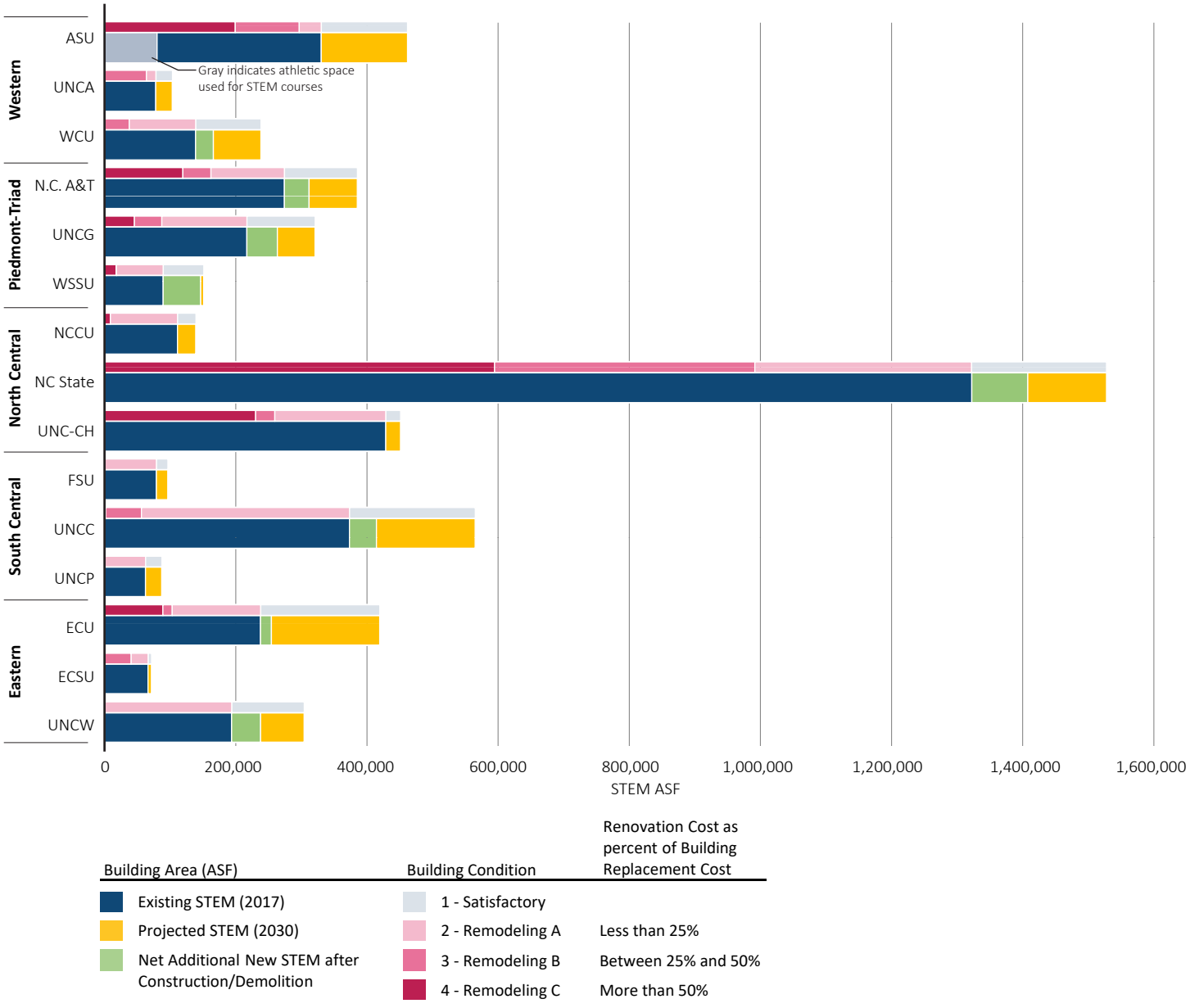
Capital Planning Tools

Bringing the Results Together

This report offers systemwide and university-level analysis. The appendices include detailed tables to help the UNC System identify challenges and opportunities down to the individual building level.

The chart below is an example of the layered presentation of data contained in each University Analysis chapter. It incorporates 2017 STEM space allocation and condition, STEM construction and demolition projects underway, and projected 2030 STEM space needs by institution. In some cases, building conditions or inadequate student station sizes could become the impetus for STEM capital projects. By considering these factors together, along with anticipated growth in specific STEM disciplines, the System can evaluate current and future facilities pressure points.

2030 STEM Space Projection and Building Condition



Capital Planning Tools

Evaluation of Multiple Factors

Moving forward, the results of this study can be used to evaluate opportunities at the systemwide level down to the department level. The System Office received space utilization tables, like the sample below, for all universities in this study. The tables display room data from the DAVE space inventories and schedule data from the Student Data Mart. Each scheduled room is shown with its STEM category (if applicable), room use code, area, station count, station size, and scheduled day and night use data from fall 2017.

This table can be used to assess utilization of individual rooms. For example, if a university suggests repurposing a group of classrooms to create a new lab, the fall 2017 utilization of those classrooms could be examined. Knowing the hours scheduled per week and seating capacity of the rooms proposed for renovation, the space utilization table could help identify nearby classrooms with remaining hours and appropriate seating capacity to absorb the potential displaced instruction.

Sample Space Utilization Table

	Classrooms			Class Labs			Other Scheduled Spaces		
	Low	Target Range	High	Low	Target Range	High	Low	Target Range	High
Seat Fill	<62%	62% to 77%	>77%	<75%	75% to 90%	>90%	No Criteria Applied		
Day Hours/Week	<29	29 to 35	>35	<19	19 to 26	>26			
Night Hours/Week	No Criteria Applied			No Criteria Applied					

No use reported in this category

							Classrooms				Class Labs				Other Scheduled Spaces			
Building	Room Number	Room STEM Category	Use Code	Room Area	Stations	Station Size	Day Hours	Day Seats	Night Hours	Night Seats	Day Hours	Day Seats	Night Hours	Night Seats	Day Hours	Day Seats	Night Hours	Night Seats
FINCH LABS	10		110	600	30	20	32	91.1%										
FINCH LABS	11		110	620	31	20	22	48.0%	14	46.7%								
FINCH LABS	12	Engineering	210	1,500	32	47					15	79.9%						
FINCH LABS	13	Engineering	210	1,500	30	50					24	49.7%	4	74.2%				
FINCH LABS	14	Hard Science	210	990	21	47					35	25.1%						
FINCH LABS	15	Hard Science	210	1,200	24	50					15	22.3%						
FINCH LABS	16	Hard Science	210	1,200	25	48					19	49.7%	6	56.1%				
FINCH LABS	17	Hard Science	220	1,400	28	50									14	56.1%		
FINCH LABS	18		520	5,000	250	20									5	38.3%		
FINCH LABS	19		610	3,200	160	20									22	83.8%		
FINCH LABS	20		610	1,850	93	20									4	33.3%		
GLEN HALL	320		110	800	41	20	25	69.3%	6	46.7%								
GLEN HALL	321		110	800	40	20	23	68.9%	5	33.3%								
GLEN HALL	322		110	910	46	20	23	52.0%										
GLEN HALL	323		110	710	36	20	6	53.6%	6	100.0%								
GLEN HALL	324		110	650	33	20	20	72.6%	3	16.7%								
GLEN HALL	325	Health Science	210	1,200	25	48					6	81.0%	8	20.1%				
GLEN HALL	326	Health Science	210	1,200	24	50					17	88.2%						
GLEN HALL	327	Health Science	210	1,450	29	50					25	90.3%						
GLEN HALL	328	Health Science	210	1,450	29	50					4	56.8%	12	55.5%				
HYDE HALL	200		110	600	30	20	11	81.3%										
HYDE HALL	201		110	620	22	28	23	78.5%	3	33.3%								
HYDE HALL	202		110	800	40	20	31	53.3%	3	27.1%								
HYDE HALL	203		110	800	40	20	27	64.9%	6	45.8%								
HYDE HALL	204		110	910	46	20	32	69.1%	3	45.8%								
HYDE HALL	205		410	710	36	20									15	27.1%		
HYDE HALL	206	Math	210	820	22	37					32	70.1%						
HYDE HALL	207	Math	210	1,200	38	32					28	68.3%						
HYDE HALL	208	Technology	210	1,500	30	50					17	80.1%	6	12.5%				

Capital Planning Tools

Appendix D (sample below) shows building condition, space type, enrollment growth, and calculated additional space needs by university and STEM category. This table could help the System evaluate construction and renovation priorities.

For example, if a discipline needs substantial additional space and its existing facilities are in generally good condition, the university might look for opportunities to repurpose suitable space in a nearby building in need of remodeling. This would reduce the university's backlog of deferred maintenance while creating the specialized STEM space required. In another scenario, perhaps a nearby building in poor condition could become a building site for new construction, thereby improving the built environment and maintaining STEM adjacencies.

Sample Appendix D - STEM Evaluation Table

Building Condition Code

1	Satisfactory Condition (No renovation needed)
2	Remodeling A (Renovation cost less than 25% of building replacement cost)
3	Remodeling B (Renovation cost between 25% and 50% of building replacement cost)
4	Remodeling C (Renovation cost more than 50% of building replacement cost)

ENG = Engineering
HARD SCI = Hard Science
HLTH SCI = Health Science
MATH = Mathematics
TECH = Technology

Notes

* Rounding caused variation in the enrollment projections limited to +/- one student per STEM category systemwide.
** When calculated net space need was negative, zero was entered.

			2017 Building Condition and STEM Space									2030 Additional Enrollment and STEM Space			
Region/ University	STEM Category	Condition	Labs	Offices	Study	Special Use	General Use	Service and Support	Clinic	Total	Percent in Condition Code	Enrollment Growth*	Labs (ASF)	Offices (ASF)	Total Space (ASF)
Western Region															
ASU	**ENG**	1		2,200				1,565		3,765	9.2%				
		2								0	0.0%				
		3								0	0.0%				
		4	29,900	6,572			789	90		37,351	90.8%				
	Subtotal		**29,900**	**8,772**			**789**	**1,655**		**41,116**		**56**	**19,699**	**3,080**	**22,779**
	HARD SCI	1	12,751	9,446		1,915	1,050	2,400		27,562	25.9%				
		2	41,828	20,138	1,118		1,759	2,206		67,049	63.1%				
		3	4,154	1,787			89	1,644		7,674	7.2%				
		4	1,940	2,004						3,944	3.7%				
	Subtotal		**60,673**	**33,375**	**1,118**	**1,915**	**2,898**	**6,250**		**106,229**		**489**	**42,504**	**8,510**	**51,014**
	HLTH SCI	1	973	1,529						2,502	1.6%				
		2			408		1,366			1,774	1.2%				
		3	5,182	3,484		561	226			9,453	6.1%				
		4	22,585	26,533		89,377	1,916			140,411	91.1%				
	Subtotal		**28,740**	**31,546**	**408**	**89,938**	**3,508**			**154,140**		**473**	**25,368**	**5,430**	**30,798**
	MATH	1								0	0.0%				
		2	3,288	6,130						9,418	100.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**3,288**	**6,130**						**9,418**		**246**	**4,871**	**4,350**	**9,221**
	TECH	1								0	0.0%				
		2	8,328	10,872				152		19,352	100.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**8,328**	**10,872**				**152**		**19,352**		**582**	**9,120**	**8,510**	**17,630**
ASU			**130,929**	**90,695**	**1,526**	**91,853**	**7,195**	**8,057**		**330,255**		**1,846**	**101,562**	**29,880**	**131,442**

Response to 2018 Senate Bill 99

North Carolina's 15 comprehensive universities that confer STEM degrees report standardized data sets to the UNC System annually. Universities' teaching practices may vary, but types of instructional spaces and their scheduled use follow typical patterns. JMZ was able to apply universal analytical methods to these 15 universities without deviations in process.

At times, a discipline or department has practices that preclude evaluation by traditional means. For example, a school of medicine conducts most instruction in a clinical setting. The time, duration, and location of instruction vary from week to week. Similarly, when a university launches a new program for which there is no precedent, historical utilization metrics may not apply.

The Brody School of Medicine at East Carolina University and the UNC Applied Physical Sciences and Institute for Convergent Science at UNC Chapel Hill are projects for which universal analytical methods yielded no valuable conclusions. To evaluate these capital requests in accordance with the 2018 Senate Bill 99 mandate, JMZ reviewed them based on pedagogy and existing building condition.

Brody School of Medicine at East Carolina University

While still in the planning stages, the proposed new Brody School of Medicine will approach 200,000 gross square feet (GSF) and will replace a substantial portion of the existing 480,279 GSF building.

The existing building was constructed in 1982 and renovated in 1999. The 38-year-old facility is in fair to poor condition (UNC System building condition code 3). If it were to be fully renovated to address building condition alone, a significant amount of specialized swing space would be required. Such swing space is not available.

The School strives to be a leader in rural medicine, a strategic goal that will require pedagogies, approaches, and space configurations that may not be supported by the existing facility. The School also seeks to increase enrollment by adding 40 students per class - a net increase of 160 students or nearly 50 percent.

To ensure programmatic efficiency, user comfort, energy efficiency, effective operations, and fluid collaboration, the Brody School of Medicine is pursuing new construction instead of comprehensive renovation. This strategy will result in demolition of some of the School's outdated existing facilities, thereby avoiding deferred maintenance renovation costs and stranded investment in the creation of highly specialized swing space.

Significant capital investment in the Brody School of Medicine is justified to address the fair to poor building condition. Due to the specialized spaces required, construction of swing space to temporarily house portions the School would be very costly. Strategic planning will be required to determine which portions of the Brody School of Medicine could be renovated and which should be replaced with new construction. Comprehensive renovation or new construction will allow the School to create the specialized spaces needed to house modern research and programs dedicated to rural health.

UNC Applied Physical Sciences and Institute for Convergent Science at UNC Chapel Hill

The proposal for an Institute for Convergent Science as a home for the Applied Physical Sciences responds to a need for interdisciplinary instruction and research space. The initiatives described in the Institute's fundraising campaign (https://campaign.unc.edu/funding-priority/institute-convergent-science/) require science and engineering facilities that are unlike Chapel Hill's existing instructional and research labs.

The University uses dedicated space for separate science and engineering disciplines spread across campus in different buildings of varying condition. Having consolidated, centralized space for Convergent Science is essential to support intended interdisciplinary collaboration. While the evaluation of research space was not part of this study, the University reported that much of their existing research space is not suitable for Convergent Science in condition, configuration, or location. Construction of new facilities for Applied Physical Sciences and the Institute for Convergent Science will allow old, outdated facilities to be retired or repurposed for other uses.

Whether through new construction, comprehensive renovation, or a combination of the two, creation of a facility for Convergent Science is justified. Detailed review of the proposed new building space program (space configuration and size) was not part of this study.

Response to 2018 Senate Bill 99

Other STEM Projects in Planning Phases

Individual universities' self-reported data may not reflect every nuance of their STEM space use or condition. Department-level scheduling practices, space quality evaluation methods, suitability or configuration of space, and new instructional initiatives are some factors that cannot be captured in the registrar's course schedule or UNC System space inventory.

For universities requesting STEM capital project funding, their University Analysis chapter in this study gives baseline analysis to guide further discussion. If the report does not show future space need in the related STEM category, the university should be asked to demonstrate how factors outside the self-reported data drive the need for a capital project.

UNC System Plan for Future STEM Capital Projects

Technologies are evolving rapidly nationwide, and university systems that respond nimbly to industry demands and changing STEM pedagogies will be best positioned to attract students. This report, in conjunction with the MGT report, will provide the UNC System with the tools it needs to justify and streamline its STEM facilities construction and renewal process.

The System will use this report to:

- Identify needs for STEM capital projects;
- Evaluate the projects in a systemwide framework;
- Determine the appropriateness of accommodating the needs within existing facilities;
- Develop systemwide and regional implementation plans; and
- Establish priorities for advancing requested STEM capital projects.

Resources for STEM Capital Planning

The remaining sections in this Systemwide STEM Capital Planning Study can be considered individually or in combination to inform capital planning decisions. Results displayed in this report offer high-level guidance to the System. Further analysis at the university level is required to determine whether the calculated space needs and utilization improvement opportunities in this report represent required capital projects.

University Analysis

A separate chapter for each of the 15 STEM degree-granting universities is provided and includes:

- Fall 2018 and projected 2030 STEM enrollment
- 2017 space allocation
- Fall 2017 weekly instructional space utilization
- Capacity to accommodate projected 2030 undergraduate and graduate instructional demand
- A summary of findings and additional clarifying information provided by the university

Appendices

The following data has been placed in the appendix of this report and may contribute to future discussions with universities about their enrollment projections, building conditions, STEM space allocation, instructional space utilization results, and unique space needs.

Appendix A
STEM Enrollment Projections by University and STEM Category

Appendix B
Space and Instruction Classified as STEM

Appendix C
Supplemental Information from Universities

Appendix D
STEM Evaluation Table

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University Analysis Introduction

Methodology

Three foundational datasets informed the analysis conducted by JMZ:

- The annual projected rate of enrollment change in STEM programs by university, as established by MGT.
- Each university's fall 2017 course schedule.
- 2017 STEM academic space allocation (measured in assignable square feet, or ASF), space use, seating capacity, and building condition as reported to the System by each university. Research space was excluded.

The enrollment projections used in this study represent **potential STEM growth** over the next decade. An individual university's enrollment growth and associated space needs may vary depending on strategic initiatives, growth or decline in non-STEM programs, and other factors that could not be predicted at the time of this study.

The course schedules provided weekly student clock hours (WSCH) delivered in each STEM discipline (regardless of a student's major) and were used to assess instructional utilization of classrooms and STEM-dedicated labs. Instructional **space utilization** analysis reveals whether recommended hourly and seat fill targets were met and, if not, where capacity may exist to absorb future enrollment. While lower division and graduate STEM students were not included in MGT's enrollment projections, JMZ's evaluation of course schedules accounted for their use of instructional space.

In some cases, **building condition** alone could become the impetus for a STEM capital project, regardless of the other factors. When all factors are considered in tandem, future space needs could be met by reassigning or repurposing existing space, thereby improving building conditions and offsetting the need for new construction.

University Reports

At each of the 15 STEM degree-granting universities, course schedule, space, and enrollment data were evaluated together to determine where additional STEM space could be needed by 2030. A report was prepared for each university to illustrate its unique STEM needs as part of the larger, systemwide whole.

The final pages of each university report provide a summary and next steps. The university's comments in response to their portion of the ***Systemwide STEM Capital Planning Study*** are included in Appendix C.

Process

Project Timeline

June 2018 North Carolina Senate Bill 99

March 2019 MGT begins

- Assess impacts of population change, education, and workforce needs
- Review prior studies, plans, and reports
- Work with STEM institutions to gather stakeholder input:
  - Programs
  - Preferences
  - Initiatives
  - Funding
  - Barriers
  - Enrollment Projections

July 2019 MGT final report issued

July 2019 JMZ begins

- Apply MGT enrollment projections to STEM instruction
- Classify STEM space in DAVE inventories
- Evaluate space needs resulting from enrollment growth
- Overlay building condition data
- Identify space needs and opportunities
- Consider STEM capital projects under construction

January 2020 Draft Reports issued to the System

February 2020 Presentations to Universities

- Draft reports sent in advance
- Additional data provided to Universities for review
- Universities invited to provide detailed comments and request follow-up virtual meetings

April-May 2020 Additional University Meetings

June 2020 University final comments received

July 2020 JMZ Final Report issued

Project Timeline

As shown in the timeline at left, this yearlong study began in July 2019 as the MGT ***STEM Program Needs Assessment*** study was being completed. MGT's enrollment projections were informed by discussions with each STEM degree-granting institution, which were summarized in Appendix E of that report.

From July 2019 through January 2020, JMZ worked closely with the UNC System office to establish the study methodology, analyze the 2017 self-reported data from the 15 institutions, quantify the impact of STEM capital projects already under construction, and prepare graphics and narratives to support the study results.

University Presentations and Comment Period

On February 10, 11, and 12, 2020, presentations were conducted with all 15 universities included in this study. Universities received their draft reports for review in advance of their presentation.

In late February 2020, the System Office sent each university their presentation along with report appendices A and B. Universities were encouraged to schedule follow-up meetings to further clarify and review the methodology used for the study. Seven universities participated in virtual meetings with the System Office and JMZ between April 27, 2020 and May 14, 2020.

By June 2020, all 15 universities had responded to a request from the System Office to submit supplemental information for the report. Some indicated that the February presentation, additional data, and/or follow-up meetings had sufficiently addressed their concerns. Others offered information that was not captured or was incorrect in their self-reported data. In some cases, universities provided details about initiatives or planned programs they felt could affect their future space needs.

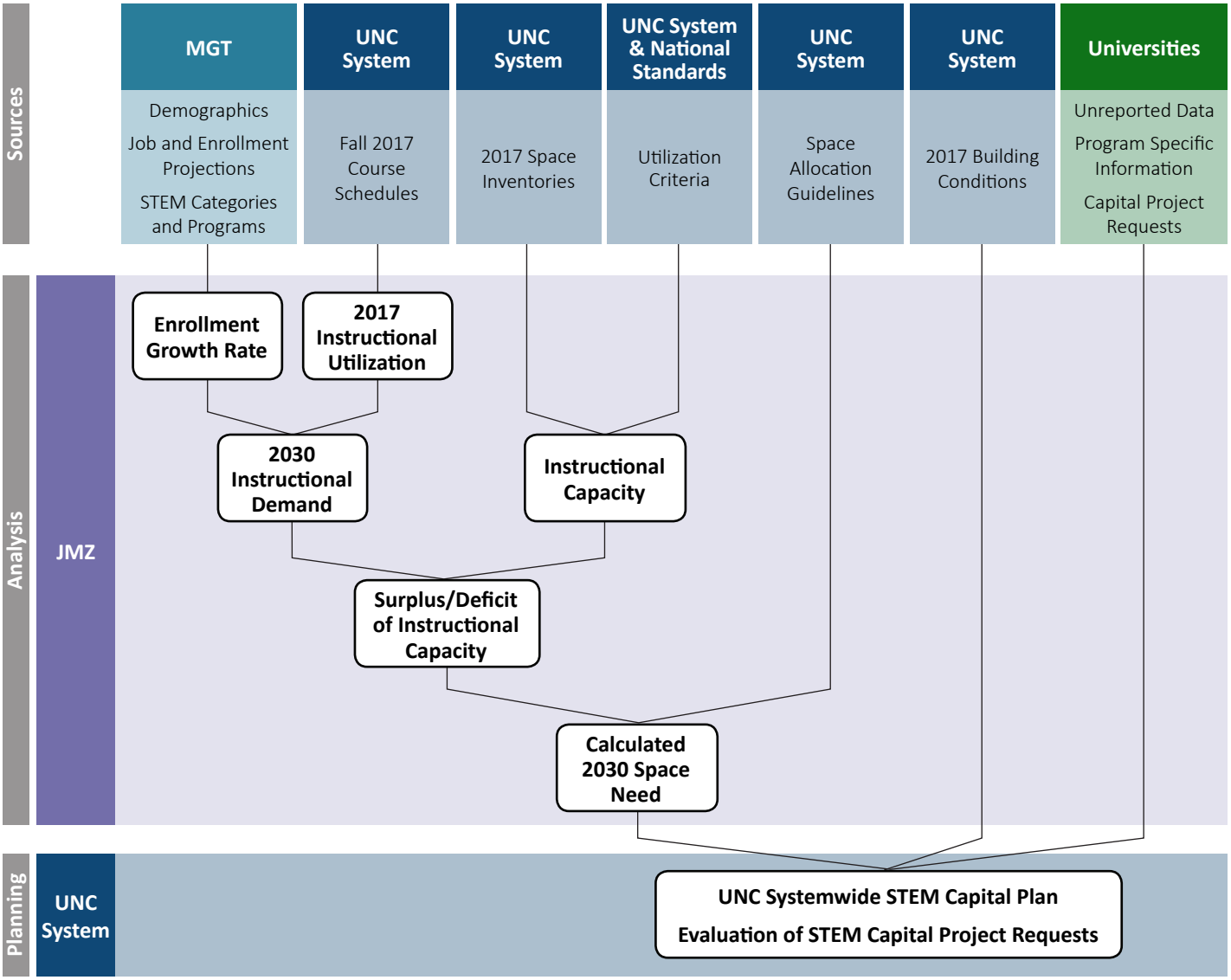
Each university's supplemental information is summarized in Appendix C of this report, with responses from JMZ where appropriate.

Process

Aggregate Data

This report compiles information and guidelines from multiple sources to create a framework for evaluation of capital funding requests. Results may be considered at a university level (as displayed in the University Analysis reports), by region, or systemwide.

Sources and Results



Process

Common Themes

During presentations, follow-up meetings, and in the universities' comments, several common themes emerged.

Use of Classification of Instructional Programs (CIP) Codes: The CIP system is used to code instructional programs to facilitate the organization, collection, and reporting of fields of study and program completions. Most CIP codes correspond to academic and occupational instructional programs offered for credit at the postsecondary level. The CIP methodology is widely used for higher education planning and was accepted by the System's academic affairs leaders for MGT's use in identifying STEM majors.

A number of universities suggested that use of CIP codes alone to analyze STEM instruction could exclude some STEM subjects. JMZ recognized this possibility during analysis and supplemented use of CIP codes with additional measures. When a university's course schedule included CIP codes, JMZ sorted the data according to the STEM CIP codes identified in the MGT report. When a university did not utilize CIP codes or when the codes did not capture all STEM instruction, JMZ sorted the course schedule by subject. If a discrepancy was discovered, the course name and instruction location were considered. Lists were then compared among universities to verify matching results.

Data Accuracy: Some universities discovered that the 2017 data they self-reported to the UNC System contained inaccuracies of varying magnitudes.

Most inaccuracies related to existing building conditions, space coding, and course scheduling (primarily surrounding health science courses). While wholesale verification of millions of square feet of space and thousands of courses was not possible as part of this study, the planning process brought to light the importance of the data submitted annually to the System. Additional clarifying data provided by each university has been reflected in Appendix C. Universities that had data accuracy issues expressed that their processes would be adjusted to ensure a higher degree of accuracy in future submissions to the System.

Leased Space: Universities that lease space for STEM education questioned why this space was included in the study since it does not "belong" to them.

It is assumed that universities lease STEM space because it is necessary for the delivery of STEM education. Therefore, leased space was analyzed in the same way as "owned" space. As the UNC System uses the results of this study to evaluate the need for future STEM-focused capital projects, leased space will have to be considered in terms of its function, location, necessity, partnership aspects, and other factors.

Research Space: Many universities, especially those with a substantial emphasis on STEM research, pointed out that their future STEM space needs picture would be incomplete if research space was not included in this study.

In response to the North Carolina Legislature's mandate, MGT's analysis was limited to STEM undergraduate enrollment to fill jobs requiring bachelor's degrees. Therefore, JMZ's subsequent study followed suit. The UNC System has discussed the value and possibility of including the evaluation of STEM research space as an addendum to this study in the future.

Putting the Results to Work

Technologies are evolving rapidly nationwide, and university systems that respond nimbly to industry demands and changing STEM pedagogies will be best positioned to attract students. This report, in conjunction with the MGT report, will provide the UNC System with the tools it needs to justify and streamline its STEM facilities construction and renewal process.

The System will use this report to:

- Identify needs for STEM capital projects;
- Evaluate the projects in a systemwide framework;
- Determine the appropriateness of accommodating the needs within existing facilities;
- Develop systemwide and regional implementation plans; and
- Establish priorities for advancing requested STEM capital projects.

University Analysis

Purpose of this Study

In March 2019 the UNC System commissioned a ***Systemwide STEM Program Needs Assessment,*** which was prepared by MGT Consulting Group. This report, the ***Systemwide STEM Capital Planning Study,*** builds upon MGT's work and provides a projection of the physical space required to accommodate future STEM enrollment. The UNC System will use this capital planning study to guide the development of a systemwide STEM capital improvement plan.

By 2030, Appalachian State University is projected to gain nearly 2,000 STEM upper division majors. Though its share of systemwide STEM students will remain the same at 7.7 percent, math and technology degrees are expected to grow faster at ASU than at most of the System's other universities. The analysis on the following pages can help the university fine tune its space utilization and prepare campus facilities to accommodate STEM growth.

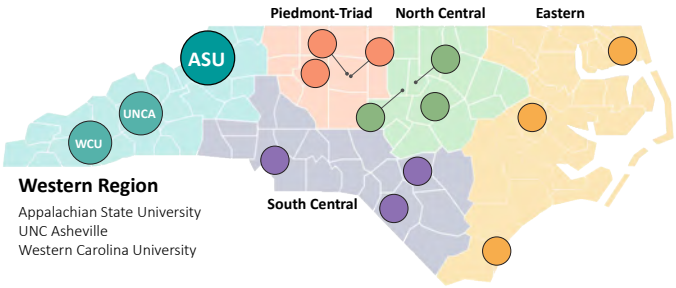
STEM Categories

MGT's study divided STEM majors into five categories: engineering, hard science, health science, math, and technology. In this study, physical space is sorted into the same five categories.

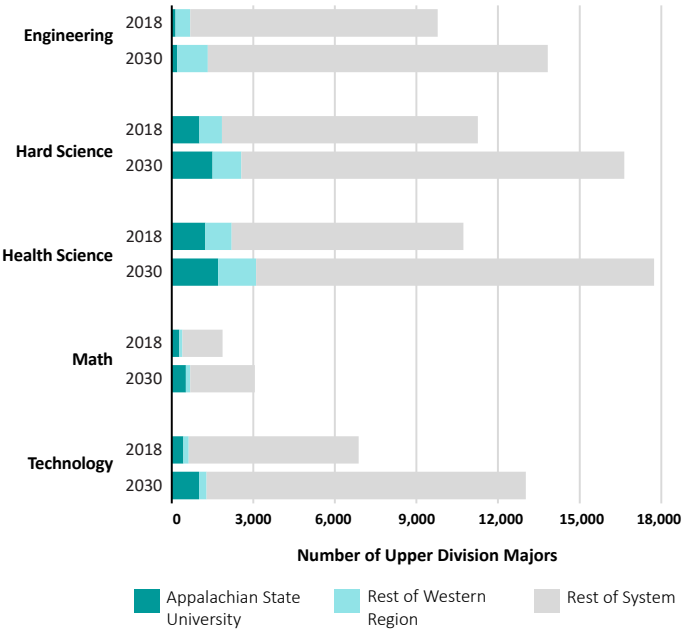
- Engineering space is dedicated to a broad range of engineering subjects, including hands-on technical instruction related to engineering programs.
- Hard science space houses lab-based sciences such as biology, chemistry, physics, geology, and anatomy and physiology. Social sciences are excluded.
- Health science space is dedicated to clinically-oriented, non-research health professions such as nursing and occupational therapy.
- Math space supports all math instruction.
- Technology space accommodates instruction in computer science and data analytics.

Most, but not all, fall 2017 instruction in designated STEM spaces was in STEM subjects. All instruction delivered in STEM spaces counted toward STEM weekly space utilization.

UNC System Regional Map



Appalachian State University STEM Majors

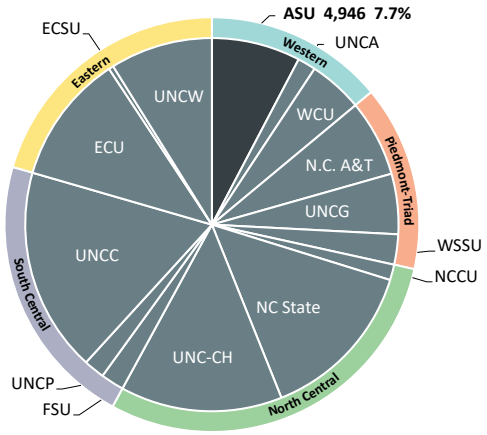


Undergraduate Enrollment

Understanding the Data Set

- MGT's enrollment analyses projected 2018 to 2028 enrollment growth of upper division majors only. JMZ extrapolated to 2030 using the MGT enrollment growth rate for the 2023-2028 period with some minor adjustments from the UNC System.
- While lower division and graduate STEM students were not included in MGT's enrollment projections, space needs associated with STEM growth of these groups are accounted for in this study.

Systemwide 2030 STEM Upper Division Enrollment



Western Region STEM Enrollment Outlook

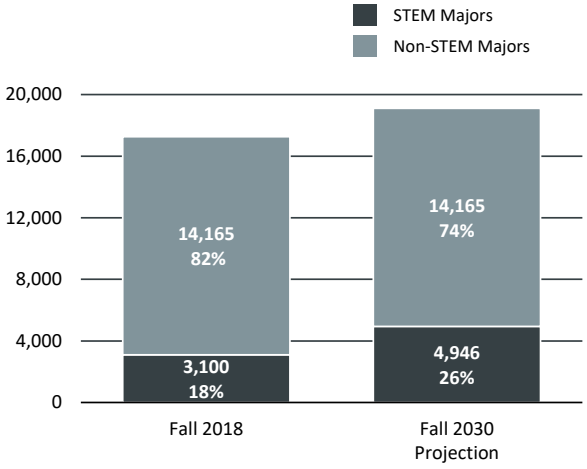
MGT considered industry growth, expected population change, and individual universities' enrollment targets in its enrollment analysis.

Population in the Western Region is projected to grow eight percent overall, yet the 18 to 24 year old age group is expected to shrink by four percent.

Historically, students living in the Western Region have had limited access to engineering and technology degrees at their home universities. Western Region institutions have launched initiatives to spur enrollment growth in these STEM categories. Enrollment in Western Region engineering programs is expected to grow faster by percentage than in the rest of the state.

ASU Upper Division STEM Majors

Headcount



Appalachian State STEM Highlights

(Source: Appendix E of the MGT Report)

- The university anticipates growth in health sciences, some of which can be accommodated in its newly-constructed Public Health Building.
- The College of Business offers scholarships, student engagement initiatives, and a Women in IT program to drive interest, enrollment, and retention in technology majors.
- ASU's Sustainable Technology and Built Environment program is approved as a prerequisite for the American Board of Certified Energy Practitioners' Photovoltaics, Solar Heating, and Small Wind Associates certification.

ASU Upper Division STEM Majors by Category

Headcount

STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering	144	201	*57*	*2.8%*
Hard Science	1,015	1,503	*488*	*3.3%*
Health Science	1,234	1,707	*473*	*2.7%*
Math	281	527	*246*	*5.4%*
Technology	426	1,008	*582*	*7.4%*
Total	**3,100**	**4,946**	***1,846***	***4.0%***

2017 Space Allocation

Understanding the Data Set

- Space allocation is based on 2017 UNC System data, self-reported by each university.
- Only buildings where space is allocated to STEM programs are included in this study.
- Space prorated for any amount of STEM is captured as 100 percent STEM since it is capable of supporting STEM education.
- General use classrooms are not counted as STEM-dedicated space. See Appendix B for a list of UNC System category codes considered STEM.
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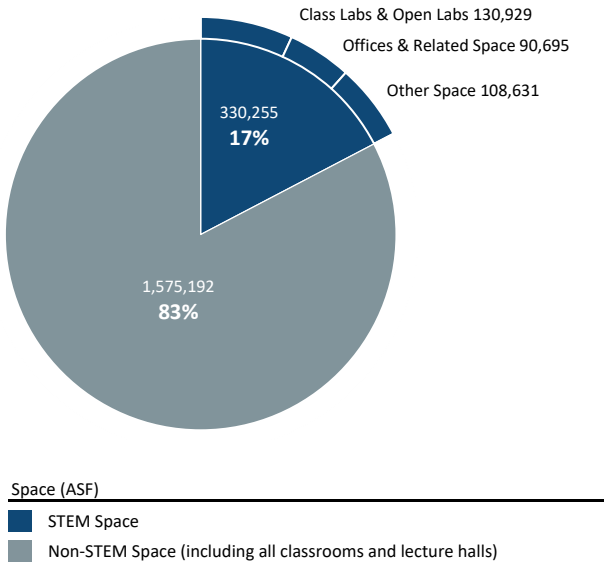
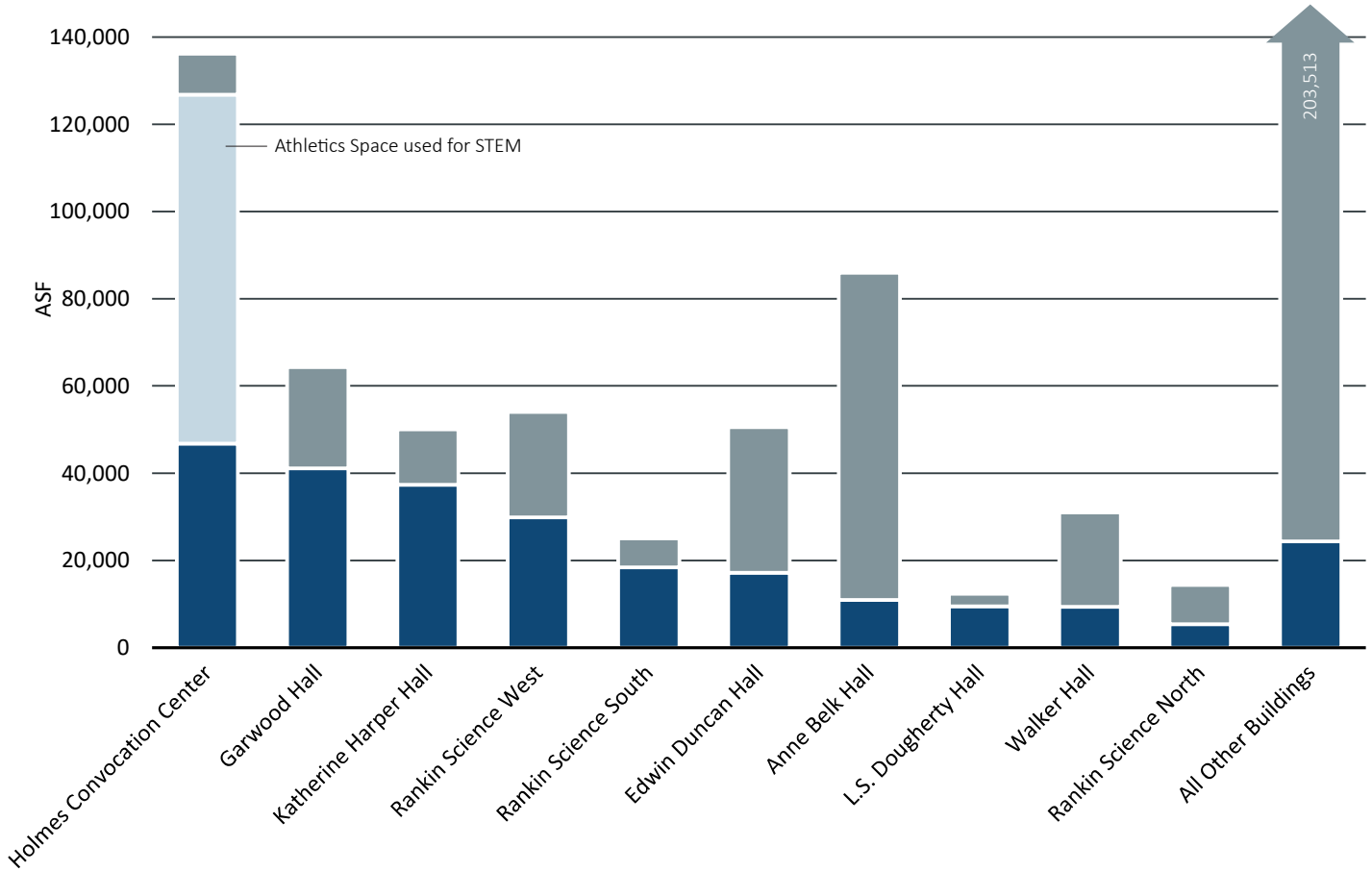
STEM Space Summary



2017 STEM Academic Space by Building



Instructional Space Utilization

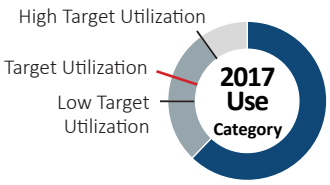
Understanding the Data Set

- Instructional space utilization is based on the fall 2017 course schedule (the most recent, fully vetted course schedule available at the time of this study).
- The study considered daytime room use in a 45-hour week based on the target criteria below from the Association for Learning Environments.
- While the study targets are ideal, a utilization range of five percent below or 10 percent above each target is considered reasonable.
- In a dedicated STEM space, all instruction delivered in that space was counted toward its fall 2017 utilization, including non-STEM courses.

Space Utilization Targets

	Seat Fill			Hours Used		
Space Type	Low	**Target**	High	Low	**Target**	High
Classrooms	62%	**67%**	77%	29	**31**	35
Class Labs	75%	**80%**	90%	19	**21**	26

Understanding the Results



Darkest tone: Fall 2017 space use (hourly or seat fill)

Middle tone: Remaining capacity within target range

Lightest tone: Remaining capacity above target range; use at this level is not expected

Utilization Summary

Classrooms

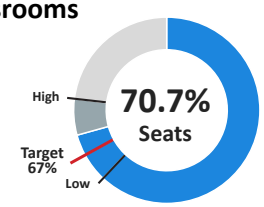
- On average, classroom seats were filled slightly above target capacity when they were in use.
- The lowest hourly target of 29 hours per week was not met.

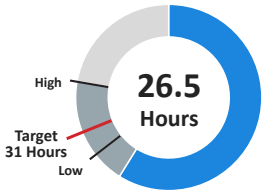
Class Labs

- Labs in all categories except technology met the target seat fill range. Engineering labs were overfilled.
- All labs had remaining hours available within the target range, yet the two scheduled math labs nearly met the highest hourly target.

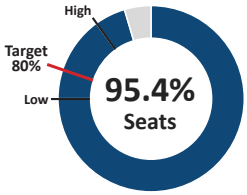
2017 Weekly Utilization - Seats and Hours

Classrooms

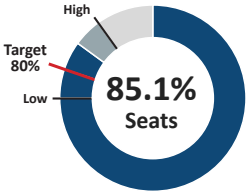




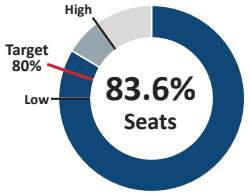
Engineering Labs



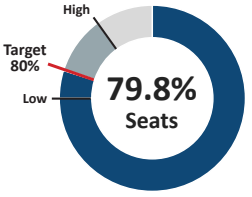
Hard Science Labs



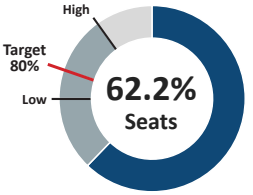
Health Science Labs



Math Labs



Technology Labs



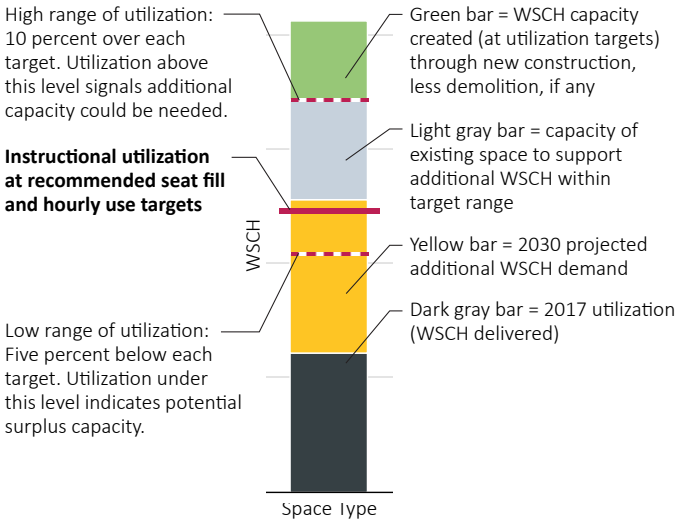
Weekly Instructional Capacity and Projections

Appalachian STATE UNIVERSITY

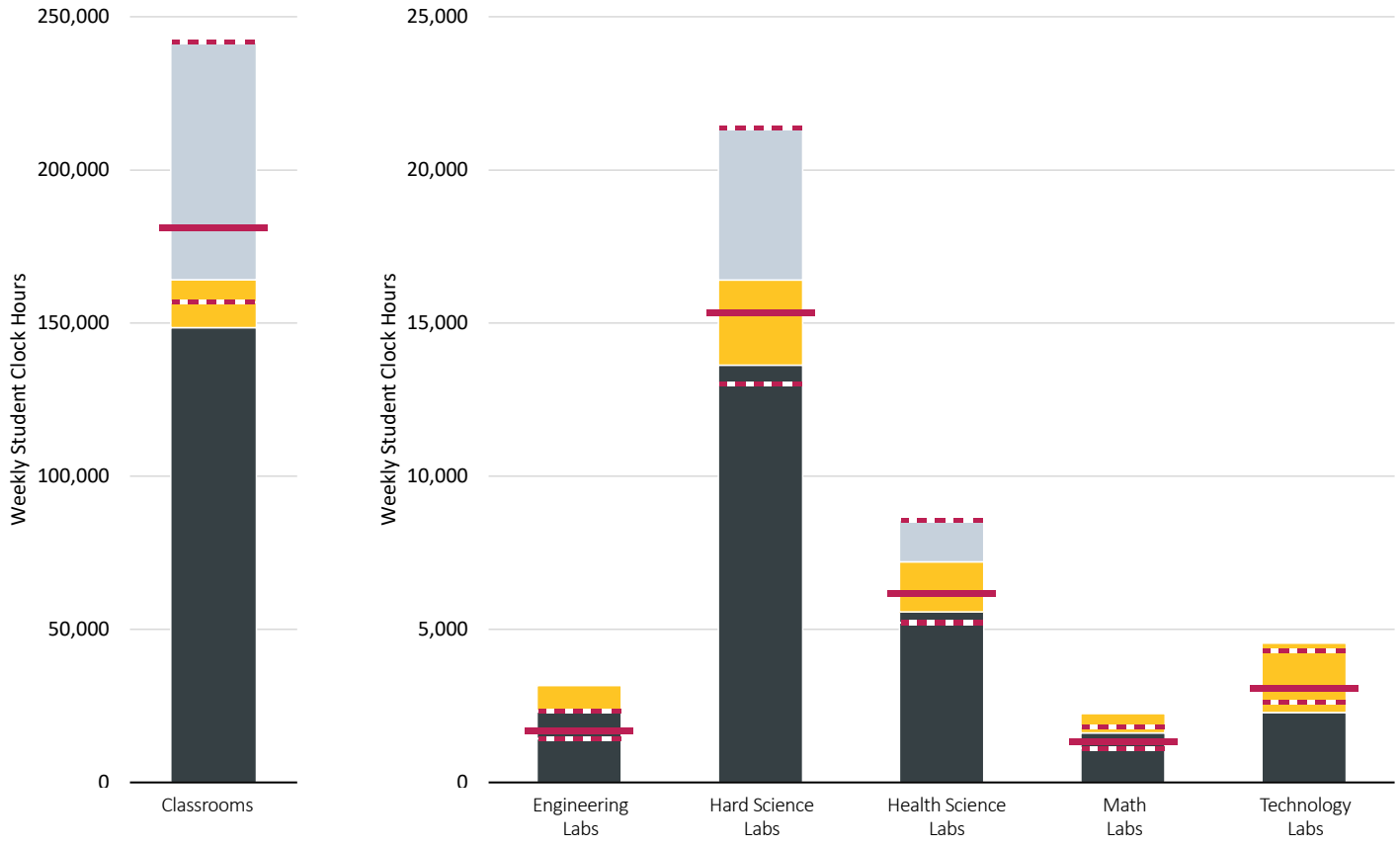
Understanding the Data Set

- An institution's capacity to accommodate future instruction is measured in weekly student clock hours (WSCH). One WSCH equals one student occupying one station for one hour.
- WSCH capacity is calculated using the number of stations in the 2017 space inventory with seat and hourly utilization target criteria applied.
- 2030 STEM course demand is projected to grow according to enrollment projections. Non-STEM course demand was held at the fall 2017 level.
- Graduate programs are evaluated separately. The effect of their growth on instructional demand is included later in this report.
- Future lab demand is based on the assumption that fall 2017 courses were scheduled in the labs best suited to deliver the required instruction.

Understanding the Results



Utilization, Capacity, and Projections



Space Implications of Enrollment Growth
Undergraduate

Understanding the Data Set

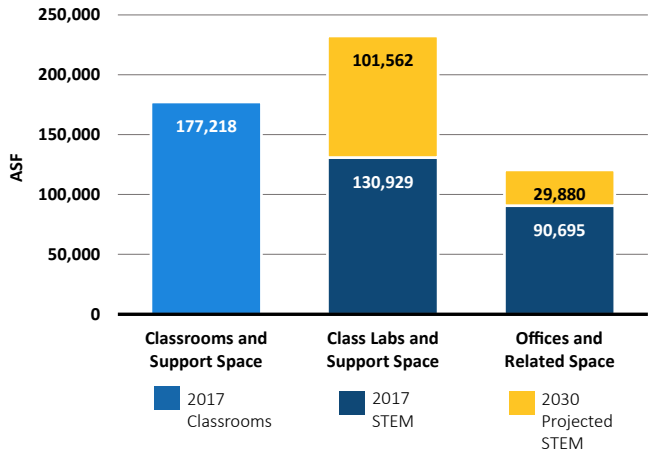
- Projections were made for classrooms, class labs, and office space only. Station sizes conform to UNC System standards.

Instructional Space	Station Size (ASF)
Classrooms	22
Engineering	108
Hard Science	70
Health Science	70
Math	33
Technology	50

Offices	Station Size (ASF)
Faculty	190
Staff (blended size)	140
Graduate Student	95

- If the projected 2030 instructional demand for an individual lab exceeded target capacity, a space need for an additional lab of the same type was generated. If a lab was not scheduled in 2017 or is projected to be underutilized in 2030, it could potentially offset future space demand.
- For each university, the 2018 STEM student:faculty and STEM faculty:staff ratios were maintained within System parameters. Since reliable data for current faculty and staff office space is not available, projections reflect the space needed for additional 2030 STEM faculty and staff only.
- The 2017 building condition codes were self-reported by each university to the UNC System. Building conditions were downgraded by one level in 2030 to reflect the presumed deterioration of structures if no substantial facilities improvements occur. None were reduced to demolition status.

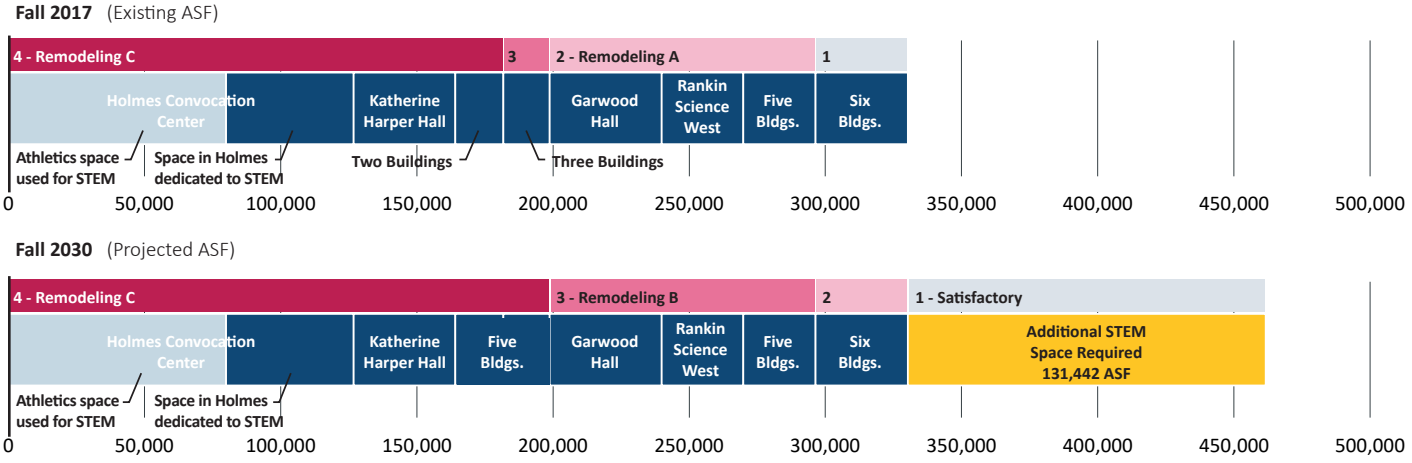
Academic Space by Category



Potential Space Offsets

	2017 Number of Labs		2030 Number of Labs	
	Labs (Inventory)	Labs Not Scheduled	Total Labs Needed	Underutilized Labs
Engineering	6	1	15	
Hard Science	44	3	69	20
Health Science	15	4	27	2
Math	2		5	
Technology	6		10	3
Total	73	8	126	25

STEM Academic Space by Building



Space Implications of Enrollment Growth
Graduate

Understanding the Data Set

- Graduate enrollment growth rates in this report were established using historical enrollment patterns and UNC System guidance. Graduate programs were not included in the MGT analysis.
- Without knowledge of specific graduate program curricula, it is assumed that all graduate students use on-campus space every semester.
- Projected 2030 instructional space demand for graduate students was layered on top of undergraduate demand. If the sum of 2030 undergraduate and graduate instruction would cause classrooms or labs to exceed target capacity, a space need for an additional room of the same type was generated.

Graduate Students by Category

Headcount

STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering	27	34	*7*	*1.9%*
Hard Science	77	100	*23*	*2.2%*
Health Science	165	205	*40*	*1.8%*
Math	15	23	*8*	*3.6%*
Technology	70	126	*56*	*5.0%*
Total	**354**	**488**	***134***	***2.7%***

Instruction by Course Level

STEM Category		WSCH 2017	WSCH 2030	*Annual Percent Change*
Engineering	Undergraduate	7,603	10,613	*2.8%*
	Graduate	206	261	*2.0%*
Subtotal		***7,809***	***10,873***	***2.8%***
Hard Science	Undergraduate	42,311	50,352	*1.5%*
	Graduate	693	917	*2.4%*
Subtotal		***43,004***	***51,269***	***1.5%***
Health Science	Undergraduate	13,344	18,470	*2.7%*
	Graduate	1,121	1,409	*1.9%*
Subtotal		***14,465***	***19,879***	***2.7%***
Math	Undergraduate	14,504	18,652	*2.1%*
	Graduate	180	286	*3.9%*
Subtotal		***14,684***	***18,938***	***2.1%***
Technology	Undergraduate	5,932	14,036	*7.4%*
	Graduate	285	546	*5.6%*
Subtotal		***6,217***	***14,582***	***7.4%***
Total STEM		**86,178**	**115,540**	***2.5%***

Space Implications

Classrooms

No additional classrooms will be required to accommodate projected STEM graduate enrollment growth in 2030.

Class Labs

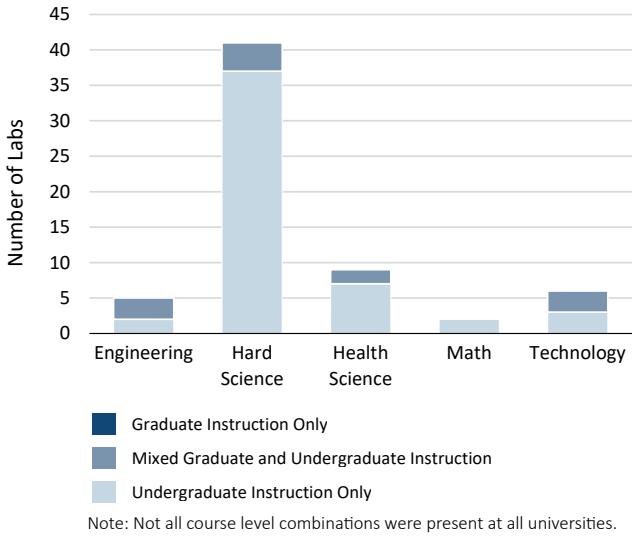
Most labs were used exclusively for undergraduate instruction in fall 2017. No labs at ASU were scheduled for graduate instruction only. In most cases, the additional lab space recommended to accommodate STEM undergraduate enrollment growth will likely satisfy the space needs of future STEM graduate students as well.

If enrollment projections are met, Garwood Hall room 244 would be over capacity in 2030. Garwood 244 is an 18-station digital electronics lab that served both undergraduates and graduates in fall 2017. It did not meet the hourly utilization target, but the seat fill target was exceeded. If the lab continues to have unused hourly capacity in 2030, additional lab sections could be scheduled in lieu of creating an additional lab. Using UNC standard station sizes, 1,512 ASF would be required to duplicate Garwood 244.

Offices

If enrollment projections are met, 12,730 ASF of additional graduate office space should be allocated to STEM to accommodate 134 additional graduate students.

2017 Use of Scheduled Labs by Course Level



Note: Not all course level combinations were present at all universities.

University Summary

Space Utilization Opportunities

Classrooms

- Four classrooms were not scheduled in fall 2017:
  - Smith Wright Hall 309
  - Living Learning 214
  - Garwood Hall 444
  - Anne Belk Hall 222
- There were 76 classrooms with station sizes smaller than 18 square feet. If stations in these rooms were right-sized to 22 square feet or larger, lecture capacity (WSCH) overall would be reduced.
- If enrollment surges, Appalachian State could increase seat fill targets to 80 percent in its 70 classrooms with station sizes greater than 22 square feet.

Engineering Labs

Five labs in Katherine Harper Hall used for Sustainable Technology and Built Environment instruction were used beyond recommended targets in fall 2017. One lab, Katherine Harper Hall 213, was not scheduled. Nearly all meetings in these labs were STEM courses. Increases in Sustainable Technology and Built Environment enrollment will further stress these high-demand labs.

The existing Sustainable Technology and Built Environment labs have relatively small capacities; one has 12 seats, three have 16 seats, one has 18 seats, and one has 22 seats. If future labs were to have the same capacities, an additional nine labs would be required to accommodate projected growth. Depending on specific program requirements, fewer labs with greater seating capacities could meet the projected need.

Hard Science Labs

By 2030, additional instructional capacity equivalent to 25 labs will be required to accommodate Hard Science instruction if enrollment projections are met. The capacity need can be addressed multiple ways:

- Repurpose existing unscheduled or underutilized space within Hard Science disciplines or campus-wide. Three labs were not scheduled in fall 2017: Garwood Hall 260, a Physics lab; Garwood 440, a Chemistry lab; and Rankin Science South 122, a Geology lab.
- Maximize utilization in existing Hard Science labs. Schedule data shows that 18 labs were used beyond recommended utilization targets in fall 2017. The remaining labs could be candidates to meet future needs through sharing or reassignment of space.
- Construct new labs in an addition or new building if the previous options do not satisfy the full future space need.

Health Science Labs

Class labs in the Holmes Convocation Center were used for both STEM and non-STEM education in fall 2017. The university recognized that continued growth of Health Science programs would reduce the availability of space in Holmes for physical education and recreation uses.

The new Leon Levine Hall of Health Sciences was opened in 2018 to house the Beaver School of Health Sciences. The University reports that the Leon Levine Hall of Health Sciences will accommodate demand for health science instruction through 2030.

Math Labs

The University's two Math labs were both highly utilized. Three additional Math labs are recommended to accommodate STEM growth.

Technology Labs

Six class labs were categorized as Technology labs in the space inventory, yet two of them were used for only Hard Science instruction in fall 2017. Technology majors are projected to more than double by 2030, so it is likely that all six labs coded for Technology will be needed for Technology instruction. The University should review space coding and departmental assignments of Computer Science labs in anticipation of enrollment growth.

University Summary

Next Steps

Data Accuracy

Information presented in this report is based, in part, on standard data submitted annually by individual universities to the UNC System. Inaccuracies in reported data could affect these results. Where possible, inconsistencies were identified, confirmed with the System, and corrected. However, room-by-room auditing of space data was beyond the scope of this study.

If the University believes a conclusion was drawn in error, the related data should be corrected by the university before its next submission to the System to ensure the validity of future studies.

Maximize Utilization at Pressure Points

Underutilized classrooms provide an opportunity to repurpose space to create additional labs and offices. However, if STEM enrollment projections are met, the University could approach target utilization, on average, within its existing classrooms. This may allow certain underutilized classrooms to be repurposed, yet may not yield sufficient surplus space to offset future STEM space needs.

As enrollment grows, the University may need additional STEM lab space before funding is available to build or renovate. The University should plan strategically to identify enrollment thresholds that, when met, prompt actions such as scheduling evening lab courses, increasing target seat utilization in labs (within safe limits), and/or sharing lab space among disciplines (where pedagogically feasible).

Supplemental Information from the University

University comments can be found in Appendix C.

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University Analysis

Purpose of this Study

In March 2019 the UNC System commissioned a ***Systemwide STEM Program Needs Assessment,*** which was prepared by MGT Consulting Group. This report, the ***Systemwide STEM Capital Planning Study,*** builds upon MGT's work and provides a projection of the physical space required to accommodate future STEM enrollment. The UNC System will use this capital planning study to guide the development of a systemwide STEM capital improvement plan.

By 2030, UNC Asheville is expected to gain over 300 STEM upper division majors. Over half of these will be engineering majors in UNC Asheville's joint engineering program with NC State. Over 80 additional hard science majors are expected at Asheville in the next decade. The analysis on the following pages can help the university fine tune its space utilization and prepare campus facilities to accommodate STEM growth.

STEM Categories

MGT's study divided STEM majors into five categories: engineering, hard science, health science, math, and technology. In this study, physical space is sorted into the same five categories.

- Engineering space is dedicated to a broad range of engineering subjects, including hands-on technical instruction related to engineering programs.
- Hard science space houses lab-based sciences such as biology, chemistry, physics, geology, and anatomy and physiology. Social sciences are excluded.
- Health science space is dedicated to clinically-oriented, non-research health professions such as nursing and occupational therapy.
- Math space supports all math instruction.
- Technology space accommodates instruction in computer science and data analytics.

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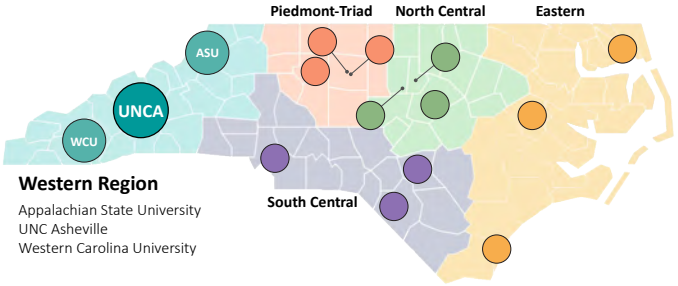
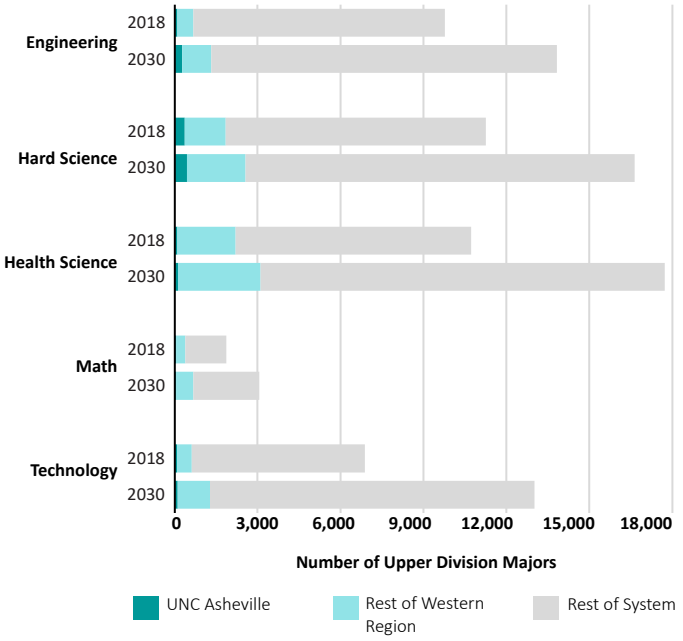
UNC System Regional Map



UNC Asheville STEM Majors



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Understanding the Data Set

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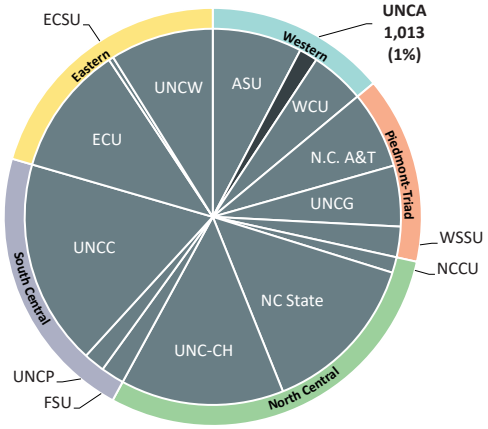
Systemwide 2030 STEM Upper Division Enrollment



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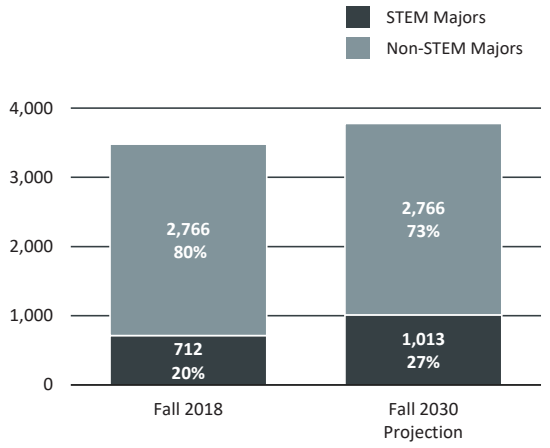
Historically, students living in the Western Region have had limited access to engineering and technology degrees at their home universities. Western Region institutions have launched initiatives to spur enrollment growth in these STEM categories. Enrollment in Western Region engineering programs is expected to grow faster by percentage than in the rest of the state.

UNCA Upper Division STEM Majors

Headcount



UNC Asheville STEM Highlights

(Source: Appendix E of the MGT Report)

- The University's health sciences programs are helping improve rural healthcare access, in part through collaboration with the North Carolina Center for Health and Wellness, which offers students research opportunities.
- New maker spaces and engineering shop equipment are assets to new and growing STEM programs, yet equipment maintenance is challenging.
- The cooperative engineering programs with NC State have been very successful and are growing quickly. There is concern that growth may be limited by faculty teaching loads.

UNCA Upper Division STEM Majors by Category

Headcount

STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering	105	272	*167*	*8.3%*
Hard Science	368	450	*82*	*1.7%*
Health Science	98	122	*24*	*1.8%*
Math	51	57	*6*	*0.9%*
Technology	90	112	*22*	*1.8%*
Total	**712**	**1,013**	***301***	***3.0%***

2017 Space Allocation

Understanding the Data Set

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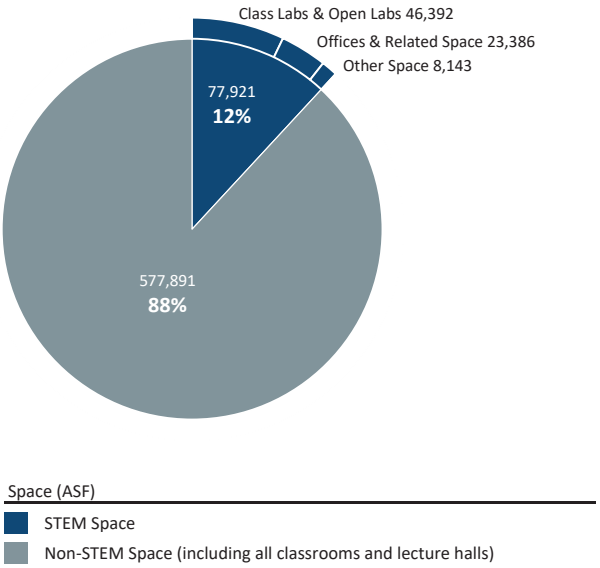
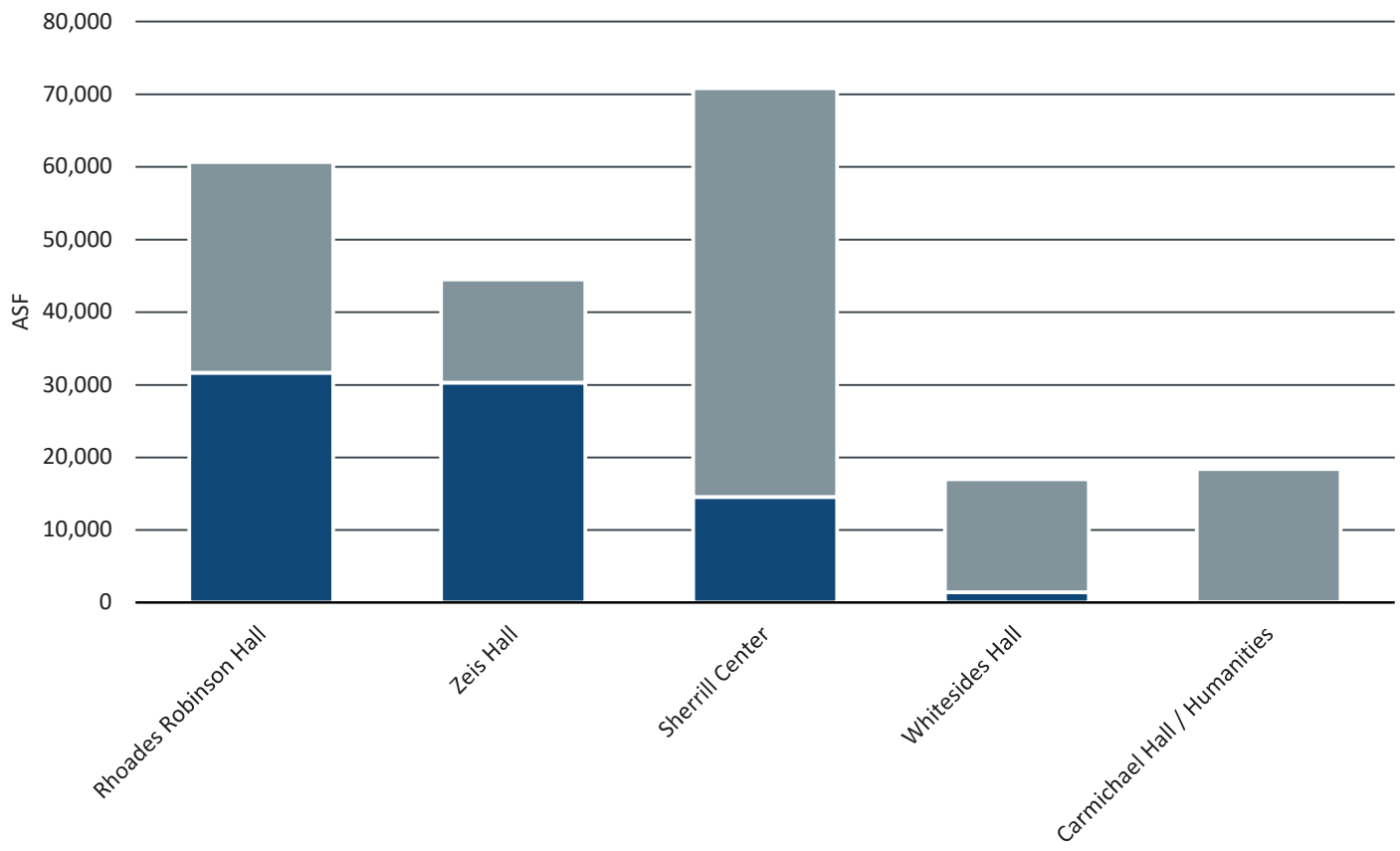


2017 STEM Academic Space by Building



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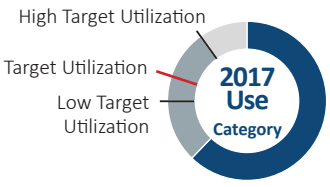
Space Type	Low	**Target**	High	Low	**Target**	High
Classrooms	62%	**67%**	77%	29	**31**	35
Class Labs	75%	**80%**	90%	19	**21**	26

Understanding the Results



Darkest tone: Fall 2017 space use (hourly or seat fill)

Middle tone: Remaining capacity within target range

Lightest tone: Remaining capacity above target range; use at this level is not expected

Utilization Summary

Classrooms

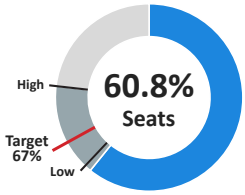
- On average, classrooms did not reach the low seat fill target when they were in use.
- The lowest hourly use target of 29 hours was not met.

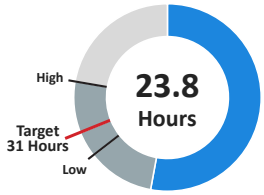
Class Labs

- Hard Science labs reached the target seat fill. Technology labs approached the high target seat fill. Engineering labs had additional seating capacity.
- On average, no STEM labs met the hourly use target range.

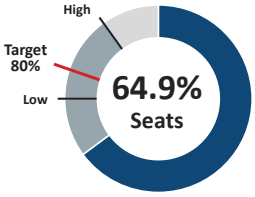
2017 Weekly Utilization - Seats and Hours

Classrooms

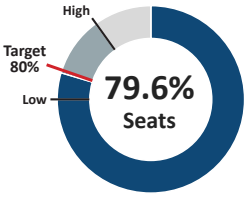




Engineering Labs

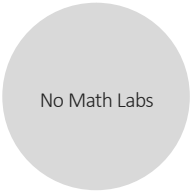


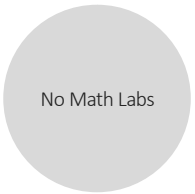
Hard Science Labs



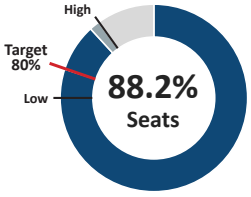
Health Science Labs

Math Labs





Technology Labs



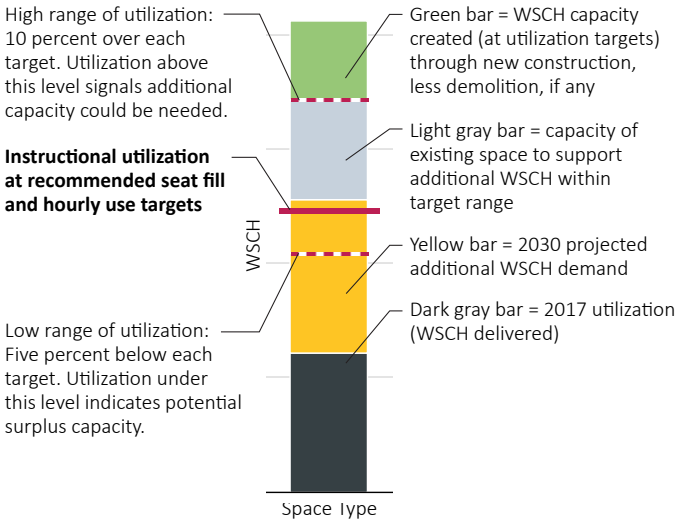
Weekly Instructional Capacity and Projections

University of North Carolina Asheville

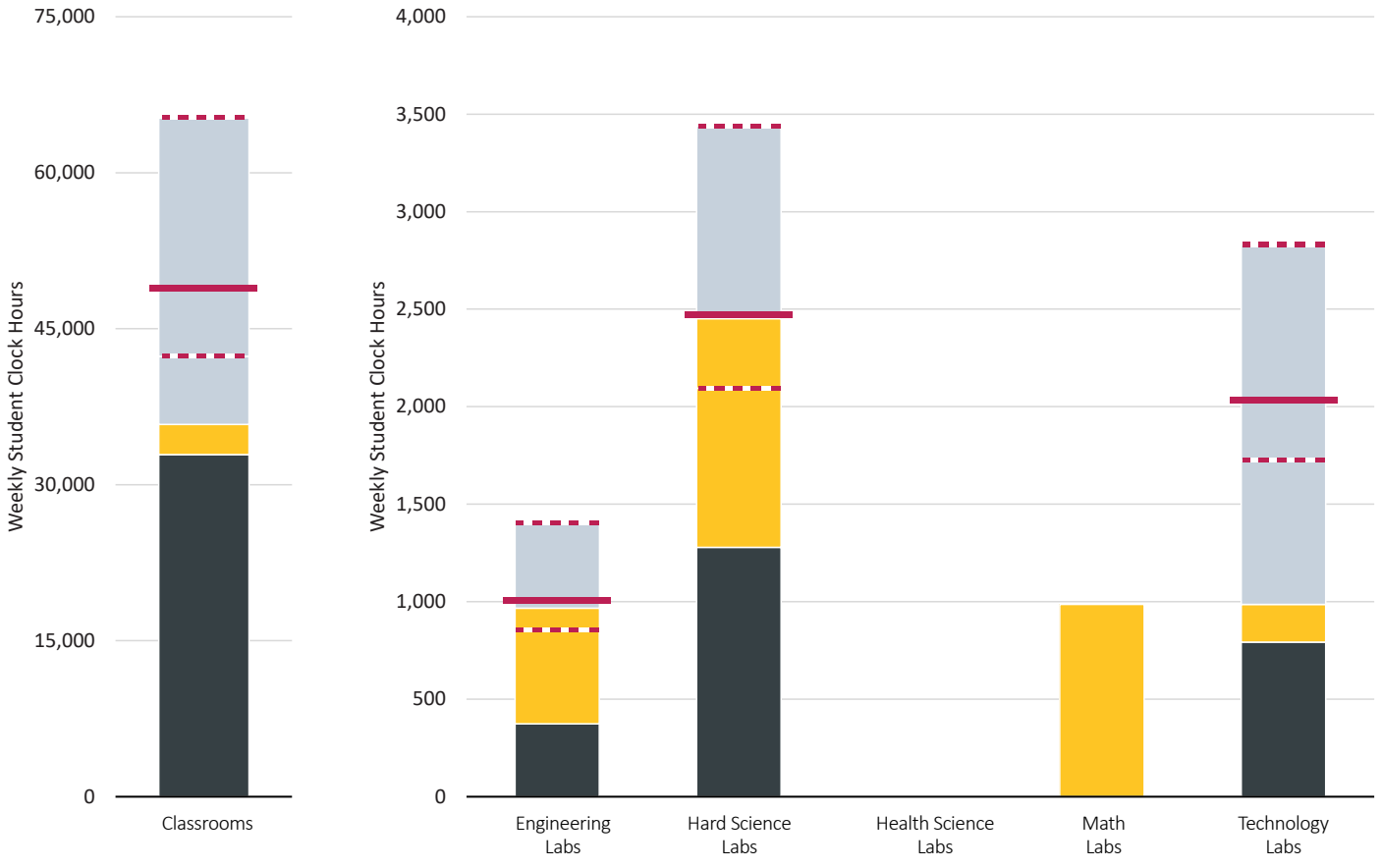
Understanding the Data Set

- An institution's capacity to accommodate future instruction is measured in weekly student clock hours (WSCH). One WSCH equals one student occupying one station for one hour.
- WSCH capacity is calculated using the number of stations in the 2017 space inventory with seat and hourly utilization target criteria applied.
- 2030 STEM course demand is projected to grow according to enrollment projections. Non-STEM course demand was held at the fall 2017 level.
- Graduate programs are evaluated separately. The effect of their growth on instructional demand is included later in this report.
- Future lab demand is based on the assumption that fall 2017 courses were scheduled in the labs best suited to deliver the required instruction.

Understanding the Results



2017 Utilization and 2030 Projections



Space Implications of Enrollment Growth

Undergraduate

Understanding the Data Set

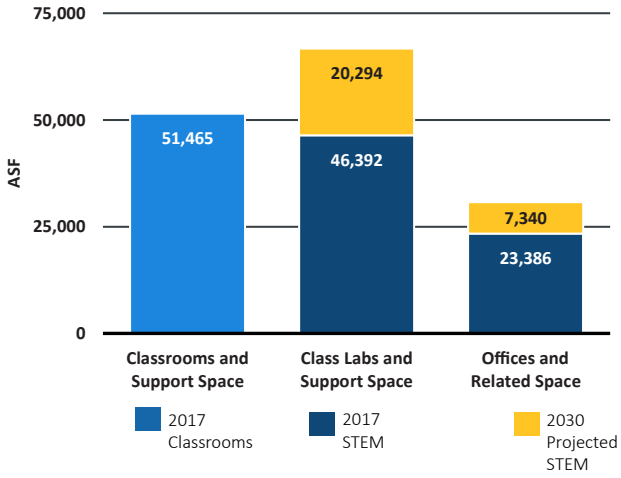
- Projections were made for classrooms, class labs, and office space only. Station sizes conform to UNC System standards.

Instructional Space	Station Size (ASF)
Classrooms	22
Engineering	108
Hard Science	70
Health Science	70
Math	33
Technology	50

Offices	Station Size (ASF)
Faculty	190
Staff (blended size)	140
Graduate Student	95

- If the projected 2030 instructional demand for an individual lab exceeded target capacity, a space need for an additional lab of the same type was generated. If a lab was not scheduled in 2017 or is projected to be underutilized in 2030, it could potentially offset future space demand.
- For each university, the 2018 STEM student:faculty and STEM faculty:staff ratios were maintained within System parameters. Since reliable data for current faculty and staff office space is not available, projections reflect the space needed for additional 2030 STEM faculty and staff only.
- The 2017 building condition codes were self-reported by each university to the UNC System. Building conditions were downgraded by one level in 2030 to reflect the presumed deterioration of structures if no substantial facilities improvements occur. None were reduced to demolition status.

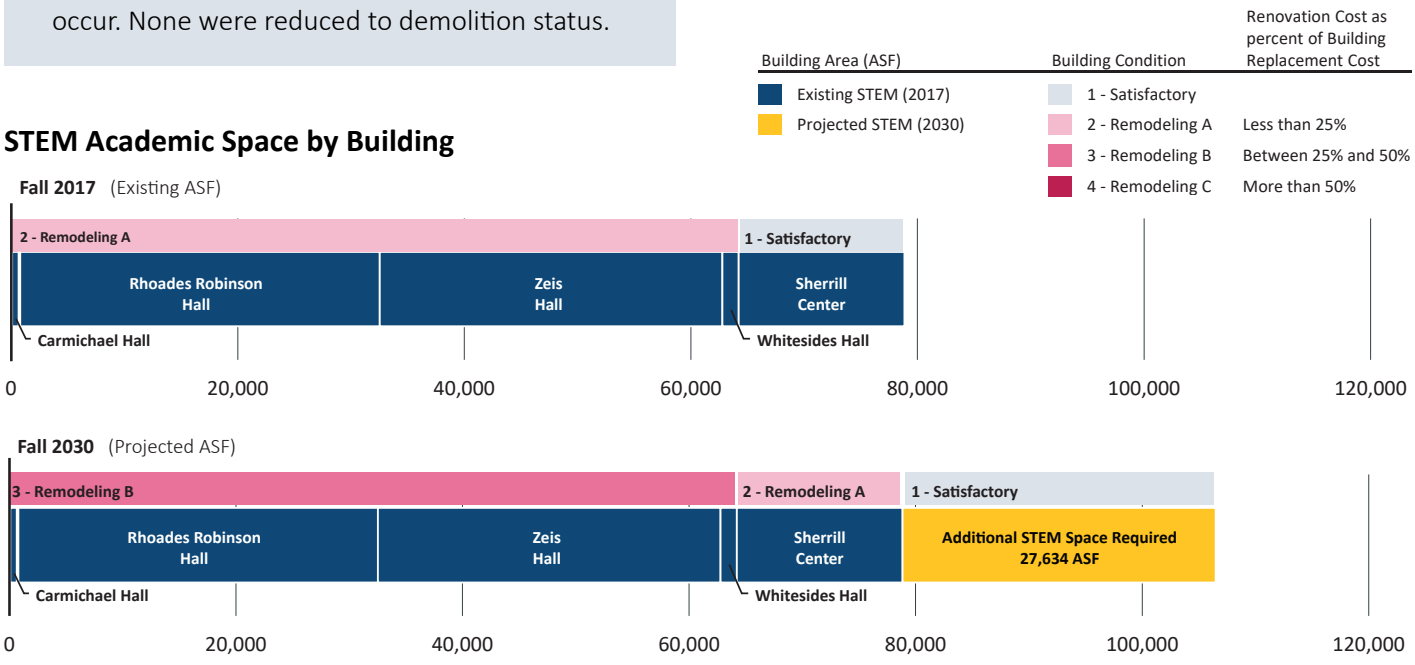
Academic Space by Category



Potential Space Offsets

	2017 Number of Labs		2030 Number of Labs	
	Labs (Inventory)	Labs Not Scheduled	Total Labs Needed	Underutilized Labs
Engineering	3	1	5	
Hard Science	7	1	8	5
Health Science				
Math				
Technology	5	2	7	1
Total	15	4	20	6

STEM Academic Space by Building



University Summary

Space Utilization Opportunities

Classrooms

- All but three of the University's 66 classrooms were scheduled in fall 2017. Owens Hall 302A, Karpen Hall 5, and Karpen Hall 6 were not scheduled. The overall average hourly utilization was low. There will be sufficient capacity in the existing classrooms to accommodate the projected growth in STEM lecture instruction.
- There were 9 classrooms with station sizes smaller than 18 square feet. If stations in these rooms were right-sized to 22 square feet or larger, lecture capacity (WSCH) overall would be reduced.
- If enrollment surges, UNC Asheville could increase seat fill targets to 80 percent in its 29 classrooms with station sizes greater than 22 square feet.

Engineering Labs

Three labs in Rhoades-Robinson Hall were dedicated to Engineering instruction; two were scheduled in daytime fall 2017. Both scheduled labs are projected to exceed instructional capacity by 2030. Two additional labs are recommended.

Hard Science Labs

All of the University's six Hard Science labs were scheduled. One Physics lab, Rhoades-Robinson room 111, is expected to exceed instructional capacity if enrollment projections are met.

Many Biology, Environmental Science, Physics, and Chemistry courses were taught in open labs. Over 6,500 ASF of the total projected additional lab space needed is intended to accommodate these courses and their expected 2030 growth.

Health Science Labs

There were no class labs dedicated to Health Science. Two Health Science open labs were lightly scheduled in fall 2017.

Math Labs

There were no class labs dedicated to Math. Math and Statistics were taught in classrooms and in one open lab, Rhoades-Robinson room 211. Instructional demand in Rhoades-Robinson room 211 is projected to exceed capacity by 2030. Additional lab space was added to the class lab projection to accommodate this instruction.

Technology Labs

Five class labs were categorized as technology labs in the space inventory; three were scheduled. Two of the scheduled labs are projected to exceed capacity by 2030. Two additional labs are recommended.

Next Steps

Data Accuracy

Information presented in this report is based, in part, on standard data submitted annually by individual universities to the UNC System. Inaccuracies in reported data could affect these results. Where possible, inconsistencies were identified, confirmed with the System, and corrected. However, room-by-room auditing of space data was beyond the scope of this study.

If the University believes a conclusion was drawn in error, the related data should be corrected by the university before its next submission to the System to ensure the validity of future studies.

Maximize Utilization at Pressure Points

Underutilized classrooms provide an opportunity to repurpose space to create additional labs and offices. While there is an apparent surplus of classrooms at the University, underutilized space may not be in the right location or configuration to offset STEM space needs.

As enrollment grows, the University may need additional lab space before funding is available to build or renovate. The University should plan strategically to identify enrollment thresholds that, when met, prompt actions such as scheduling evening lab courses, increasing target seat utilization in labs (within safe limits), and/or sharing lab space among disciplines (where pedagogically feasible).

Supplemental Information from the University

University comments can be found in Appendix C.

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University Analysis

Purpose of this Study

In March 2019 the UNC System commissioned a ***Systemwide STEM Program Needs Assessment,*** which was prepared by MGT Consulting Group. This report, the ***Systemwide STEM Capital Planning Study,*** builds upon MGT's work and provides a projection of the physical space required to accommodate future STEM enrollment. The UNC System will use this capital planning study to guide the development of a systemwide STEM capital improvement plan.

By 2030, Western Carolina University is expected to gain nearly 1,100 upper division STEM majors. Over 75 percent of these will be engineering and health science students. The analysis on the following pages can help the university fine tune its space utilization and prepare campus facilities to accommodate STEM growth.

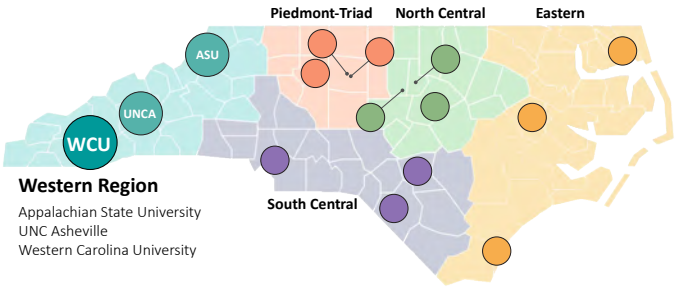
STEM Categories

MGT's study divided STEM majors into five categories: engineering, hard science, health science, math, and technology. In this study, physical space is sorted into the same five categories.

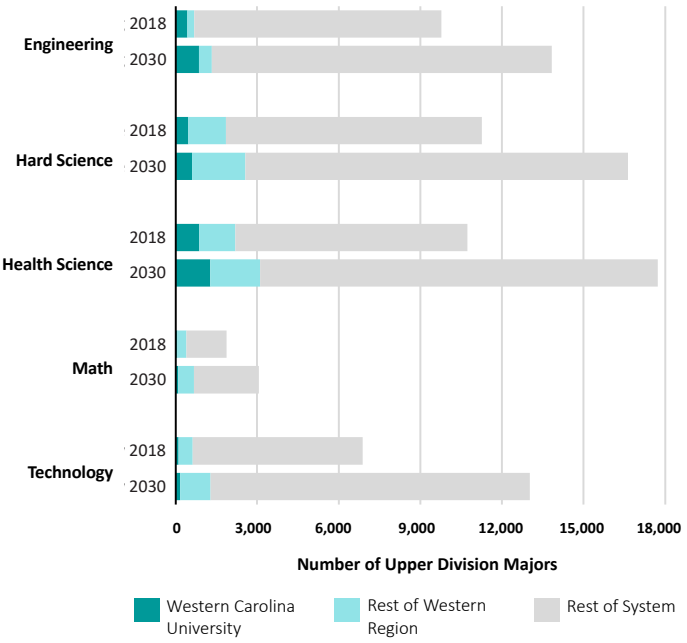
- Engineering space is dedicated to a broad range of engineering subjects, including hands-on technical instruction related to engineering programs.
- Hard science space houses lab-based sciences such as biology, chemistry, physics, geology, and anatomy and physiology. Social sciences are excluded.
- Health science space is dedicated to clinically-oriented, non-research health professions such as nursing and occupational therapy.
- Math space supports all math instruction.
- Technology space accommodates instruction in computer science and data analytics.

Most, but not all, fall 2017 instruction in designated STEM spaces was in STEM subjects. All instruction delivered in STEM spaces counted toward STEM weekly space utilization.

UNC System Regional Map



Western Carolina University STEM Majors

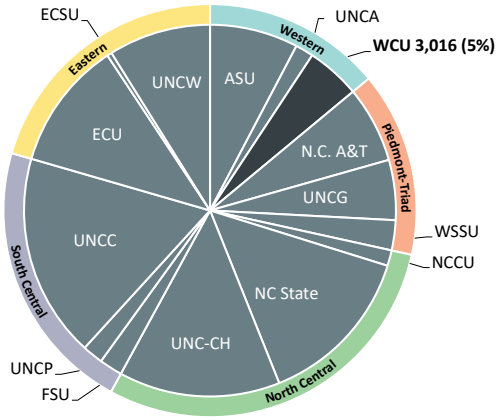


Undergraduate Enrollment

Understanding the Data Set

- MGT's enrollment analyses projected 2018 to 2028 enrollment growth of upper division majors only. JMZ extrapolated to 2030 using the MGT enrollment growth rate for the 2023-2028 period with some minor adjustments from the UNC System.
- While lower division and graduate STEM students were not included in MGT's enrollment projections, space needs associated with STEM growth of these groups are accounted for in this study.

Systemwide 2030 STEM Upper Division Enrollment



Western Region STEM Enrollment Outlook

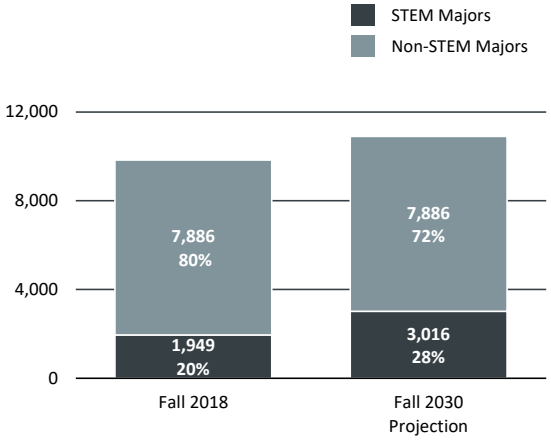
MGT considered industry growth, expected population change, and individual universities' enrollment targets in its enrollment analysis.

Population in the Western Region is projected to grow eight percent overall, yet the 18 to 24 year old age group is expected to shrink by four percent.

Historically, students living in the Western Region have had limited access to engineering and technology degrees at their home universities. Western Region institutions have launched initiatives to spur enrollment growth in these STEM categories. Enrollment in Western Region engineering programs is expected to grow faster by percentage than in the rest of the state.

WCU Upper Division STEM Majors

Headcount



Western Carolina University STEM Highlights

(Source: Appendix E of the MGT Report)

- Expanded capstone projects, relationships with regional employers, and new STEM instruction facilities have helped WCU with attraction and retention.
- The university envisions a new data analytics program in the next decade, which would be an interdisciplinary effort with the math, information technology, and business departments.
- The university offers an integrated health program with no clinical requirements. With limited clinical sites in the area, the major is an attractive option for students starting in the health professions.

WCU Upper Division STEM Majors by Category

Headcount

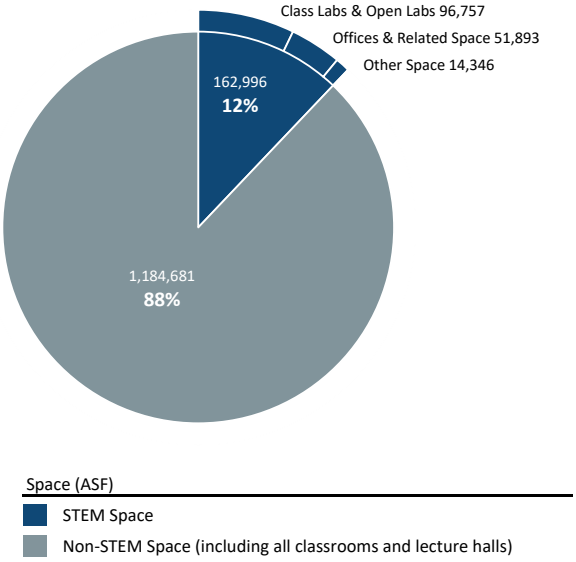
STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering	435	859	*424*	*5.8%*
Hard Science	467	614	*147*	*2.3%*
Health Science	872	1,280	*408*	*3.3%*
Math	64	97	*33*	*3.5%*
Technology	111	166	*55*	*3.4%*
Total	**1,949**	**3,016**	***1,067***	***3.7%***

2017 Space Allocation

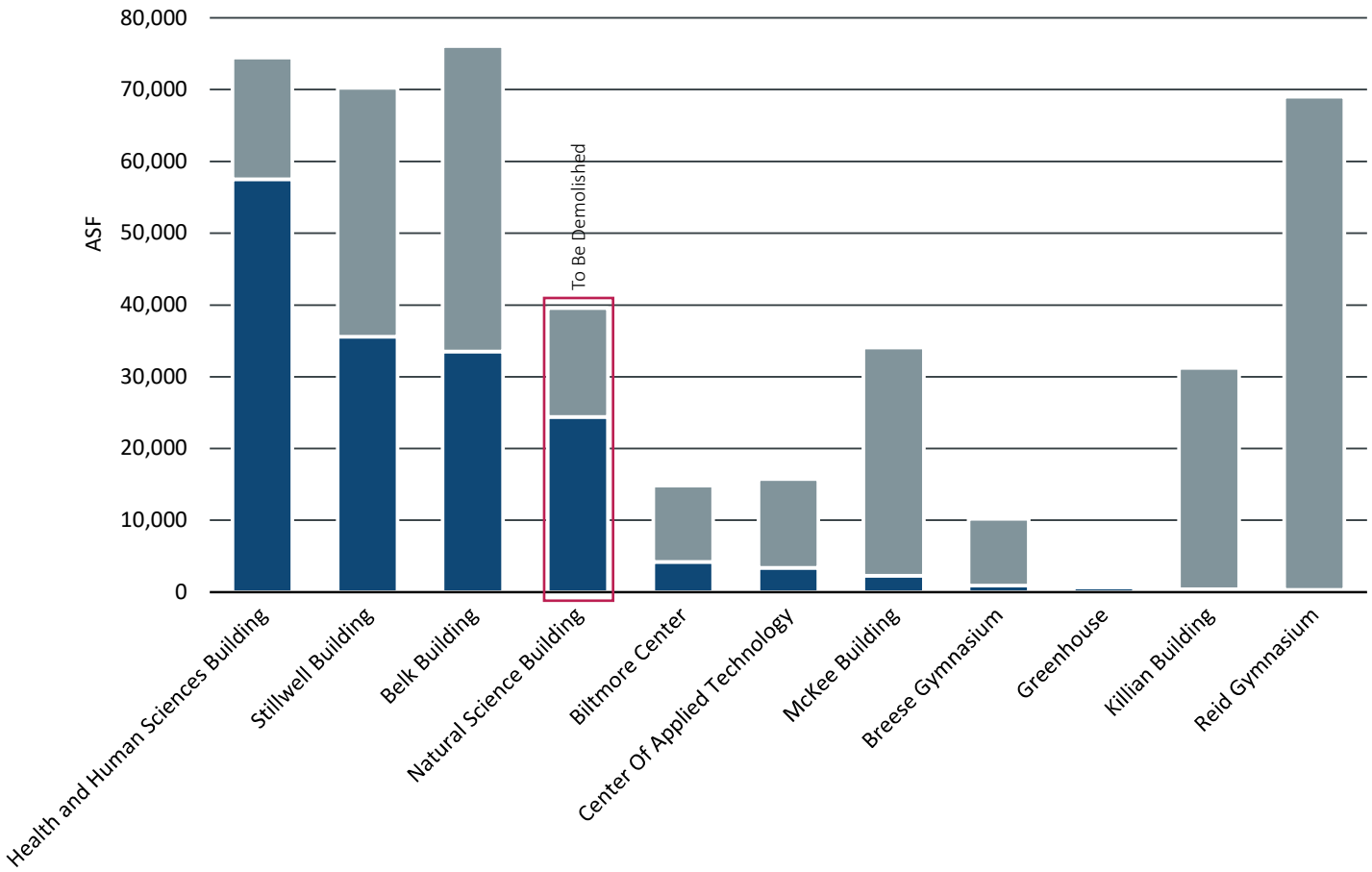
Understanding the Data Set

- Space allocation is based on 2017 UNC System data, self-reported by each university.
- Only buildings where space is allocated to STEM programs are included in this study.
- Space prorated for any amount of STEM is captured as 100 percent STEM since it is capable of supporting STEM education.
- General use classrooms are not counted as STEM-dedicated space. See Appendix B for a list of UNC System category codes considered STEM.
- The study does not include research or related space. However, the instructional spaces in the study may support research activities during unscheduled hours.
- Program space is quantified in assignable square feet (ASF).

STEM Space Summary



2017 STEM Academic Space by Building



Instructional Space Utilization

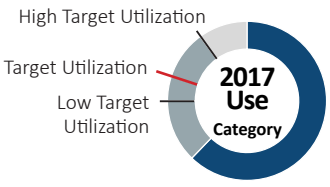
Understanding the Data Set

- Instructional space utilization is based on the fall 2017 course schedule (the most recent, fully vetted course schedule available at the time of this study).
- The study considered daytime room use in a 45-hour week based on the target criteria below from the Association for Learning Environments.
- While the study targets are ideal, a utilization range of five percent below or 10 percent above each target is considered reasonable.
- In a dedicated STEM space, all instruction delivered in that space was counted toward its fall 2017 utilization, including non-STEM courses.

Space Utilization Targets

	Seat Fill			Hours Used		
Space Type	Low	**Target**	High	Low	**Target**	High
Classrooms	62%	**67%**	77%	29	**31**	35
Class Labs	75%	**80%**	90%	19	**21**	26

Understanding the Results



Darkest tone: Fall 2017 space use (hourly or seat fill)

Middle tone: Remaining capacity within target range

Lightest tone: Remaining capacity above target range; use at this level is not expected

Utilization Summary

Classrooms

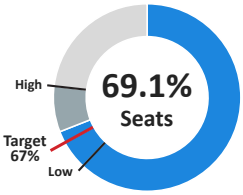
On average, classroom seat fill met the 67 percent target when rooms were in use. Hourly utilization nearly reached the lowest hourly use target of 29 hours.

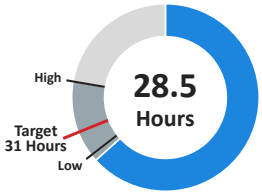
Class Labs

- Seat fill in Health Science and Hard Science labs reached the target range. Engineering labs did not meet the target seat fill.
- Hard Science labs met the low hourly use target. Engineering labs and Health Science labs did not meet the hourly utilization target.

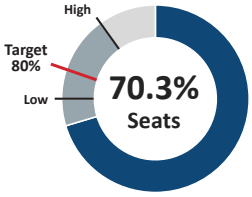
2017 Weekly Utilization - Seats and Hours

Classrooms

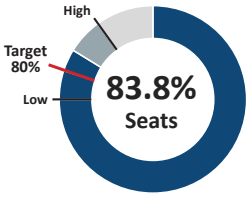




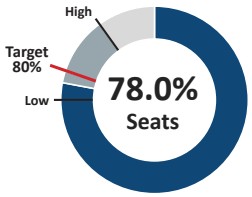
Engineering Labs



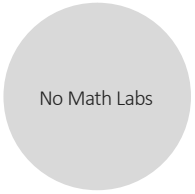
Hard Science Labs

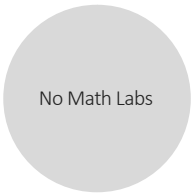


Health Science Labs



Math Labs





Technology Labs

Weekly Instructional Capacity and Projections

Western Carolina University

Understanding the Data Set

- An institution's capacity to accommodate future instruction is measured in weekly student clock hours (WSCH). One WSCH equals one student occupying one station for one hour.
- WSCH capacity is calculated using the number of stations in the 2017 space inventory with seat and hourly utilization target criteria applied.
- 2030 STEM course demand is projected to grow according to enrollment projections. Non-STEM course demand was held at the fall 2017 level.
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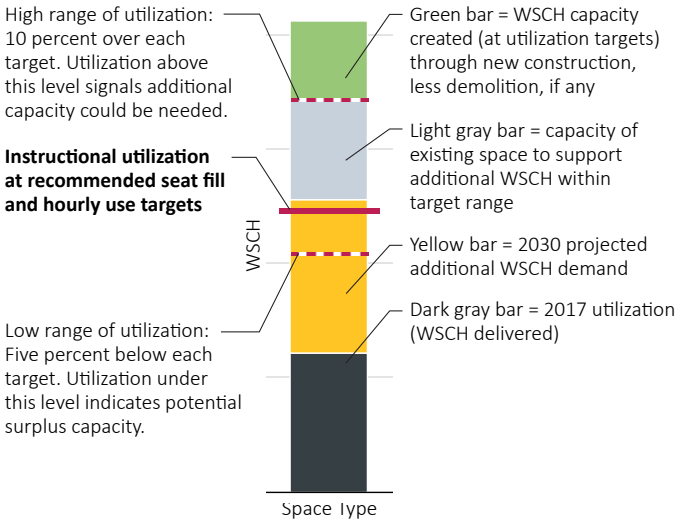
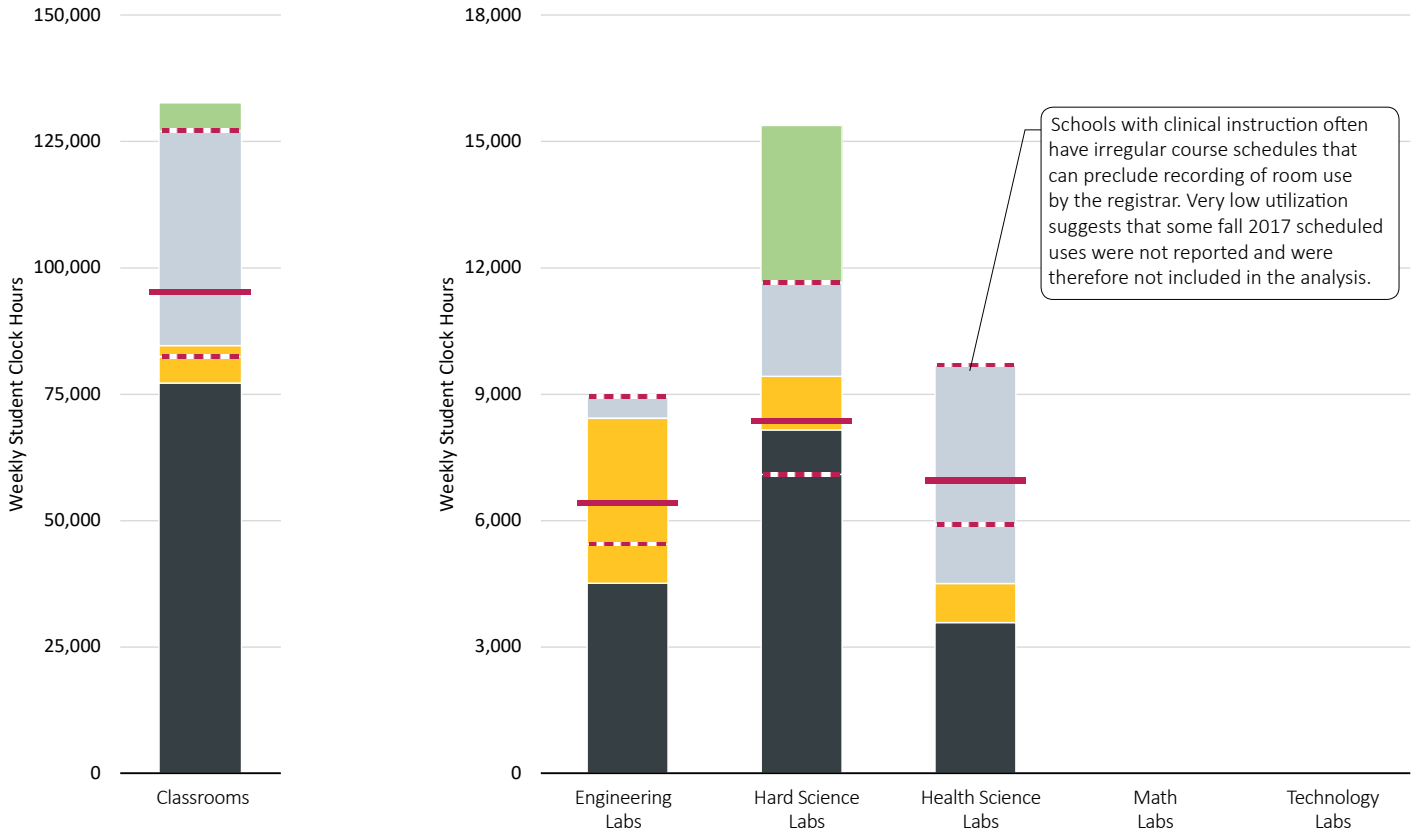
- Future lab demand is based on the assumption that fall 2017 courses were scheduled in the labs best suited to deliver the required instruction.

Understanding the Results



2017 Utilization and 2030 Projections



Space Implications of Enrollment Growth
Undergraduate

Understanding the Data Set

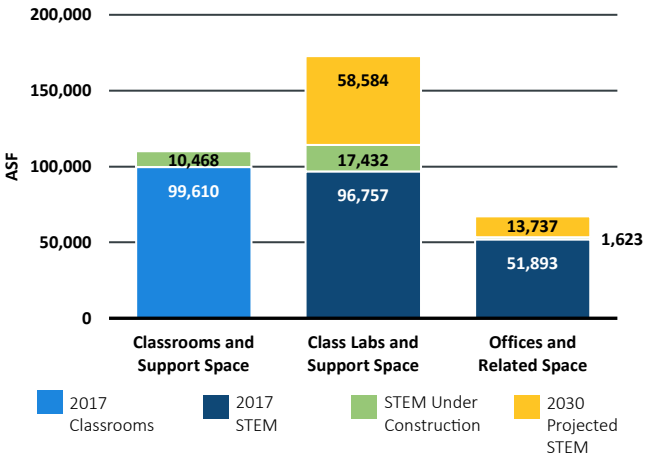
- Projections were made for classrooms, class labs, and office space only. Station sizes conform to UNC System standards.

Instructional Space	Station Size (ASF)
Classrooms	22
Engineering	108
Hard Science	70
Health Science	70
Math	33
Technology	50

Offices	Station Size (ASF)
Faculty	190
Staff (blended size)	140
Graduate Student	95

- If the projected 2030 instructional demand for an individual lab exceeded target capacity, a space need for an additional lab of the same type was generated. If a lab was not scheduled in 2017 or is projected to be underutilized in 2030, it could potentially offset future space demand.
- For each university, the 2018 STEM student:faculty and STEM faculty:staff ratios were maintained within System parameters. Since reliable data for current faculty and staff office space is not available, projections reflect the space needed for additional 2030 STEM faculty and staff only.
- The 2017 building condition codes were self-reported by each university to the UNC System. Building conditions were downgraded by one level in 2030 to reflect the presumed deterioration of structures if no substantial facilities improvements occur. None were reduced to demolition status.

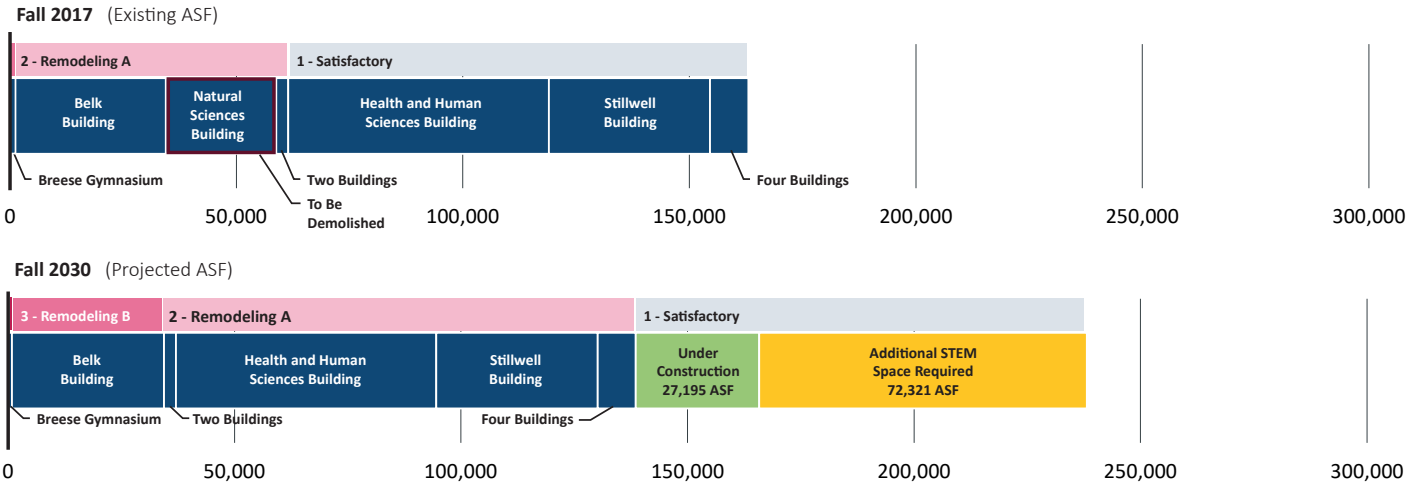
Academic Space by Category



Potential Space Offsets

	2017 Number of Labs		2030 Number of Labs	
	Labs (Inventory)	Labs Not Scheduled	Total Labs Needed	Underutilized Labs
Engineering	13	1	22	4
Hard Science	20		24	8
Health Science	22	7	27	10
Math				
Technology				
Total	55	8	73	22

STEM Academic Space by Building



Space Implications of Enrollment Growth
Graduate

Understanding the Data Set

- Graduate enrollment growth rates in this report were established using historical enrollment patterns and UNC System guidance. Graduate programs were not included in the MGT analysis.
- Without knowledge of specific graduate program curricula, it is assumed that all graduate students use on-campus space every semester.
- Projected 2030 instructional space demand for graduate students was layered on top of undergraduate demand. If the sum of 2030 undergraduate and graduate instruction would cause classrooms or labs to exceed target capacity, a space need for an additional room of the same type was generated.

Graduate Students by Category

Headcount

STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering	75	119	*44*	*3.9%*
Hard Science	38	46	*8*	*1.6%*
Health Science	397	514	*117*	*2.2%*
Math				
Technology				
Total	**510**	**679**	***169***	***2.4%***

Undergraduate and Graduate Instruction

STEM Category		WSCH 2017	WSCH 2030	*Annual Percent Change*
Engineering	Undergraduate	5,436	10,735	*5.8%*
	Graduate	99	163	*4.3%*
Subtotal		***5,535***	***10,897***	***5.8%***
Hard Science	Undergraduate	20,269	22,800	*1.0%*
	Graduate	96	116	*1.6%*
Subtotal		***20,365***	***22,915***	***1.0%***
Health Science	Undergraduate	14,444	21,218	*3.3%*
	Graduate	1,196	1,571	*2.3%*
Subtotal		***15,639***	***22,789***	***3.2%***
Math	Undergraduate	5,710	6,825	*1.5%*
	Graduate			
Subtotal		***5,710***	***6,825***	***1.5%***
Technology	Undergraduate	841	1,257	*3.4%*
	Graduate			
Subtotal		***841***	***1,257***	***3.4%***
Total STEM		**48,089**	**64,683**	***2.5%***

Space Implications

Classrooms

No additional classrooms will be required to accommodate projected STEM graduate enrollment growth in 2030.

Class Labs

Most labs were used exclusively for undergraduate instruction in fall 2017. Three labs were scheduled for graduate instruction only. The additional lab space recommended to accommodate STEM undergraduate enrollment growth will likely satisfy the space needs of future STEM graduate students as well.

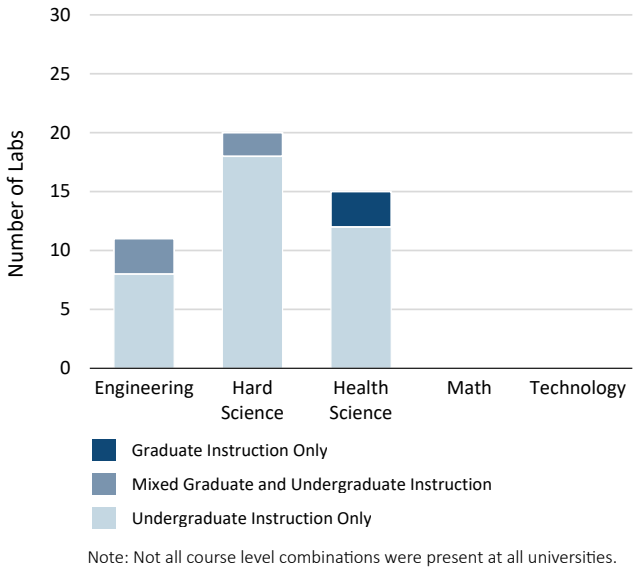
The combined undergraduate and graduate demand for hard science labs at WCU will result in many labs approaching their target capacity. Utilization of hard science labs will need to meet seat fill and hourly targets if the demand is to be accommodated.

In the health sciences, the cadaver lab will approach target utilization if graduate and undergraduate enrollment targets are met.

Offices

If enrollment projections are met, 16,055 ASF of additional graduate office space should be allocated to STEM to accommodate 169 additional graduate students.

2017 Use of Scheduled Labs by Course Level



Note: Not all course level combinations were present at all universities.

University Summary

Space Utilization Opportunities

Classrooms

- All of the University's 108 classrooms were scheduled in fall 2017. There will be sufficient seats in classrooms to meet 2030 demand, though average utilization could exceed the low targets.
- There were 27 classrooms with station sizes smaller than 18 square feet. If stations in these rooms were right-sized to 22 square feet or larger, lecture capacity (WSCH) overall would be reduced.
- If enrollment surges, WCU could increase seat fill targets to 80 percent in its 37 classrooms with station sizes greater than 22 square feet.

Engineering Labs

Thirteen class labs were dedicated to Engineering instruction in fall 2017. Twelve were scheduled. Belk 209 was not scheduled.

Eight labs will be overscheduled in 2030 if enrollment projections are met. To meet projected demand, nine additional labs could be needed.

There is a lab at the Biltmore Center (room 105) that was called an Electrical Lab, but it was scheduled for Health Science instruction.

Hard Science Labs

All Hard Science labs were scheduled in fall 2017. An additional nine labs would be needed by 2030 to accommodate demand. The new Tom Apodaca Science Building will include five of the needed labs. An additional four could be required. The capacity need can be addressed multiple ways:

- Repurpose existing unscheduled or underutilized space within Hard Science disciplines or campus-wide. When the Tom Apodaca Science Building is occupied, some labs in Stillwell Hall may be available to be repurposed.
- Maximize utilization in existing Hard Science labs. Schedule data shows that eight labs may not reach recommended utilization targets in 2030. These labs could be candidates to meet future needs through sharing or reassignment of space.
- Construct new labs in an addition or new building if the previous options cannot be employed.

Health Science Labs

Thirteen of 22 Health Science class labs were scheduled (a three-room Simulation Lab was counted as one lab). Five are projected to be scheduled over-capacity in 2030. Five additional labs will be required by 2030.

Math and Technology Instruction

Courses in Math and Technology were delivered in classrooms. Instruction in these disciplines was recorded as lecture demand.

Next Steps

Data Accuracy

Information presented in this report is based, in part, on standard data submitted annually by individual universities to the UNC System. Inaccuracies in reported data could affect these results. Where possible, inconsistencies were identified, confirmed with the System, and corrected. However, room-by-room auditing of space data was beyond the scope of this study.

If the University believes a conclusion was drawn in error, the related data should be corrected by the university before its next submission to the System to ensure the validity of future studies.

Maximize Utilization at Pressure Points

Underutilized classrooms provide an opportunity to repurpose space to create additional labs and offices. However, given the University's generally good classroom utilization, there may not be sufficient capacity for classrooms to be converted to offset future STEM space needs.

As enrollment grows, the University may find itself in need of additional STEM lab capacity before funding is available to build or renovate. The University should plan strategically to identify enrollment thresholds that, when met, prompt actions such as scheduling evening courses, increasing target seat utilization (within safe limits), or sharing space among disciplines.

Supplemental Information from the University

University comments can be found in Appendix C.

North Carolina Agricultural and Technical State University

University Analysis

Purpose of this Study

In March 2019 the UNC System commissioned a *Systemwide STEM Program Needs Assessment,* which was prepared by MGT Consulting Group. This report, the *Systemwide STEM Capital Planning Study,* builds upon MGT's work and provides a projection of the physical space required to accommodate future STEM enrollment. The UNC System will use this capital planning study to guide the development of a systemwide STEM capital improvement plan.

By 2030, North Carolina A&T is projected to gain nearly 2,000 additional upper division STEM majors. More than 30 percent of N.C. A&T's enrollment growth will be in engineering programs. The analysis on the following pages can help the university fine tune its space utilization and prepare campus facilities to accommodate STEM growth.

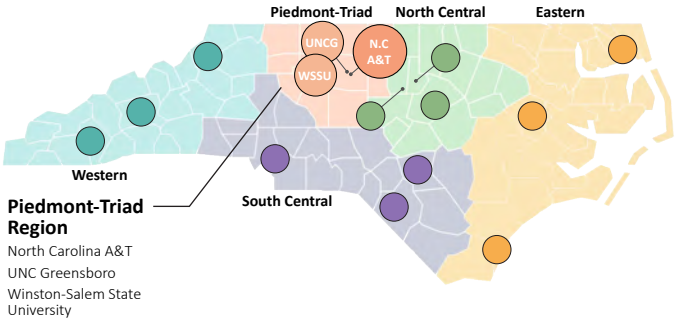
STEM Categories

MGT's study divided STEM majors into five categories: engineering, hard science, health science, math, and technology. In this study, physical space is sorted into the same five categories.

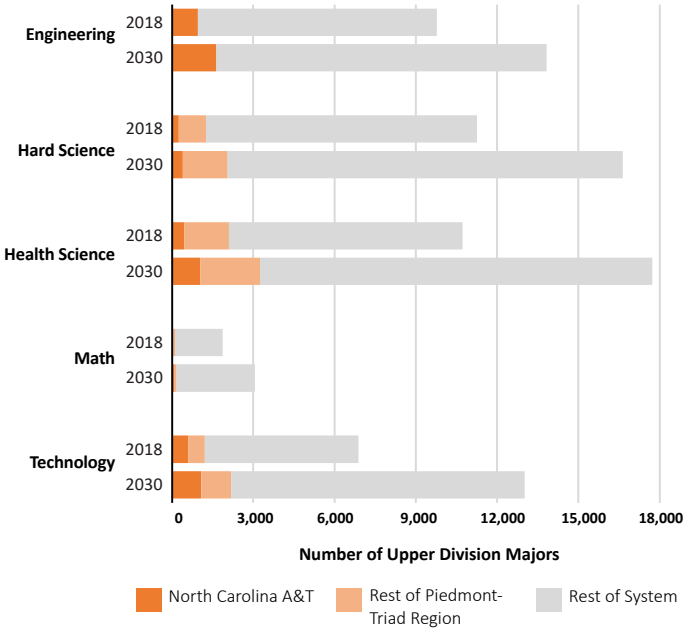
- Engineering space is dedicated to a broad range of engineering subjects, including hands-on technical instruction related to engineering programs.
- Hard science space houses lab-based sciences such as biology, chemistry, physics, geology, and anatomy and physiology. Social sciences are excluded.
- Health science space is dedicated to clinically-oriented, non-research health professions such as nursing and occupational therapy.
- Math space supports all math instruction.
- Technology space accommodates instruction in computer science and data analytics.

Most, but not all, fall 2017 instruction in designated STEM spaces was in STEM subjects. All instruction delivered in STEM spaces counted toward STEM weekly space utilization.

UNC System Regional Map



North Carolina A&T STEM Majors

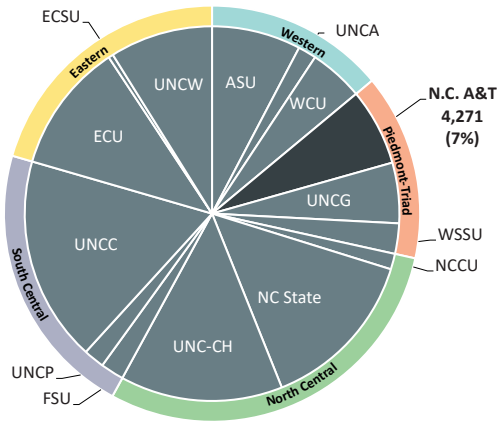


Undergraduate Enrollment

Understanding the Data Set

- MGT's enrollment analyses projected 2018 to 2028 enrollment growth of upper division majors only. JMZ extrapolated to 2030 using the MGT enrollment growth rate for the 2023-2028 period with some minor adjustments from the UNC System.
- While lower division and graduate STEM students were not included in MGT's enrollment projections, space needs associated with STEM growth of these groups are accounted for in this study.

Systemwide 2030 STEM Upper Division Enrollment



South Central Region STEM Enrollment Outlook

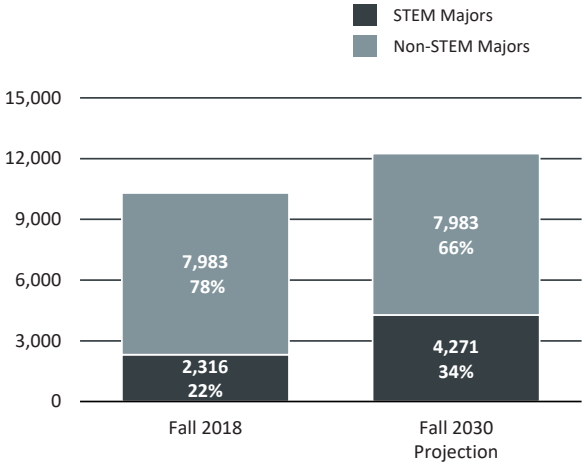
MGT considered industry growth, expected population change, and individual universities' enrollment targets in its enrollment analysis.

The Piedmont-Triad Region population overall is expected to grow by eight percent between 2020 and 2030. However, the number of traditional college-age residents (18 to 24 years old) is expected to decrease by three percent.

Enrollment in the Piedmont-Triad Region's Health Science majors is expected to grow by over 1,100 majors by 2030, and technology majors are expected to add nearly 1,000 students. Professionals in nursing, computer science, and engineering are expected to be in demand.

N.C. A&T Upper Division STEM Majors

Headcount



N.C. A&T STEM Highlights

(Source: Appendix E of the MGT Report)

- The new ERIC building will be the home of engineering and computer science programs and will serve academics, research, and community engagement needs.
- The university is partnering with local employers to keep STEM graduates in-state.
- Supplemental math instruction is helping students succeed in STEM programs.
- The nursing program is growing; interest in the program reportedly exceeds openings. Growth is said to be limited by facilities, faculty, and clinical placements.

N.C. A&T Upper Division STEM Majors by Category

Headcount

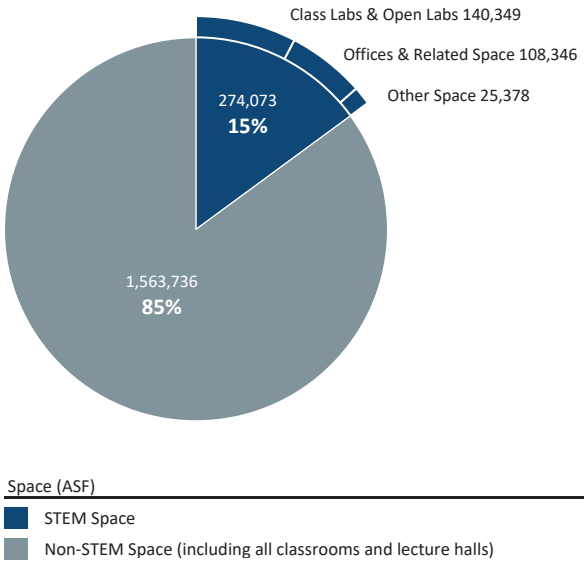
STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering	961	1,640	*679*	*4.6%*
Hard Science	251	408	*157*	*4.1%*
Health Science	462	1,053	*591*	*7.1%*
Math	47	82	*35*	*4.7%*
Technology	595	1,088	*493*	*5.2%*
Total	**2,316**	**4,271**	***1,955***	***5.2%***

2017 Space Allocation

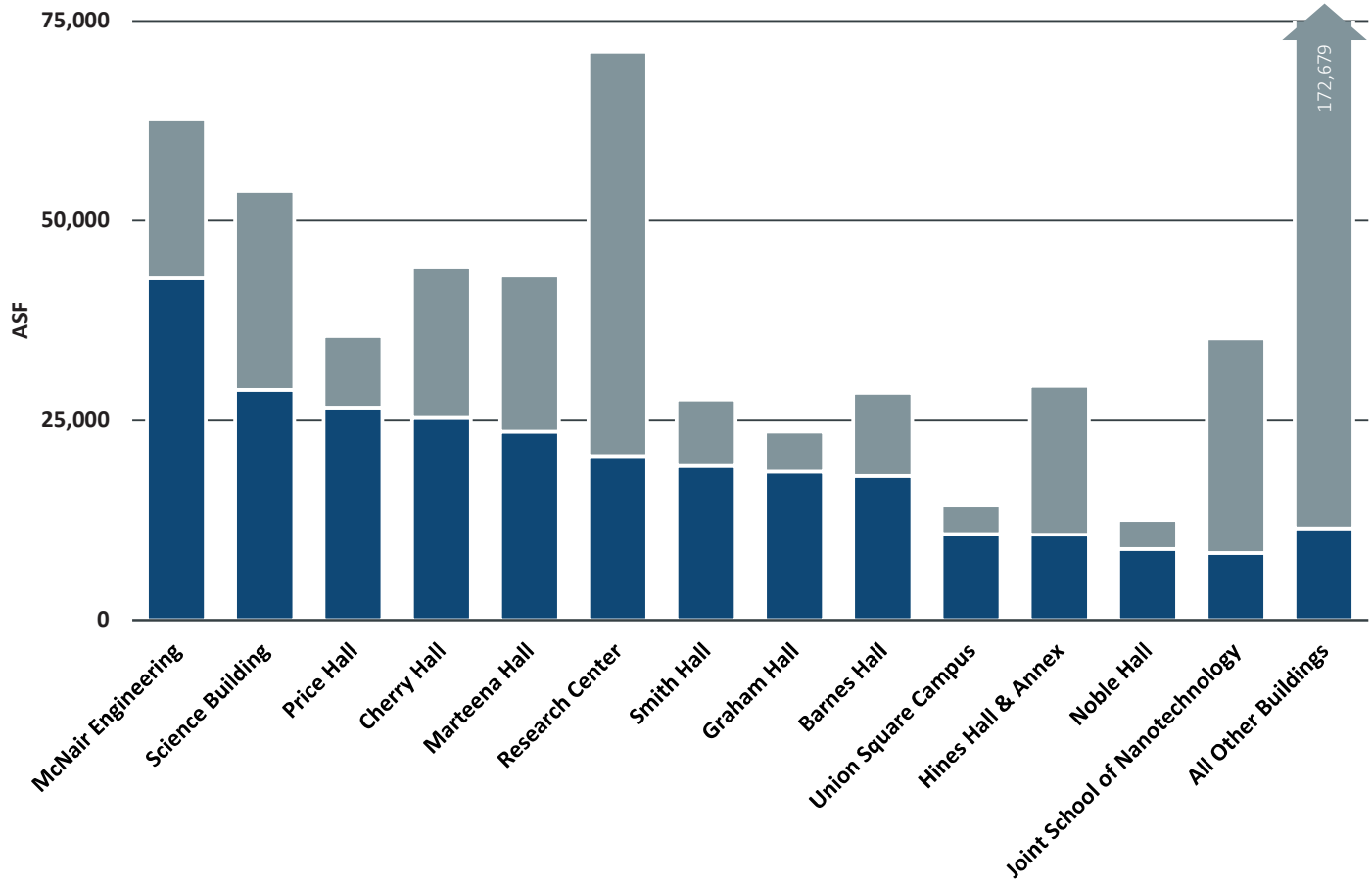
Understanding the Data Set

- Space allocation is based on 2017 UNC System data, self-reported by each university.
- Only buildings where space is allocated to STEM programs are included in this study.
- Space prorated for any amount of STEM is captured as 100 percent STEM since it is capable of supporting STEM education.
- General use classrooms are not counted as STEM-dedicated space. See Appendix B for a list of UNC System category codes considered STEM.
- The study does not include research or related space. However, the instructional spaces in the study may support research activities during unscheduled hours.
- Program space is quantified in assignable square feet (ASF).

STEM Space Summary



2017 STEM Academic Space by Building



Instructional Space Utilization

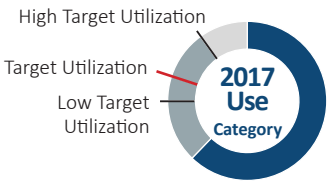
Understanding the Data Set

- Instructional space utilization is based on the fall 2017 course schedule (the most recent, fully vetted course schedule available at the time of this study).
- The study considered daytime room use in a 45-hour week based on the target criteria below from the Association for Learning Environments.
- While the study targets are ideal, a utilization range of five percent below or 10 percent above each target is considered reasonable.
- In a dedicated STEM space, all instruction delivered in that space was counted toward its fall 2017 utilization, including non-STEM courses.

Space Utilization Targets

	Seat Fill			Hours Used		
Space Type	Low	**Target**	High	Low	**Target**	High
Classrooms	62%	**67%**	77%	29	**31**	35
Class Labs	75%	**80%**	90%	19	**21**	26

Understanding the Results



Darkest tone: Fall 2017 space use (hourly or seat fill)

Middle tone: Remaining capacity within target range

Lightest tone: Remaining capacity above target range; use at this level is not expected

Utilization Summary

Classrooms

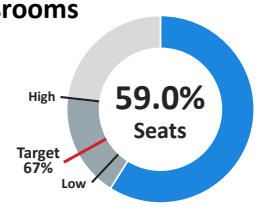
On average, classrooms did not meet the low seat fill target or the low hourly use target.

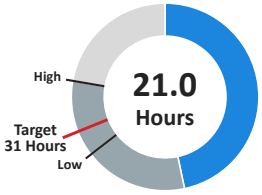
Class Labs

Labs in all categories met the target seat fill range. No labs met the hourly use range.

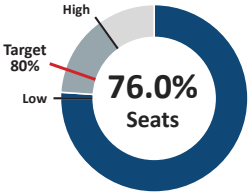
2017 Weekly Utilization - Seats and Hours

Classrooms

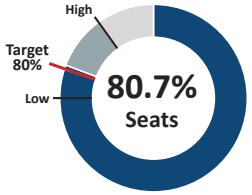




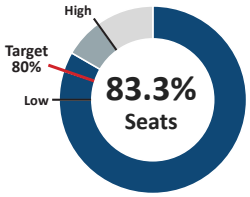
Engineering Labs



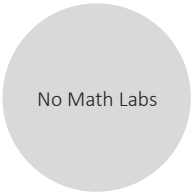
Hard Science Labs

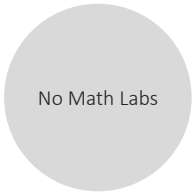


Health Science Labs



Math Labs





Technology Labs

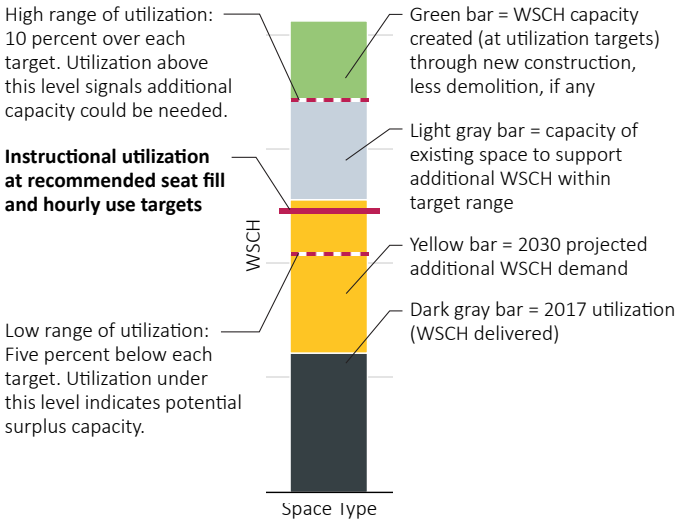
Weekly Instructional Capacity and Projections

North Carolina Agricultural and Technical State University

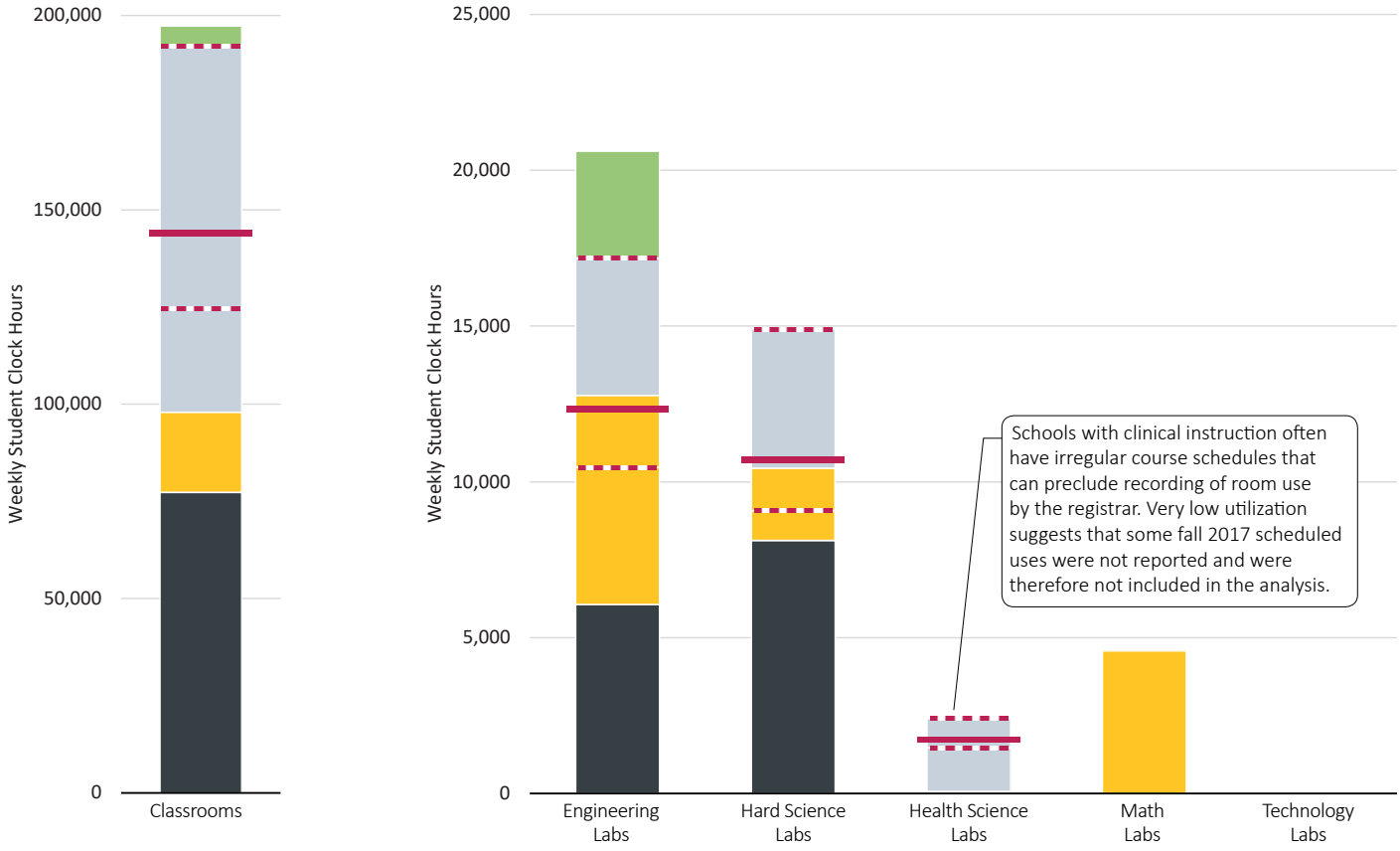
Understanding the Data Set

- An institution's capacity to accommodate future instruction is measured in weekly student clock hours (WSCH). One WSCH equals one student occupying one station for one hour.
- WSCH capacity is calculated using the number of stations in the 2017 space inventory with seat and hourly utilization target criteria applied.
- 2030 STEM course demand is projected to grow according to enrollment projections. Non-STEM course demand was held at the fall 2017 level.
- Graduate programs are evaluated separately. The effect of their growth on instructional demand is included later in this report.
- Future lab demand is based on the assumption that fall 2017 courses were scheduled in the labs best suited to deliver the required instruction.

Understanding the Results



Utilization, Capacity, and Projections



Space Implications of Enrollment Growth

Undergraduate

North Carolina Agricultural and Technical State University

Understanding the Data Set

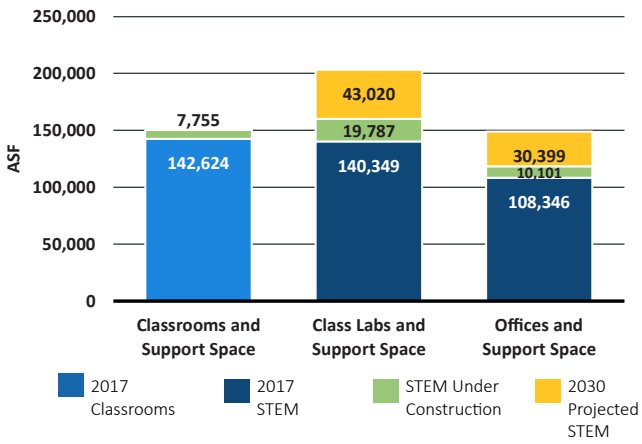
- Projections were made for classrooms, class labs, and office space only. Station sizes conform to UNC System standards.

Instructional Space	Station Size (ASF)
Classrooms	22
Engineering	108
Hard Science	70
Health Science	70
Math	33
Technology	50

Offices	Station Size (ASF)
Faculty	190
Staff (blended size)	140
Graduate Student	95

- If the projected 2030 instructional demand for an individual lab exceeded target capacity, a space need for an additional lab of the same type was generated. If a lab was not scheduled in 2017 or is projected to be underutilized in 2030, it could potentially offset future space demand.
- For each university, the 2018 STEM student:faculty and STEM faculty:staff ratios were maintained within System parameters. Since reliable data for current faculty and staff office space is not available, projections reflect the space needed for additional 2030 STEM faculty and staff only.
- The 2017 building condition codes were self-reported by each university to the UNC System. Building conditions were downgraded by one level in 2030 to reflect the presumed deterioration of structures if no substantial facilities improvements occur. None were reduced to demolition status.

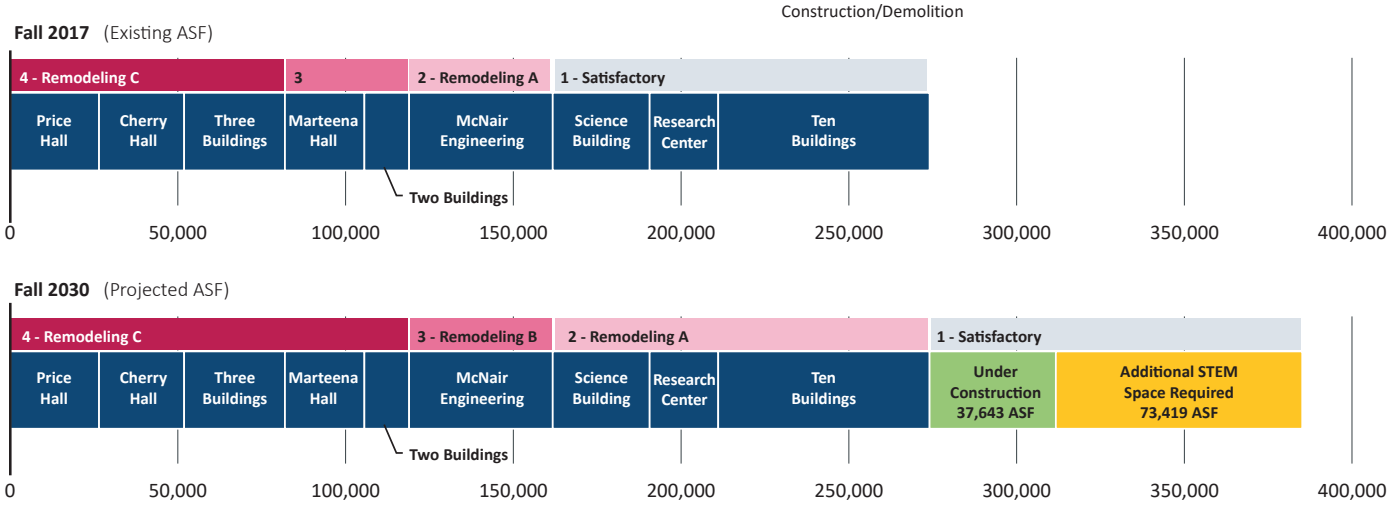
Academic Space by Category



Potential Space Offsets

	2017 Number of Labs		2030 Number of Labs	
	Labs (Inventory)	Labs Not Scheduled	Total Labs Needed	Underutilized Labs
Engineering	32	6	43	18
Hard Science	25	1	36	14
Health Science	11	10	11	1
Math				
Technology				
Total	68	17	90	33

STEM Academic Space by Building



Space Implications of Enrollment Growth
Graduate

North Carolina Agricultural and Technical State University

Understanding the Data Set

- Graduate enrollment growth rates in this report were established using historical enrollment patterns and UNC System guidance. Graduate programs were not included in the MGT analysis.
- Without knowledge of specific graduate program curricula, it is assumed that all graduate students use on-campus space every semester.
- Projected 2030 instructional space demand for graduate students was layered on top of undergraduate demand. If the sum of 2030 undergraduate and graduate instruction would cause classrooms or labs to exceed target capacity, a space need for an additional room of the same type was generated.

Graduate Students by Category

Headcount

STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering	360	515	*155*	*3.0%*
Hard Science	97	135	*38*	*2.8%*
Health Science	53	93	*40*	*4.8%*
Math	15	22	*7*	*3.2%*
Technology	68	102	*34*	*3.4%*
Total	**593**	**867**	***274***	***3.2%***

Instruction by Course Level

STEM Category		WSCH 2017	WSCH 2030	*Annual Percent Change*
Engineering	Undergraduate	14,629	24,949	*4.5%*
	Graduate	1,299	1,913	*3.3%*
Subtotal		***15,927***	***26,862***	***4.5%***
Hard Science	Undergraduate	21,713	27,366	*1.9%*
	Graduate	454	644	*3.0%*
Subtotal		***22,167***	***28,010***	***2.0%***
Health Science	Undergraduate	6,577	14,989	*7.1%*
	Graduate	63	117	*5.3%*
Subtotal		***6,640***	***15,106***	***7.1%***
Math	Undergraduate	16,141	20,667	*2.1%*
	Graduate	269	402	*3.4%*
Subtotal		***16,409***	***21,070***	***2.1%***
Technology	Undergraduate	6,467	11,824	*5.2%*
	Graduate	646	1,005	*3.7%*
Subtotal		***7,113***	***12,829***	***5.0%***
Total STEM		**68,255**	**103,877**	***3.6%***

Space Implications

Classrooms

No additional classrooms will be required to accommodate projected STEM graduate enrollment growth in 2030.

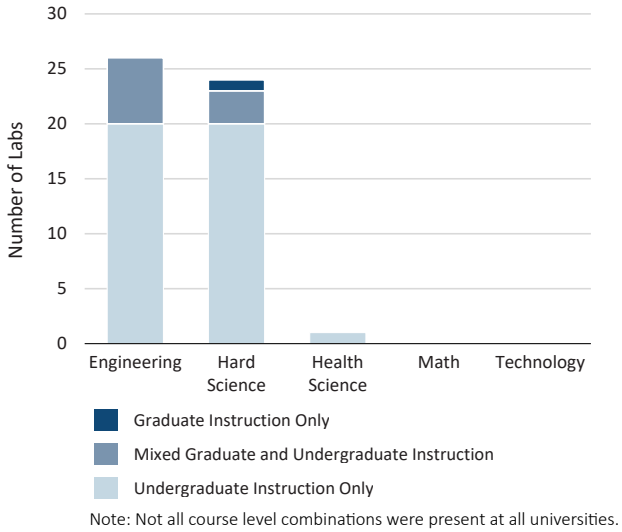
Class Labs

Most labs were used exclusively for undergraduate instruction in fall 2017. Nine labs were used for both undergraduate and graduate instruction. One lab was scheduled for graduate instruction only. The additional lab space recommended to accommodate undergraduate STEM enrollment growth will likely satisfy the space needs of future STEM graduate students as well.

Offices

If enrollment projections are met, 26,030 ASF of additional graduate office space should be allocated to STEM to accommodate 274 additional graduate students.

2017 Use of Scheduled Labs by Course Level



Note: Not all course level combinations were present at all universities.

University Summary

Space Utilization Opportunities

Classrooms

- There will be sufficient capacity in the University's 151 classrooms to meet 2030 demand if utilization targets are met. Eight classrooms were not scheduled for daytime use:
  - Price Hall 112
  - Benbow Hall 106
  - Union Square Campus rooms 160 and 230
  - McNair Engineering rooms 11, 22, and 33
  - Frazier Hall 204
- There were 65 classrooms with station sizes smaller than 18 square feet. If stations in these rooms were right-sized to 22 square feet or larger, lecture capacity (WSCH) overall would be reduced.
- If enrollment surges, North Carolina A&T could increase seat fill targets to 80 percent in its 62 classrooms with station sizes greater than 22 square feet.

Engineering Labs

Twenty-six of the University's 32 Engineering labs were scheduled in daytime, fall 2017. Graham Hall 101, Graham Hall 302, Hines Hall & Annex 207, Smith Hall 3011, Cherry Hall 314, and McNair 520 were not scheduled. Eight labs are projected to exceed target capacity by 2030. Eleven additional labs will be needed if enrollment targets are met:

- Five Applied Engineering
- Two Computer Systems
- Two Built Environment
- One Industrial Systems
- One Graphics Design Technology

The capacity need can be addressed in multiple ways:

- Maximize utilization in existing Engineering space. Schedule data shows that 18 labs may not reach recommended utilization targets in 2030. These labs may be candidates to meet future needs through sharing or reassignment of space.
- Repurpose underutilized space elsewhere on campus.
- Construct new labs in an addition or new building, only if the previous options do not satisfy the full future space need.

Hard Science Labs

Of the University's 25 Hard Science labs, only one (Barnes Hall room 20) was not scheduled. By 2030, additional instructional capacity equivalent to 11 labs will be required to accommodate hard science instruction if enrollment projections are met:

- Five Biology
- Four Chemistry
- Two Physics

Six hard science labs are projected to have more than 50 percent of their target capacity available in 2030: three labs in Barnes, one in Hines, and two in the Science Building. Highly-specialized labs may be unavailable for repurposing or joint-use.

Health Science Labs

Two courses were taught in Noble Hall room 15. Projected 2030 utilization of this lab will not exceed utilization targets. The ten class labs at the Union Square location did not have scheduled use in fall 2017.

Math Labs

Math courses were taught in open labs in 2017. Because no courses were taught in class labs, the 2030 demand for Math labs appears as a new need without existing labs to serve it.

If Math were to be taught in class labs in 2030, eight labs would be needed. Existing open labs where Math is taught could be recoded to meet part of this need (depending on the University's planned uses of Math open labs).

Technology Labs

Technology courses met in classrooms and in one Engineering Lab (Graham 203).

No class labs were dedicated to Technology. Therefore, no additional lab need was projected. The projected 2030 Technology demand was recorded in the rooms where instruction took place.

University Summary

Next Steps

Data Accuracy

Information presented in this report is based, in part, on standard data submitted annually by individual universities to the UNC System. Inaccuracies in reported data could affect these results. Where possible, inconsistencies were identified, confirmed with the System, and corrected. However, room-by-room auditing of space data was beyond the scope of this study.

If the University believes a conclusion was drawn in error, the related data should be corrected by the university before its next submission to the System to ensure the validity of future studies.

Maximize Utilization at Pressure Points

Underutilized classrooms provide an opportunity to repurpose space to create additional labs and offices. If utilization targets are met, the University should have sufficient classroom capacity to repurpose some classrooms. Available underutilized space may not be in the right location or configuration to offset STEM space needs.

As enrollment grows, the University may need additional STEM lab space before funding is available to build or renovate. The University should plan strategically to identify enrollment thresholds that, when met, prompt actions such as scheduling evening lab courses, increasing target seat utilization in labs (within safe limits), and/or sharing lab space among disciplines (where pedagogically feasible).

Supplemental Information from the University

University comments can be found in Appendix C.

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University Analysis

Purpose of this Study

In March 2019 the UNC System commissioned a ***Systemwide STEM Program Needs Assessment,*** which was prepared by MGT Consulting Group. This report, the ***Systemwide STEM Capital Planning Study,*** builds upon MGT's work and provides a projection of the physical space required to accommodate future STEM enrollment. The UNC System will use this capital planning study to guide the development of a systemwide STEM capital improvement plan.

By 2030, UNC Greensboro is projected to gain over 1,200 STEM upper division majors. While UNCG's share of systemwide STEM students will remain at 5.2 percent in the next decade, the university will gain more hard science majors than most others in the system. The analysis on the following pages can help the university fine tune its space utilization and prepare campus facilities to accommodate STEM growth.

STEM Categories

MGT's study divided STEM majors into five categories: engineering, hard science, health science, math, and technology. In this study, physical space is sorted into the same five categories.

- Engineering space is dedicated to a broad range of engineering subjects, including hands-on technical instruction related to engineering programs.
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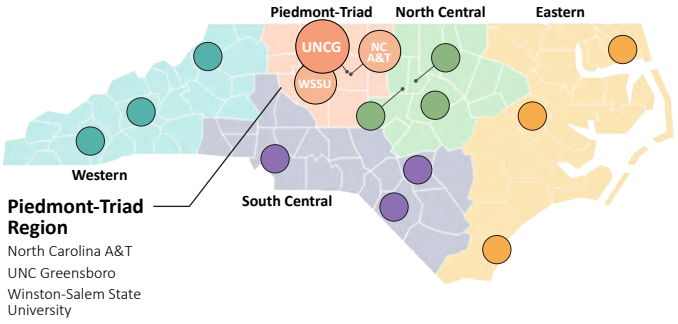
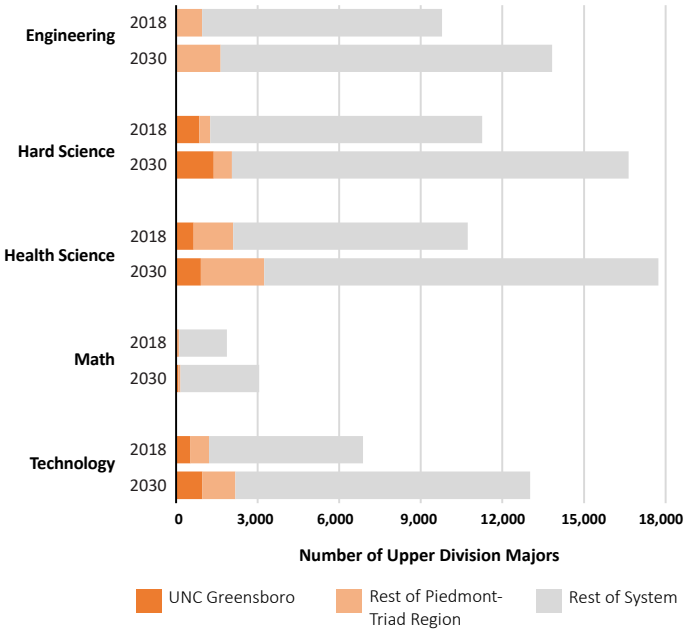


UNC Greensboro STEM Majors

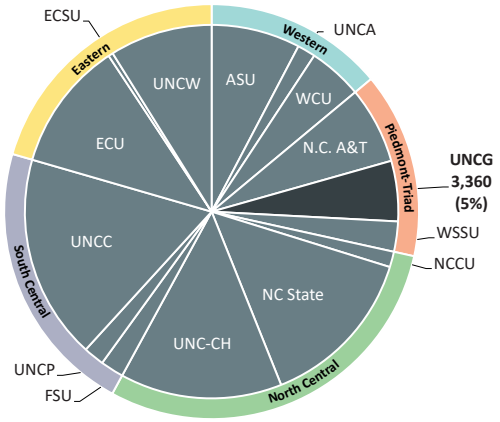


Undergraduate Enrollment

Understanding the Data Set

- MGT's enrollment analyses projected 2018 to 2028 enrollment growth of upper division majors only. JMZ extrapolated to 2030 using the MGT enrollment growth rate for the 2023-2028 period with some minor adjustments from the UNC System.
- While lower division and graduate STEM students were not included in MGT's enrollment projections, space needs associated with STEM growth of these groups are accounted for in this study.

Systemwide 2030 STEM Upper Division Enrollment



Piedmont-Triad Region STEM Enrollment Outlook

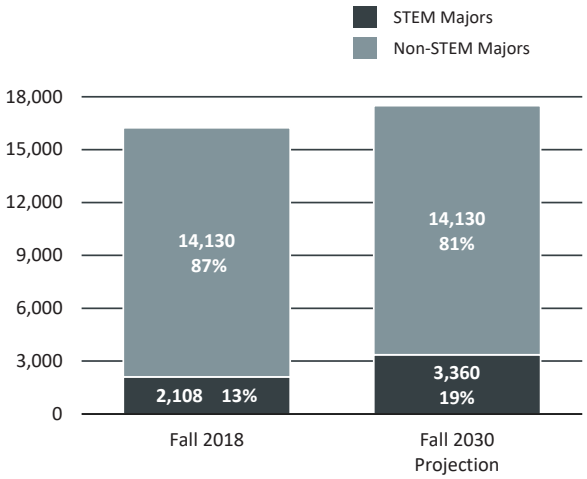
MGT considered industry growth, expected population change, and individual universities' enrollment targets in its enrollment analysis.

The Piedmont-Triad Region population overall is expected to grow by eight percent between 2020 and 2030. However, the number of traditional college-age (18 to 24 year old) residents is expected to decrease by three percent.

Enrollment in the Piedmont-Triad Region's Health Science majors is expected to grow by over 1,100 majors by 2030, and technology majors are expected to add nearly 1,000 students. Professionals in nursing, computer science, and engineering are expected to be in demand.

UNC Greensboro Upper Division STEM Majors

Headcount



UNC Greensboro STEM Highlights

(Source: Appendix E of the MGT Report)

- A new nursing building is scheduled to open in 2020. McIver House, which housed nursing instruction in 2017 and is in poor condition, will be demolished.
- Math and information science programs have grown recently in response to workforce demands.
- Undergraduate research opportunities foster engagement and retention in the hard sciences.
- The university's public health programs provide experiential learning and research opportunities.

UNC Greensboro Upper Division STEM Majors by Category

Headcount

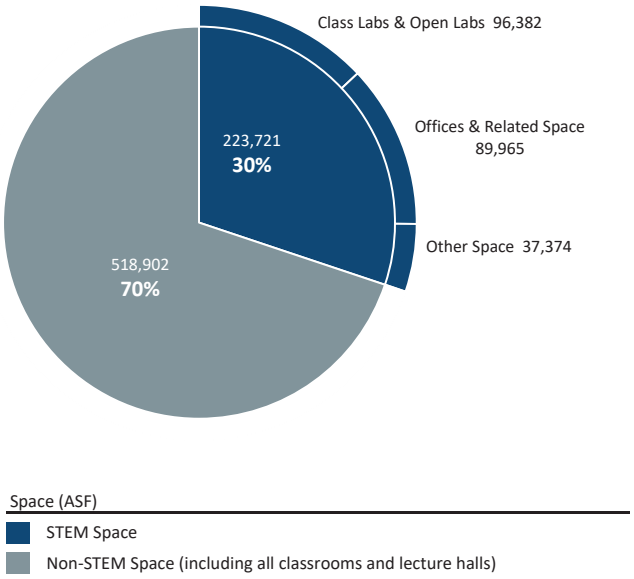
STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering				
Hard Science	862	1,385	*523*	*4.0%*
Health Science	647	919	*272*	*3.0%*
Math	67	81	*14*	*1.6%*
Technology	532	975	*443*	*5.2%*
Total	**2,108**	**3,360**	***1,252***	***4.0%***

2017 Space Allocation

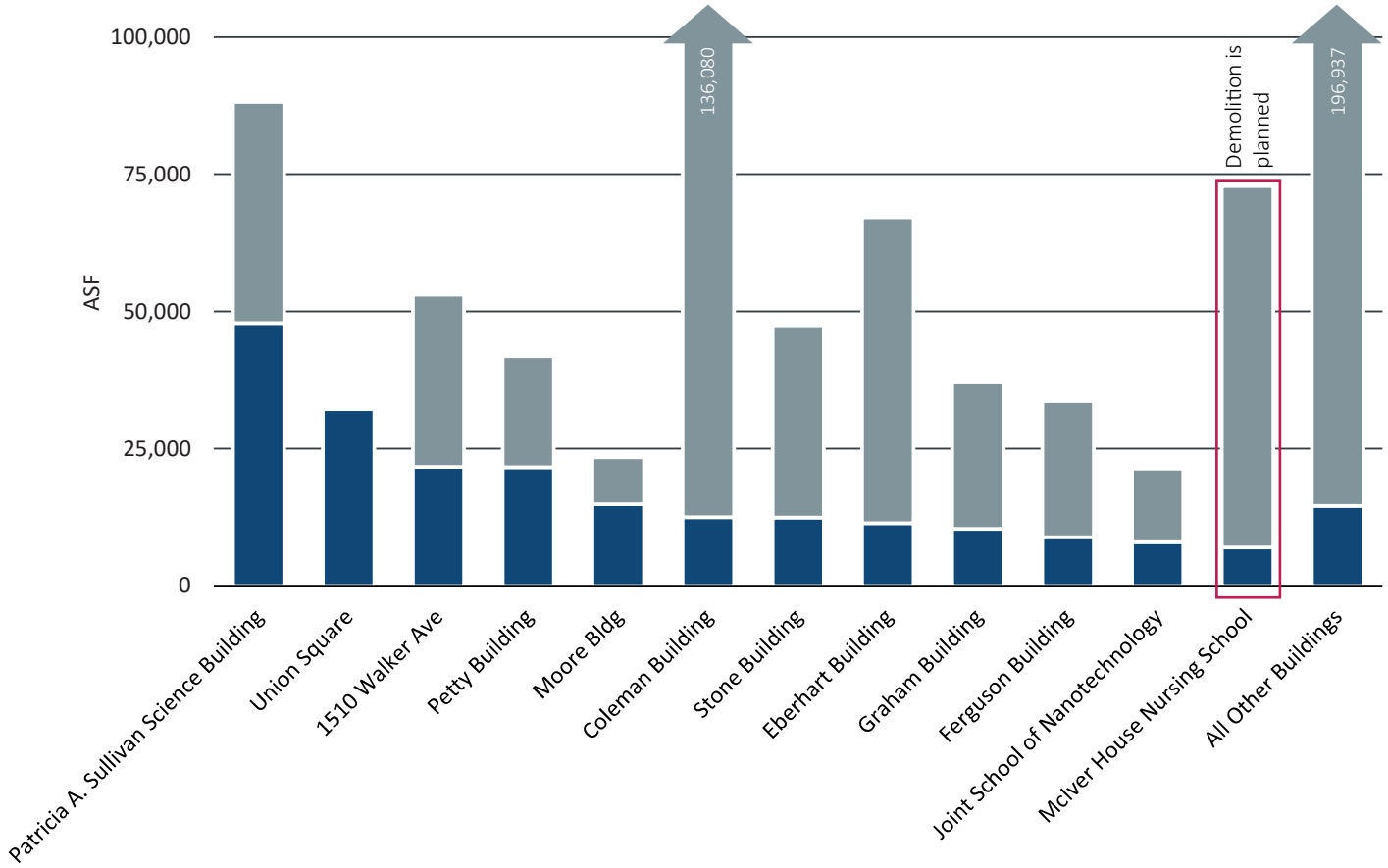
Understanding the Data Set

- Space allocation is based on 2017 UNC System data, self-reported by each university.
- Only buildings where space is allocated to STEM programs are included in this study.
- Space prorated for any amount of STEM is captured as 100 percent STEM since it is capable of supporting STEM education.
- General use classrooms are not counted as STEM-dedicated space. See Appendix B for a list of UNC System category codes considered STEM.
- The study does not include research or related space. However, the instructional spaces in the study may support research activities during unscheduled hours.
- Program space is quantified in assignable square feet (ASF).

STEM Space Summary



2017 STEM Academic Space by Building



Instructional Space Utilization

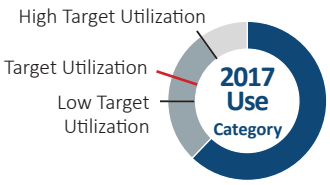
Understanding the Data Set

- Instructional space utilization is based on the fall 2017 course schedule (the most recent, fully vetted course schedule available at the time of this study).
- The study considered daytime room use in a 45-hour week based on the target criteria below from the Association for Learning Environments.
- While the study targets are ideal, a utilization range of five percent below or 10 percent above each target is considered reasonable.
- In a dedicated STEM space, all instruction delivered in that space was counted toward its fall 2017 utilization, including non-STEM courses.

Space Utilization Targets

	Seat Fill			Hours Used		
Space Type	Low	**Target**	High	Low	**Target**	High
Classrooms	62%	**67%**	77%	29	**31**	35
Class Labs	75%	**80%**	90%	19	**21**	26

Understanding the Results



Darkest tone: Fall 2017 space use (hourly or seat fill)

Middle tone: Remaining capacity within target range

Lightest tone: Remaining capacity above target range; use at this level is not expected

Utilization Summary

Classrooms

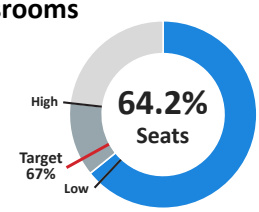
- On average, classrooms met the low 62 percent seat fill target when in use.
- The lowest hourly target of 29 hours per week was not met.

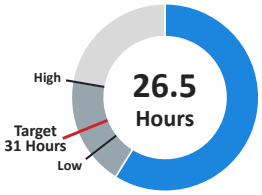
Class Labs

- Labs in all categories met the target seat fill range.
- No labs met the low hourly utilization target of 19 hours per week.

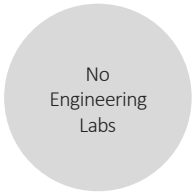
2017 Weekly Utilization - Seats and Hours

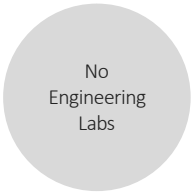
Classrooms



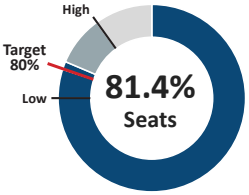


Engineering Labs

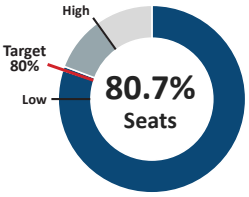




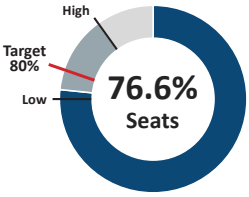
Hard Science Labs



Health Science Labs



Math Labs



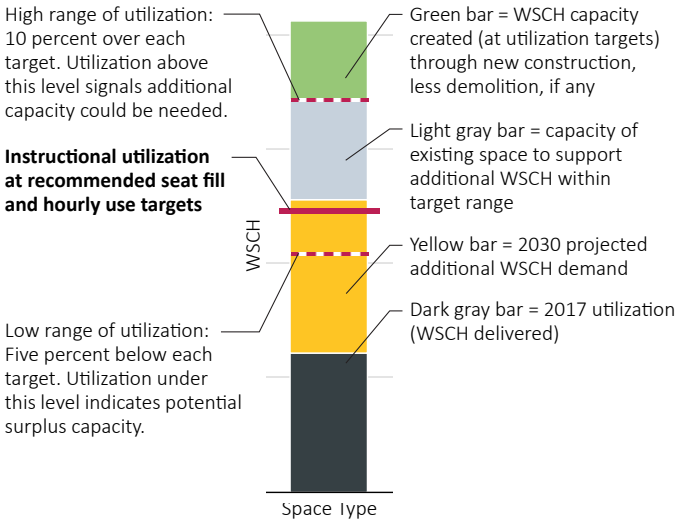
Technology Labs

Weekly Instructional Capacity and Projections

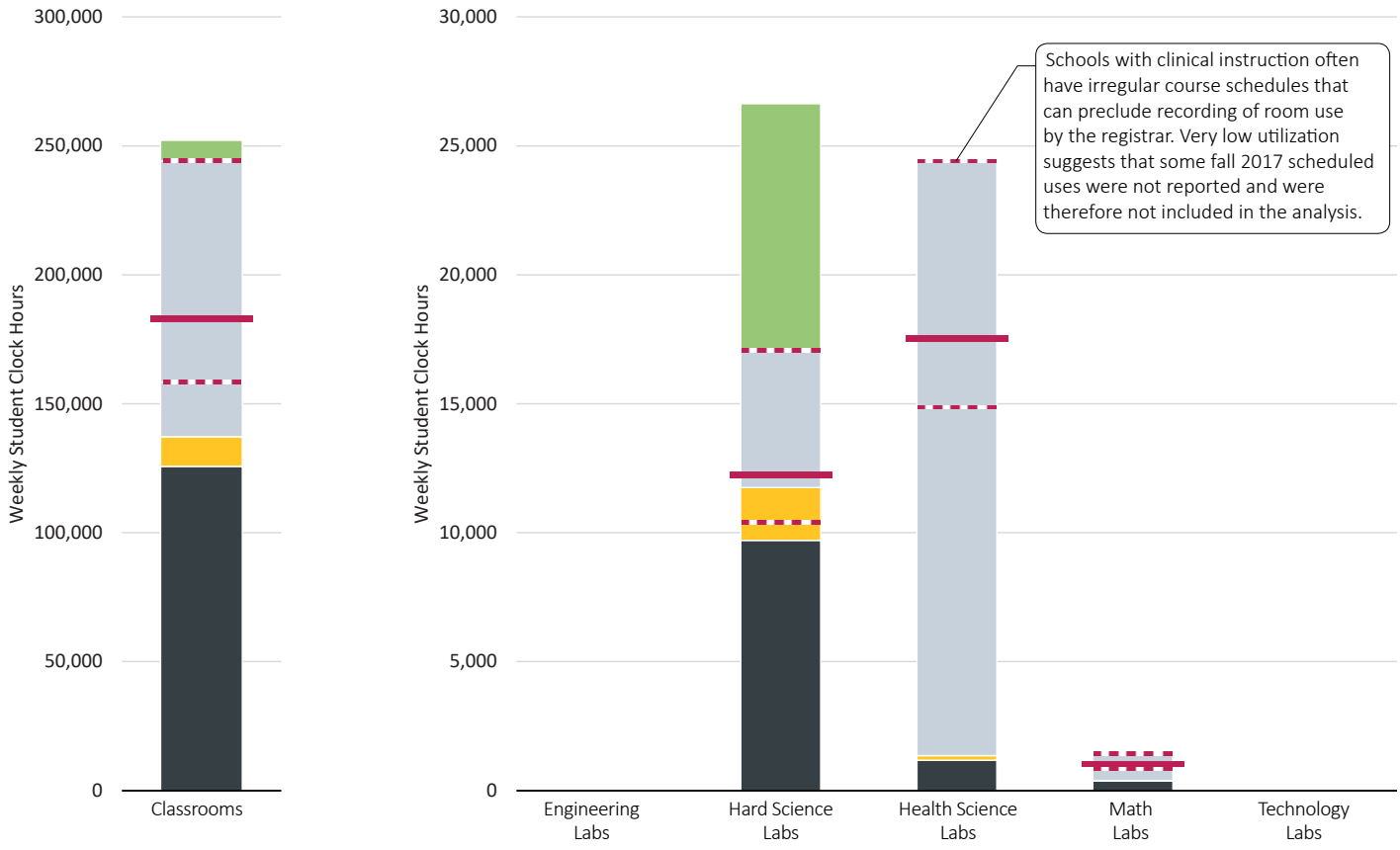
Understanding the Data Set

- An institution's capacity to accommodate future instruction is measured in weekly student clock hours (WSCH). One WSCH equals one student occupying one station for one hour.
- WSCH capacity is calculated using the number of stations in the 2017 space inventory with seat and hourly utilization target criteria applied.
- 2030 STEM course demand is projected to grow according to enrollment projections. Non-STEM course demand was held at the fall 2017 level.
- Graduate programs are evaluated separately. The effect of their growth on instructional demand is included later in this report.
- Future lab demand is based on the assumption that fall 2017 courses were scheduled in the labs best suited to deliver the required instruction.

Understanding the Results



Utilization, Capacity, and Projections



Space Implications of Enrollment Growth
Undergraduate

Understanding the Data Set

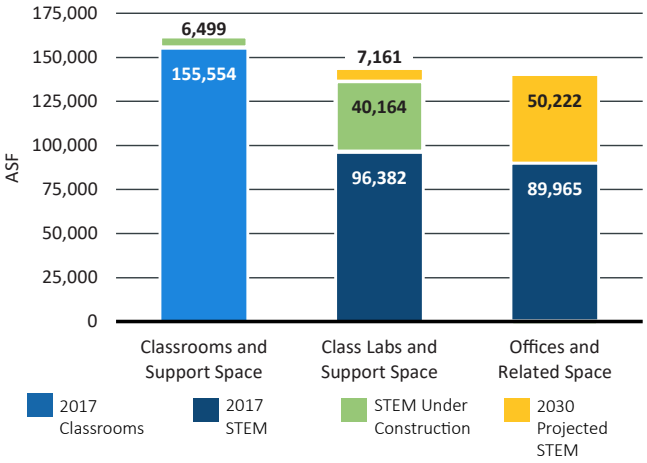
- Projections were made for classrooms, class labs, and office space only. Station sizes conform to UNC System standards.

Instructional Space	Station Size (ASF)
Classrooms	22
Engineering	108
Hard Science	70
Health Science	70
Math	33
Technology	50

Offices	Station Size (ASF)
Faculty	190
Staff (blended size)	140
Graduate Student	95

- If the projected 2030 instructional demand for an individual lab exceeded target capacity, a space need for an additional lab of the same type was generated. If a lab was not scheduled in 2017 or is projected to be underutilized in 2030, it could potentially offset future space demand.
- For each university, the 2018 STEM student:faculty and STEM faculty:staff ratios were maintained within System parameters. Since reliable data for current faculty and staff office space is not available, projections reflect the space needed for additional 2030 STEM faculty and staff only.
- The 2017 building condition codes were self-reported by each university to the UNC System. Building conditions were downgraded by one level in 2030 to reflect the presumed deterioration of structures if no substantial facilities improvements occur. None were reduced to demolition status.

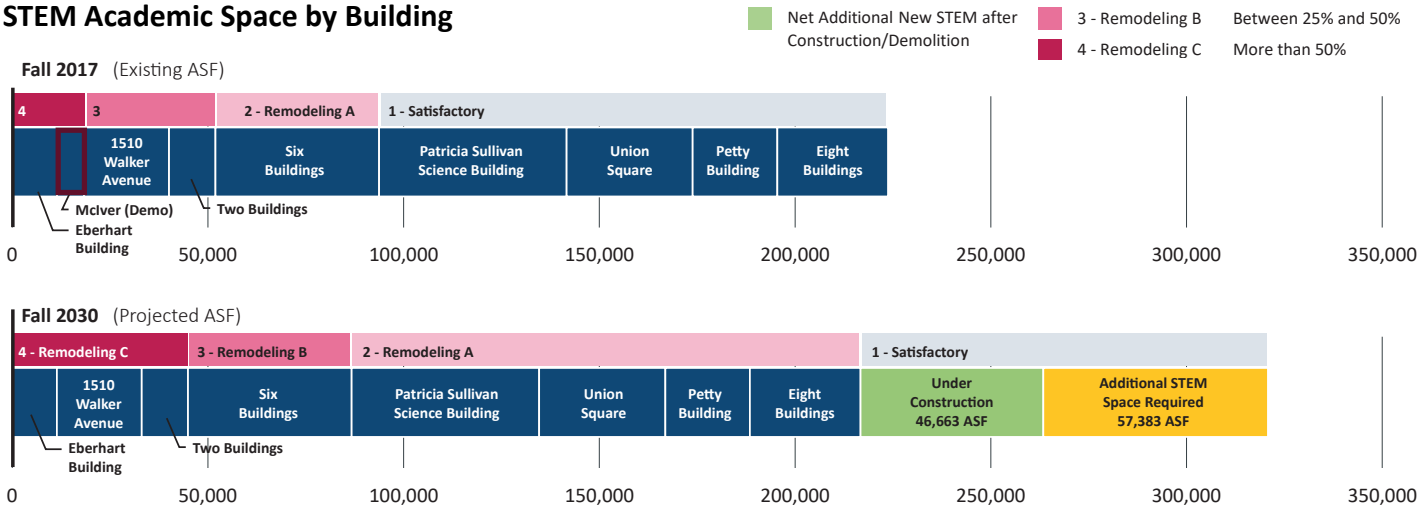
Academic Space by Category



Potential Space Offsets

	2017 Number of Labs		2030 Number of Labs	
	Labs (Inventory)	Labs Not Scheduled	Total Labs Needed	Underutilized Labs
Engineering				
Hard Science	29	1	42	18
Health Science	17	15	19	
Math	1		1	1
Technology				
Total	47	16	62	19

STEM Academic Space by Building



Space Implications of Enrollment Growth
Graduate

Understanding the Data Set

- Graduate enrollment growth rates in this report were established using historical enrollment patterns and UNC System guidance. Graduate programs were not included in the MGT analysis.
- Without knowledge of specific graduate program curricula, it is assumed that all graduate students use on-campus space every semester.
- Projected 2030 instructional space demand for graduate students was layered on top of undergraduate demand. If the sum of 2030 undergraduate and graduate instruction would cause classrooms or labs to exceed target capacity, a space need for an additional room of the same type was generated.

Graduate Students by Category

Headcount

STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering				
Hard Science	120	165	*45*	*2.7%*
Health Science	413	523	*110*	*2.0%*
Math	36	41	*5*	*1.1%*
Technology	87	131	*44*	*3.5%*
Total	**656**	**860**	***204***	***2.3%***

Instruction by Course Level

STEM Category		WSCH 2017	WSCH 2030	*Annual Percent Change*
Engineering	Undergraduate			
	Graduate			
Subtotal				
Hard Science	Undergraduate	29,729	36,205	*1.7%*
	Graduate	1,397	1,965	*2.9%*
Subtotal		***31,125***	***38,170***	***1.7%***
Health Science	Undergraduate	15,226	21,626	*3.0%*
	Graduate	3,048	3,908	*2.1%*
Subtotal		***18,274***	***25,534***	***2.8%***
Math	Undergraduate	5,532	5,824	*0.4%*
	Graduate	292	333	*1.1%*
Subtotal		***5,824***	***6,157***	***0.5%***
Technology	Undergraduate	4,672	8,562	*5.2%*
	Graduate	682	1,062	*3.8%*
Subtotal		***5,354***	***9,624***	***5.0%***
Total STEM		**60,576**	**79,485**	***2.3%***

Space Implications

Classrooms

No additional classrooms will be required to accommodate projected STEM graduate enrollment growth in 2030.

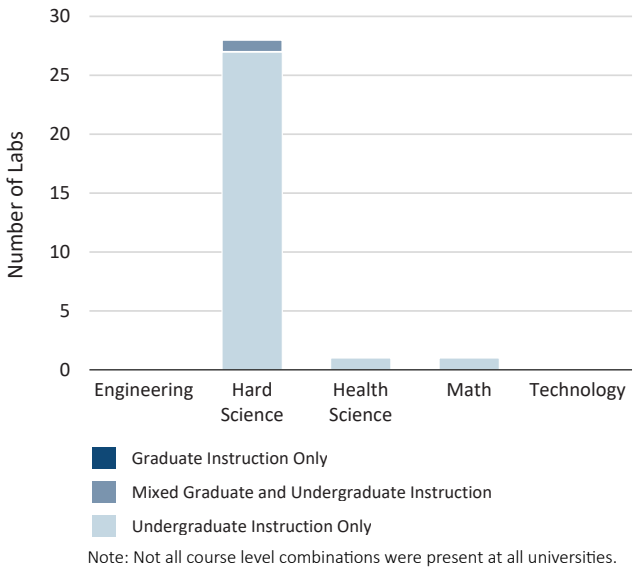
Class Labs

Most scheduled labs were used exclusively for undergraduate instruction; only one was used for mixed undergraduate and graduate instruction. The additional lab space recommended to accommodate STEM undergraduate enrollment growth will likely satisfy the space needs of future STEM graduate students as well.

Offices

If enrollment projections are met, 19,380 ASF of additional graduate office space should be allocated to STEM to accommodate 204 additional graduate students.

2017 Use of Scheduled Labs by Course Level



Note: Not all course level combinations were present at all universities.

University Summary

Space Utilization Opportunities

Classrooms

- Of the University's 149 classrooms, 146 were scheduled. Kaplan Center room 209, Shaw Residence Hall room 143, and Coleman Building room 319 were not scheduled. On average, classrooms approached target seat fill capacity in fall 2017, but additional hours were available for instruction. If utilization targets are met, there will be sufficient classroom space to accommodate projected 2030 demand.
- There were 62 classrooms with station sizes smaller than 18 square feet. If stations in these rooms were right-sized to 22 square feet or larger, lecture capacity (WSCH) overall would be reduced.
- If enrollment surges, UNC Greensboro could increase seat fill targets to 80 percent in its 26 classrooms with station sizes greater than 22 square feet.

Hard Science Labs

The University had 29 class labs dedicated to Hard Science in fall 2017. All but one, Patricia Sullivan Hall room 139, were scheduled. Thirteen additional class labs could be needed by 2030 if enrollment projections are met. Labs in the new building will meet the Biology need, yet Chemistry and Biochemistry will need more space. The capacity need can be addressed multiple ways:

- Repurpose existing unscheduled or underutilized space within Hard Science disciplines or campus-wide. With only one lab unscheduled, there may be little opportunity to repurpose existing Hard Science space.
- Maximizie utilization in labs and reassign space based on demand. Based on schedule data, 18 labs are projected to have remaining instructional capacity in 2030. If some lightly-scheduled labs could be shared by complementary disciplines, there is potential to reduce the need for additional space.
- Construct new labs in an addition or new building if the previous options cannot be employed.

Health Science Labs

Two of the University's 17 Health Science labs were scheduled: 1510 Walker room 250 and Moore Nursing Building room 429. Two additional labs will be required to meet the projected 2030 demand. If the remaining 15 Health Science labs were scheduled, additional space could be needed by 2030.

Math Labs

The University's one Math lab, Graham Building room 313, was lightly utilized. No additional labs are recommended.

Offices

When McIver Hall is demolished the University will lose many offices. The current occupancy of the offices in McIver is unknown. Perhaps not all McIver offices will require replacement, or existing underutilized space could meet some of the future STEM office space need.

Next Steps

Data Accuracy

Information presented in this report is based, in part, on standard data submitted annually by individual universities to the UNC System. Inaccuracies in reported data could affect these results. Where possible, inconsistencies were identified, confirmed with the System, and corrected. However, room-by-room auditing of space data was beyond the scope of this study.

If the University believes a conclusion was drawn in error, the related data should be corrected by the university before its next submission to the System to ensure the validity of future studies.

Maximize Utilization at Pressure Points

Underutilized classrooms provide an opportunity to repurpose space to create additional labs and offices. However, if STEM enrollment projections are met, some of the University's classrooms could meet or exceed target utilization. This may allow certain underutilized classrooms to be repurposed, yet may not yield sufficient surplus space to offset future STEM space needs.

As enrollment grows, the University may need additional STEM lab space before funding is available to build or renovate. The University should plan strategically to identify enrollment thresholds that, when met, prompt actions such as scheduling evening lab courses, increasing target seat utilization in labs (within safe limits), and/or sharing lab space among disciplines (where pedagogically feasible).

Supplemental Information from the University

University comments can be found in Appendix C.

WINSTON-SALEM STATE UNIVERSITY

University Analysis

Purpose of this Study

In March 2019 the UNC System commissioned a *Systemwide STEM Program Needs Assessment,* which was prepared by MGT Consulting Group. This report, the *Systemwide STEM Capital Planning Study,* builds upon MGT's work and provides a projection of the physical space required to accommodate future STEM enrollment. The UNC System will use this capital planning study to guide the development of a systemwide STEM capital improvement plan.

By 2030, Winston-Salem State University is projected to add over 400 additional upper division STEM majors. More than half of the university's STEM growth is expected to be in Health Science programs. The analysis on the following pages can help the university fine tune its space utilization and prepare campus facilities to accommodate STEM growth.

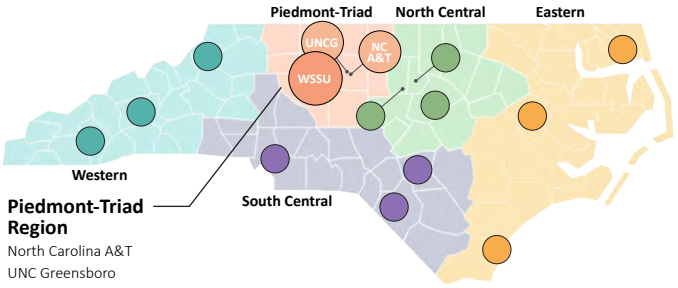
STEM Categories

MGT's study divided STEM majors into five categories: engineering, hard science, health science, math, and technology. In this study, physical space is sorted into the same five categories.

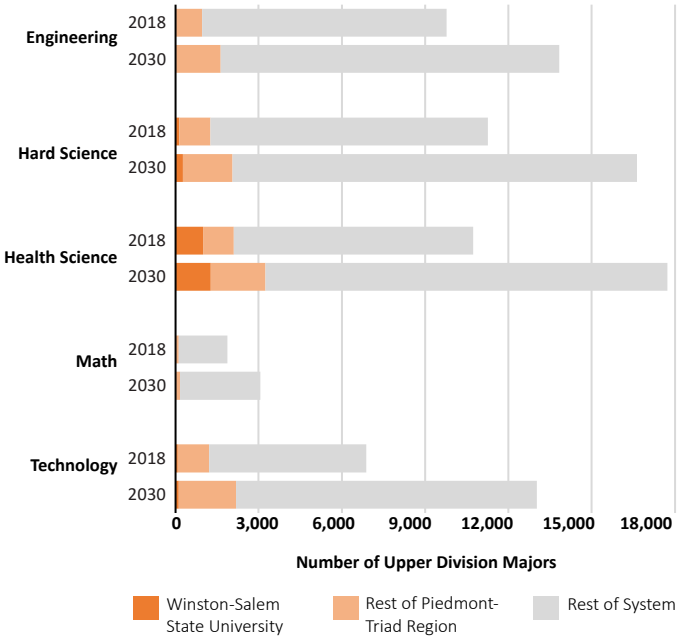
- Engineering space is dedicated to a broad range of engineering subjects, including hands-on technical instruction related to engineering programs.
- Hard science space houses lab-based sciences such as biology, chemistry, physics, geology, and anatomy and physiology. Social sciences are excluded.
- Health science space is dedicated to clinically-oriented, non-research health professions such as nursing and occupational therapy.
- Math space supports all math instruction.
- Technology space accommodates instruction in computer science and data analytics.

Most, but not all, fall 2017 instruction in designated STEM spaces was in STEM subjects. All instruction delivered in STEM spaces counted toward STEM weekly space utilization.

UNC System Regional Map



Winston-Salem State University STEM Majors



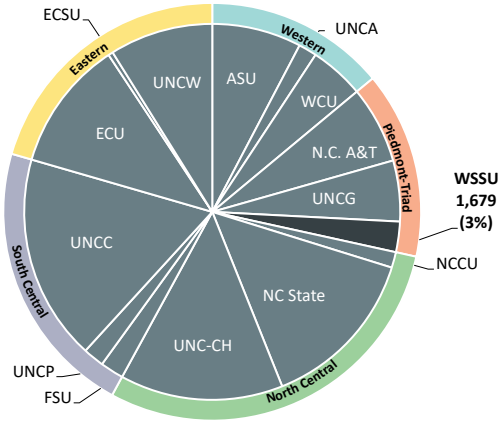
Undergraduate Enrollment

WINSTON-SALEM STATE UNIVERSITY

Understanding the Data Set

- MGT's enrollment analyses projected 2018 to 2028 enrollment growth of upper division majors only. JMZ extrapolated to 2030 using the MGT enrollment growth rate for the 2023-2028 period with some minor adjustments from the UNC System.
- While lower division and graduate STEM students were not included in MGT's enrollment projections, space needs associated with STEM growth of these groups are accounted for in this study.

Systemwide 2030 STEM Upper Division Enrollment



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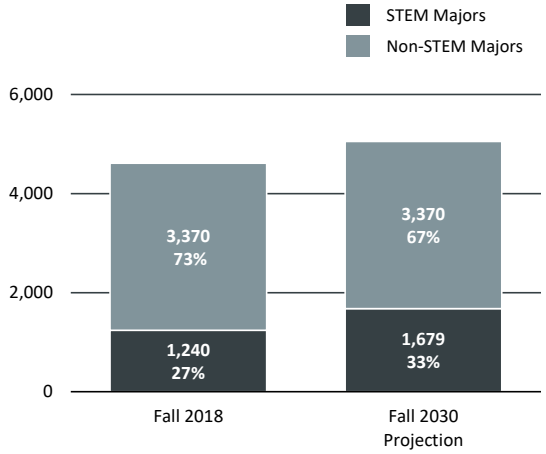
WSSU Upper Division STEM Majors

Headcount



Winston-Salem State University STEM Highlights

(Source: Appendix E of the MGT Report)

- The university is streamlining the enrollment process for non-clinical health science programs for students who choose to leave other STEM majors.
- A joint program with UNC School of the Arts could result in a virtual reality and/or gaming program at the university.
- A mobile health care lab helps nursing students get hands-on experience.

WSSU Upper Division STEM Majors by Category

Headcount

STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering				
Hard Science	151	269	*118*	*4.9%*
Health Science	997	1,278	*281*	*2.1%*
Math	5	9	*4*	*5.0%*
Technology	87	123	*36*	*2.9%*
Total	**1,240**	**1,679**	***439***	***2.6%***

2017 Space Allocation

WINSTON-SALEM STATE UNIVERSITY

Understanding the Data Set

- Space allocation is based on 2017 UNC System data, self-reported by each university.
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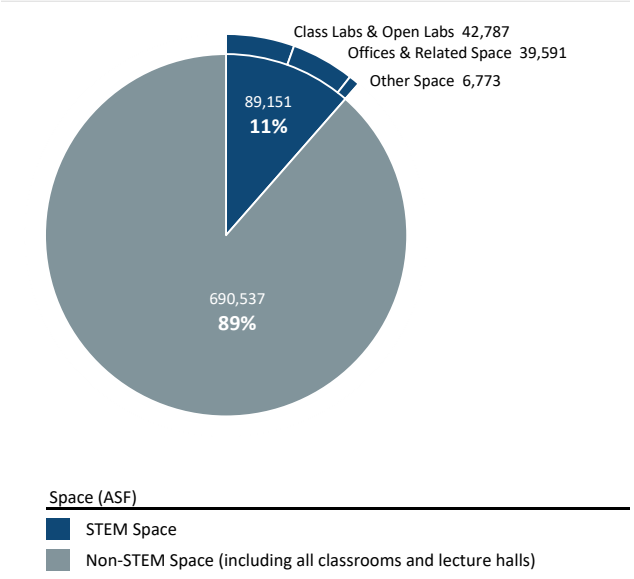
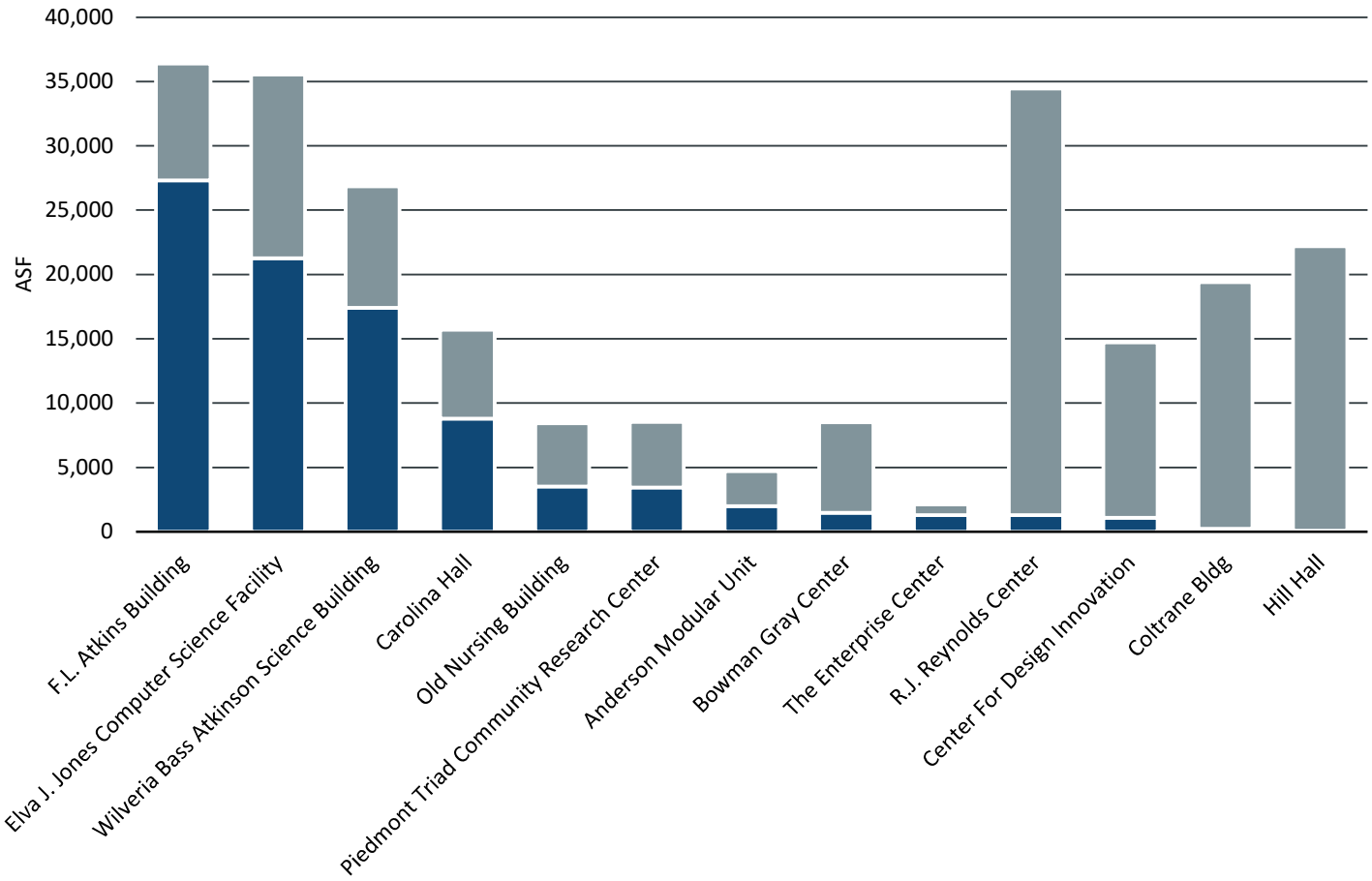
STEM Space Summary



2017 STEM Academic Space by Building



Instructional Space Utilization

WINSTON-SALEM STATE UNIVERSITY

Understanding the Data Set

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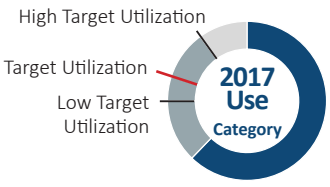
Understanding the Results



Darkest tone: Fall 2017 space use (hourly or seat fill)

Middle tone: Remaining capacity within target range

Lightest tone: Remaining capacity above target range; use at this level is not expected

Utilization Summary

Classrooms

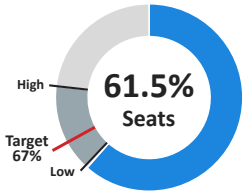
- Classroom seat fill nearly met the 62 percent low utilization target, on average.
- Hourly classroom utilization did not meet the low target of 29 hours per week.

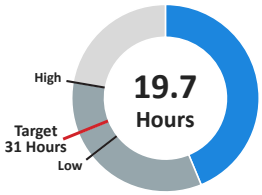
Class Labs

On average, class labs did not meet the low seat fill target of 75 percent or the low hourly target of 19 hours per week.

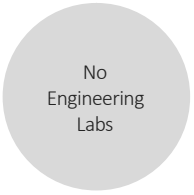
2017 Weekly Utilization - Seats and Hours

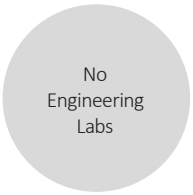
Classrooms



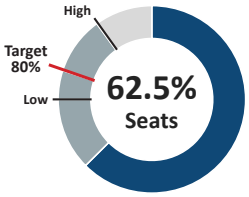


Engineering Labs

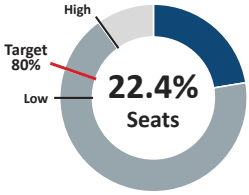




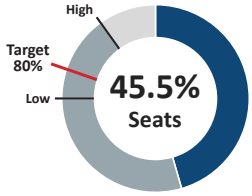
Hard Science Labs



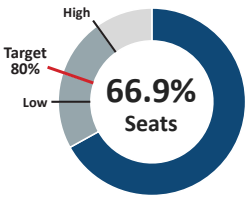
Health Science Labs



Math Labs



Technology Labs



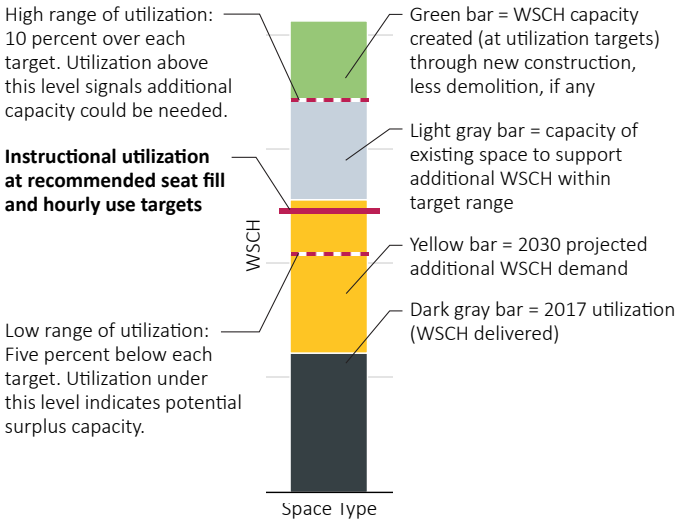
Weekly Instructional Capacity and Projections

WINSTON-SALEM STATE UNIVERSITY

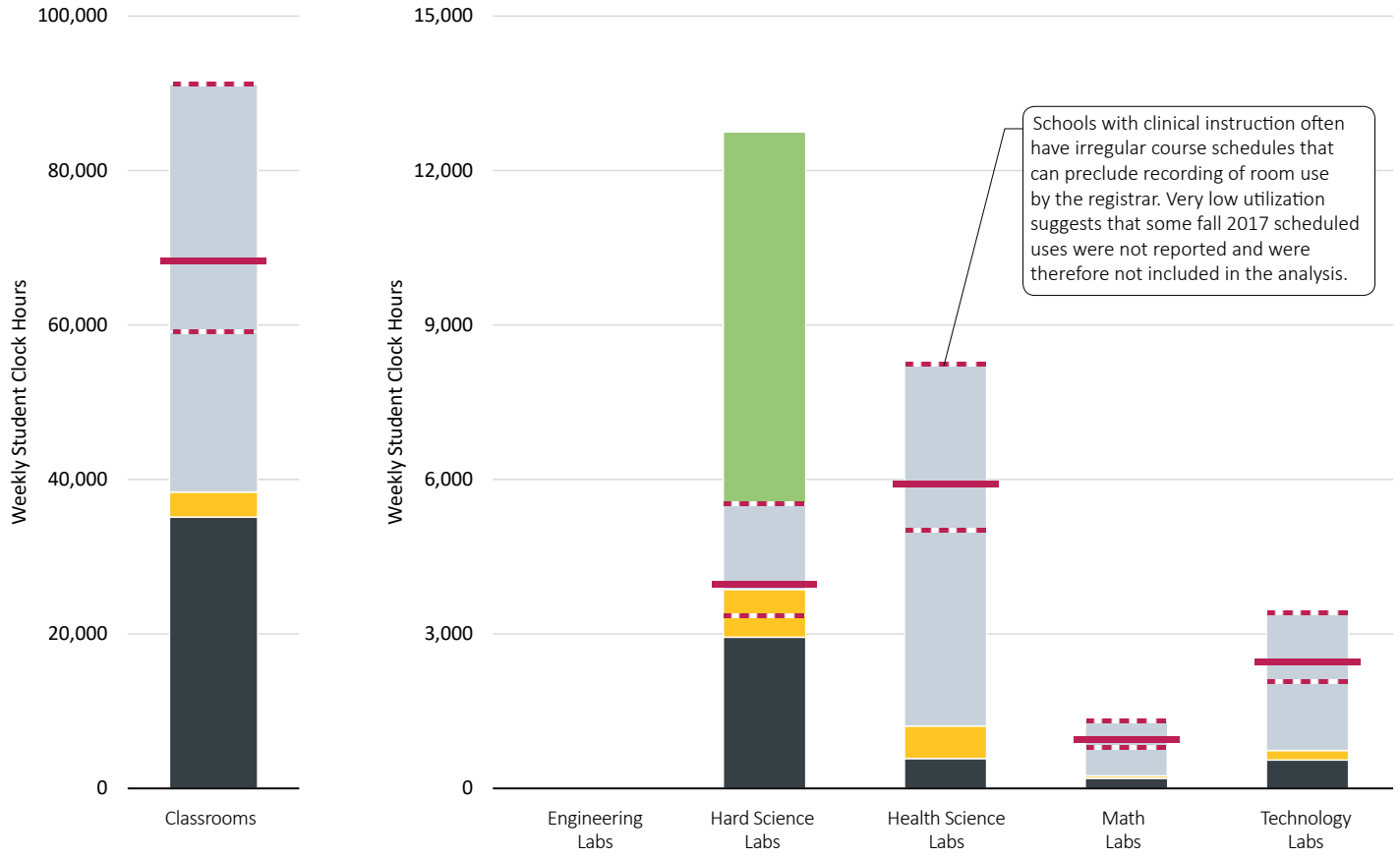
Understanding the Data Set

- An institution's capacity to accommodate future instruction is measured in weekly student clock hours (WSCH). One WSCH equals one student occupying one station for one hour.
- WSCH capacity is calculated using the number of stations in the 2017 space inventory with seat and hourly utilization target criteria applied.
- 2030 STEM course demand is projected to grow according to enrollment projections. Non-STEM course demand was held at the fall 2017 level.
- Graduate programs are evaluated separately. The effect of their growth on instructional demand is included later in this report.
- Future lab demand is based on the assumption that fall 2017 courses were scheduled in the labs best suited to deliver the required instruction.

Understanding the Results



2017 Utilization and 2030 Projections



Space Implications of Enrollment Growth
Undergraduate

WINSTON-SALEM STATE UNIVERSITY

Understanding the Data Set

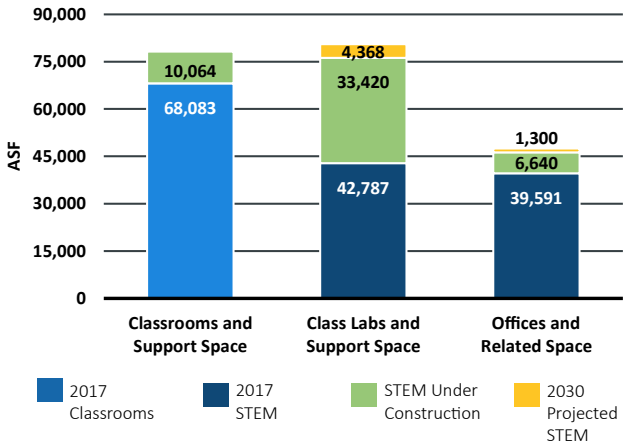
- Projections were made for classrooms, class labs, and office space only. Station sizes conform to UNC System standards.

Instructional Space	Station Size (ASF)
Classrooms	22
Engineering	108
Hard Science	70
Health Science	70
Math	33
Technology	50

Offices	Station Size (ASF)
Faculty	190
Staff (blended size)	140
Graduate Student	95

- If the projected 2030 instructional demand for an individual lab exceeded target capacity, a space need for an additional lab of the same type was generated. If a lab was not scheduled in 2017 or is projected to be underutilized in 2030, it could potentially offset future space demand.
- For each university, the 2018 STEM student:faculty and STEM faculty:staff ratios were maintained within System parameters. Since reliable data for current faculty and staff office space is not available, projections reflect the space needed for additional 2030 STEM faculty and staff only.
- The 2017 building condition codes were self-reported by each university to the UNC System. Building conditions were downgraded by one level in 2030 to reflect the presumed deterioration of structures if no substantial facilities improvements occur. None were reduced to demolition status.

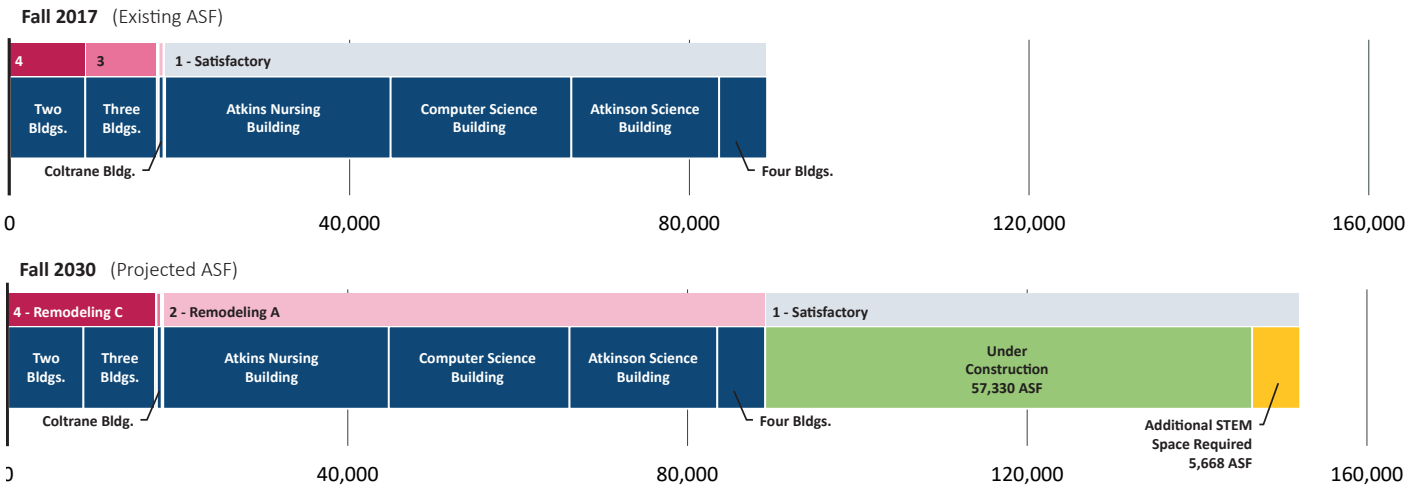
Academic Space by Category



Potential Space Offsets

	2017 Number of Labs		2030 Number of Labs	
	Labs (Inventory)	Labs Not Scheduled	Total Labs Needed	Underutilized Labs
Engineering				
Hard Science	10	2	14	5
Health Science	15	10	15	5
Math	3	1	3	2
Technology	8	5	8	3
Total	36	18	40	15

STEM Academic Space by Building



Building Area (ASF)
- Existing STEM (2017)
- Projected STEM (2030)
- Net Additional New STEM after Construction/Demolition

Building Condition
- 1 - Satisfactory
- 2 - Remodeling A
- 3 - Remodeling B
- 4 - Remodeling C

Renovation Cost as percent of Building Replacement Cost
- Less than 25%
- Between 25% and 50%
- More than 50%

Space Implications of Enrollment Growth
Graduate

WINSTON-SALEM STATE UNIVERSITY

Understanding the Data Set

- Graduate enrollment growth rates in this report were established using historical enrollment patterns and UNC System guidance. Graduate programs were not included in the MGT analysis.
- Without knowledge of specific graduate program curricula, it is assumed that all graduate students use on-campus space every semester.
- Projected 2030 instructional space demand for graduate students was layered on top of undergraduate demand. If the sum of 2030 undergraduate and graduate instruction would cause classrooms or labs to exceed target capacity, a space need for an additional room of the same type was generated.

Graduate Students by Category

Headcount

STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering				
Hard Science				
Health Science	367	434	*67*	*1.4%*
Math				
Technology				
Total	**367**	**434**	***67***	***1.4%***

Undergraduate and Graduate Instruction

STEM Category		WSCH 2017	WSCH 2030	*Annual Percent Change*
Engineering	Undergraduate			
	Graduate			
Subtotal				
Hard Science	Undergraduate	7,958	10,404	*2.3%*
	Graduate			
Subtotal		***7,958***	***10,404***	***2.3%***
Health Science	Undergraduate	5,341	6,704	*1.9%*
	Graduate	3,392	4,033	*1.5%*
Subtotal		***8,733***	***10,737***	***1.7%***
Math	Undergraduate	3,322	4,252	*2.1%*
	Graduate			
Subtotal		***3,322***	***4,252***	***2.1%***
Technology	Undergraduate	1,060	1,498	*2.9%*
	Graduate	43	54	*2.1%*
Subtotal		***1,102***	***1,552***	***2.9%***
Total STEM		**21,114**	**26,945**	***2.1%***

Space Implications

Classrooms

No additional classrooms will be required to accommodate projected STEM graduate enrollment growth in 2030.

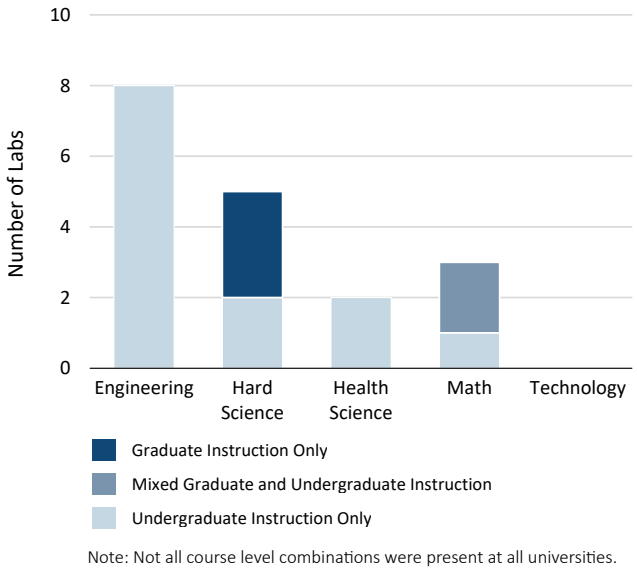
Class Labs

Most labs were used exclusively for undergraduate instruction in fall 2017. Two labs housed both graduate and undergraduate instruction. Three labs were scheduled for graduate instruction only. The additional lab space recommended to serve future STEM undergraduate enrollment will likely satisfy the space needs of future STEM graduate students.

Offices

If enrollment projections are met, 6,365 ASF of additional graduate office space should be allocated to STEM to accommodate 67 additional graduate students.

2017 Use of Scheduled Labs by Course Level



Note: Not all course level combinations were present at all universities.

University Summary

Space Utilization Opportunities

Classrooms

- Of the University's 80 classrooms, 69 were scheduled in fall 2017. If the following classrooms were, in fact, scheduled, the apparent surplus of classroom capacity may be reduced:
  - Atkins Nursing Building rooms 104 and 107
  - C. E. Gaines Complex 220
  - Carolina Hall 217
  - Computer Science Building rooms 2101, 2103, 2105, and 2116
  - Hall Patterson Building 326
  - Old Nursing Building rooms 12 and 112
- There were 20 classrooms with station sizes smaller than 18 square feet. If stations in these rooms were right-sized to 22 square feet or larger, lecture capacity (WSCH) overall would be reduced.
- If enrollment surges, Winston-Salem State University could increase seat fill targets to 80 percent in its 19 classrooms with station sizes greater than 22 square feet.

Hard Science Labs

Eight of ten Hard Science labs were scheduled. Atkinson 215 and 430 were not scheduled. Space equivalent to four additional labs will be needed by 2030 to meet projected Biology and Chemistry demand.

Health Science Labs

Ten of fifteen Health Science labs did not have scheduled use reported in fall 2017. Five of the unscheduled labs were in the Enterprise Center. Room names of Enterprise Center spaces suggest that the five individual rooms coded as class labs are part of a simulation suite and should be considered one instructional space.

Due to low scheduled use, no additional Health Science labs are projected for 2030.

Math Labs

Two of the University's three Math labs were scheduled. None of the Math labs are projected to exceed target utilization in 2030; no additional labs are recommended.

Technology Labs

Eight class labs were dedicated to Technology; three were scheduled. Nearly 60 percent of Technology instruction took place in classrooms, therefore that portion of 2030 instructional demand is recorded as classroom need. Due to low reported utilization, no additional Technology lab space is projected for 2030.

Next Steps

Data Accuracy

Information presented in this report is based, in part, on standard data submitted annually by individual universities to the UNC System. Inaccuracies in reported data could affect these results. Where possible, inconsistencies were identified, confirmed with the System, and corrected. However, room-by-room auditing of space data was beyond the scope of this study.

If the University believes a conclusion was drawn in error, the related data should be corrected by the university before its next submission to the System to ensure the validity of future studies.

Maximize Utilization at Pressure Points

Underutilized classrooms provide an opportunity to repurpose space to create additional labs and offices. While there is an apparent surplus of classrooms at the University, underutilized space may not be in the right location or configuration to offset STEM space needs.

As enrollment grows, the University may need additional STEM lab space before funding is available to build or renovate. The University should plan strategically to identify enrollment thresholds that, when met, prompt actions such as scheduling evening lab courses, increasing target seat utilization in labs (within safe limits), and/or sharing lab space among disciplines (where pedagogically feasible).

Supplemental Information from the University

University comments can be found in Appendix C.

University Analysis

Purpose of this Study

In March 2019 the UNC System commissioned a *Systemwide STEM Program Needs Assessment,* which was prepared by MGT Consulting Group. This report, the *Systemwide STEM Capital Planning Study,* builds upon MGT's work and provides a projection of the physical space required to accommodate future STEM enrollment. The UNC System will use this capital planning study to guide the development of a systemwide STEM capital improvement plan.

By 2030, North Carolina Central University is expected to gain nearly 300 upper division STEM majors. Though its share of systemwide STEM students will remain the same at 1.4 percent, math and technology degrees are expected to be among the fastest growing in the state. The analysis on the following pages can help the university fine tune its space utilization and prepare campus facilities to accommodate STEM growth.

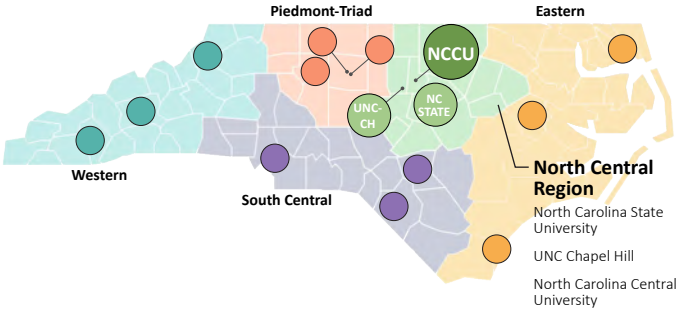
STEM Categories

MGT's study divided STEM majors into five categories: engineering, hard science, health science, math, and technology. In this study, physical space is sorted into the same five categories.

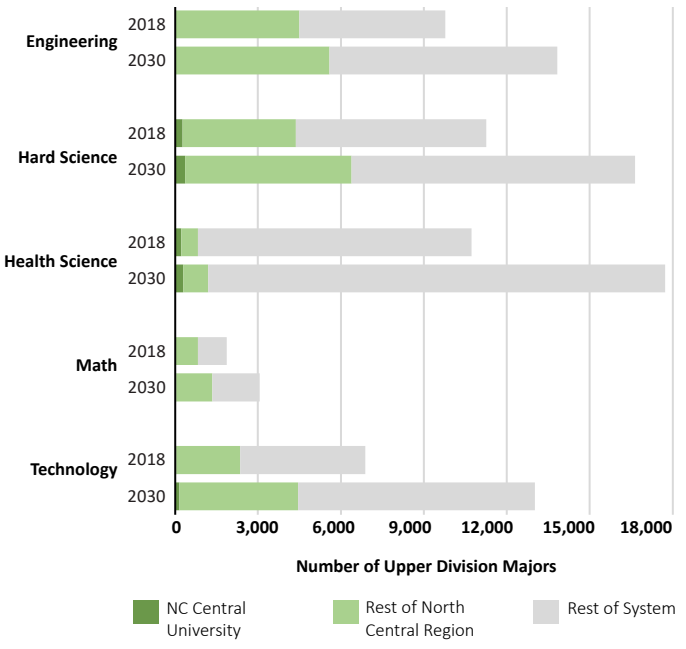
- Engineering space is dedicated to a broad range of engineering subjects, including hands-on technical instruction related to engineering programs.
- Hard science space houses lab-based sciences such as biology, chemistry, physics, geology, anatomy and physiology. Social sciences are excluded.
- Health science space is dedicated to clinically-oriented, non-research health professions such as nursing and occupational therapy.
- Math space supports all math instruction.
- Technology space accommodates instruction in computer science and data analytics.

Most, but not all, fall 2017 instruction in designated STEM spaces was in STEM subjects. All instruction delivered in STEM spaces counted toward STEM weekly space utilization.

UNC System Regional Map



NC Central University STEM Majors

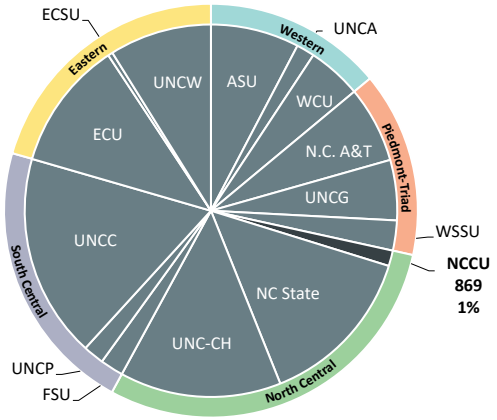


Undergraduate Enrollment

Understanding the Data Set

- MGT's enrollment analyses projected 2018 to 2028 enrollment growth of upper division majors only. JMZ extrapolated to 2030 using the MGT enrollment growth rate for the 2023-2028 period with some minor adjustments from the UNC System.
- While lower division and graduate STEM students were not included in MGT's enrollment projections, space needs associated with STEM growth of these groups are accounted for in this study.

Systemwide 2030 STEM Upper Division Enrollment



North Central Region STEM Enrollment Outlook

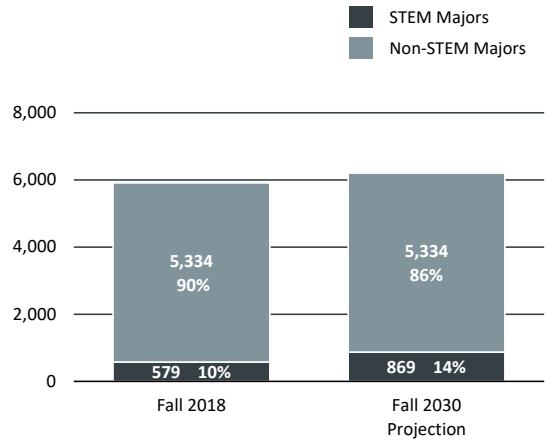
MGT considered industry growth, expected population change, and individual universities' enrollment targets in its enrollment analysis.

The North Central Region population is expected to grow 16 percent overall between 2020 and 2030. The population of traditional-age students (age 18 to 24) is expected to grow more slowly at nine percent in the next decade.

Technology programs in the North Central Region are expected to grow by nearly 2,100 students by 2030, more than any other region in the state. Hard science programs will also gain over 2,000 students. Through 2026, there will be good job prospects for nurses, software developers, and management analysts.

NCCU Upper Division STEM Majors

Headcount



North Carolina Central University STEM Highlights

(Source: Appendix E of the MGT Report)

- The DREAM STEM program helps the university identify students as scientists early, create entrepreneurship opportunities in science, and provide STEM faculty development.
- NC Central is creating 3+2 programs in STEM fields to address needs of local and regional employers.
- Computer science and technology programs are growing, but could reportedly be limited by faculty teaching loads.

NCCU Upper Division STEM Majors by Category

Headcount

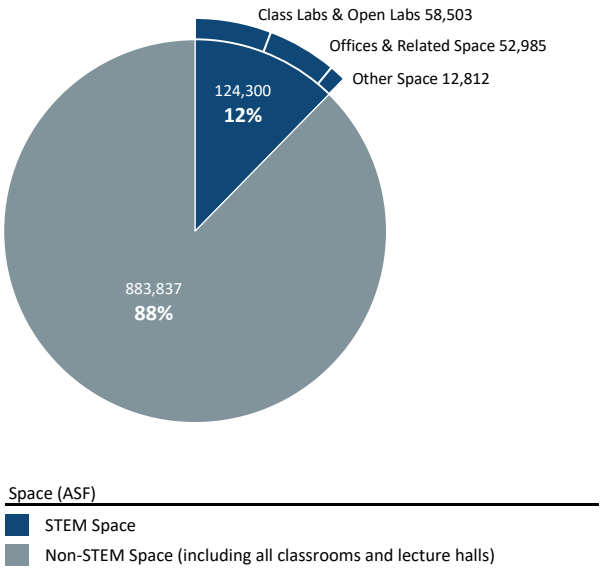
STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering				
Hard Science	278	368	*90*	*2.4%*
Health Science	230	297	*67*	*2.2%*
Math	15	41	*26*	*8.8%*
Technology	56	162	*106*	*9.3%*
Total	**579**	**869**	***290***	***3.4%***

2017 Space Allocation

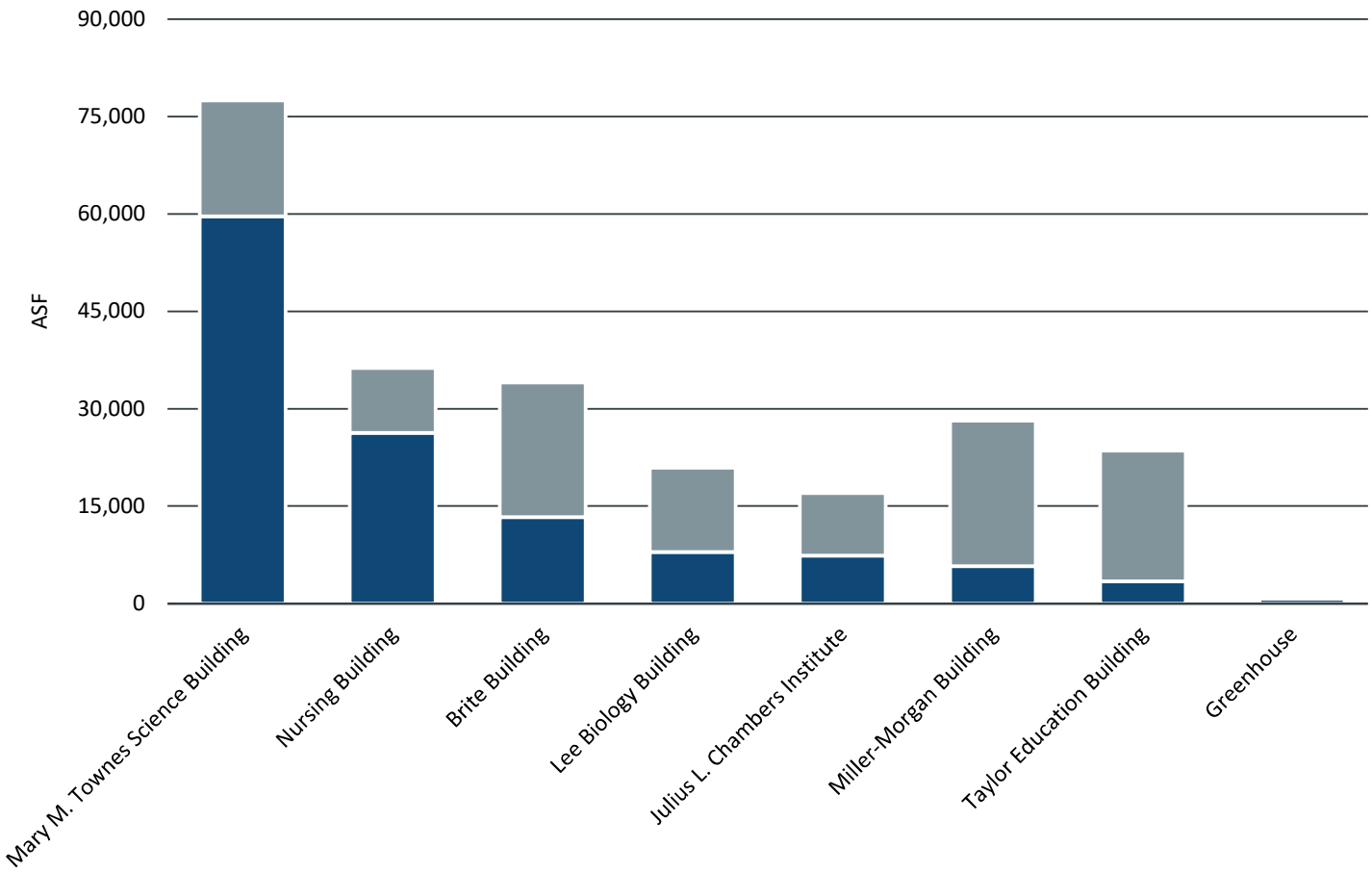
Understanding the Data Set

- Space allocation is based on 2017 UNC System data, self-reported by each university.
- Only buildings where space is allocated to STEM programs are included in this study.
- Space prorated for any amount of STEM is captured as 100 percent STEM since it is capable of supporting STEM education.
- General use classrooms are not counted as STEM-dedicated space. See Appendix B for a list of UNC System category codes considered STEM.
- The study does not include research or related space. However, the instructional spaces in the study may support research activities during unscheduled hours.
- Program space is quantified in assignable square feet (ASF).

STEM Space Summary



2017 STEM Academic Space by Building



Instructional Space Utilization

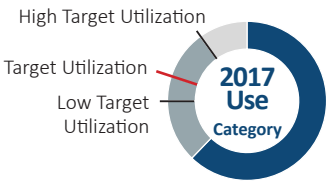
Understanding the Data Set

- Instructional space utilization is based on the fall 2017 course schedule (the most recent, fully vetted course schedule available at the time of this study).
- The study considered daytime room use in a 45-hour week based on the target criteria below from the Association for Learning Environments.
- While the study targets are ideal, a utilization range of five percent below or 10 percent above each target is considered reasonable.
- In a dedicated STEM space, all instruction delivered in that space was counted toward its fall 2017 utilization, including non-STEM courses.

Space Utilization Targets

	Seat Fill			Hours Used		
Space Type	Low	**Target**	High	Low	**Target**	High
Classrooms	62%	**67%**	77%	29	**31**	35
Class Labs	75%	**80%**	90%	19	**21**	26

Understanding the Results



Darkest tone: Fall 2017 space use (hourly or seat fill)

Middle tone: Remaining capacity within target range

Lightest tone: Remaining capacity above target range; use at this level is not expected

Utilization Summary

Classrooms

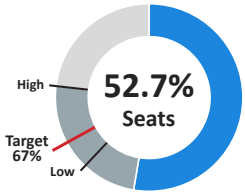
On average, classroom utilization fell short of the lowest targets for seat fill and hours used.

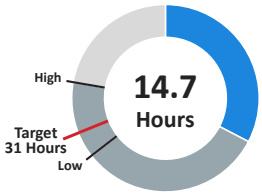
Class Labs

- Three of the university's four math labs exceeded both the seat fill and hourly targets when they were in use.
- Hard Science labs met the seat fill target, but on average, these labs did not meet the hourly utilization target. Health Science labs met neither the seat fill nor hourly target.

2017 Weekly Utilization - Seats and Hours

Classrooms



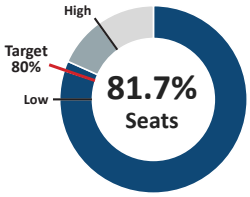


Engineering Labs

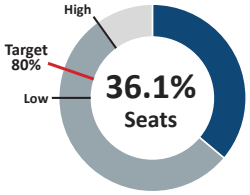
No Engineering Labs

No Engineering Labs

Hard Science Labs



Health Science Labs



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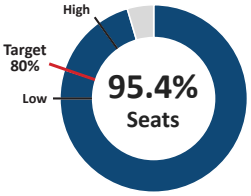

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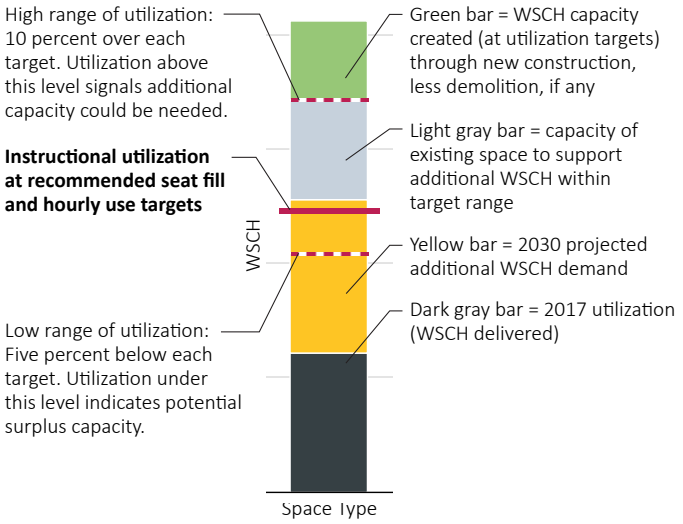
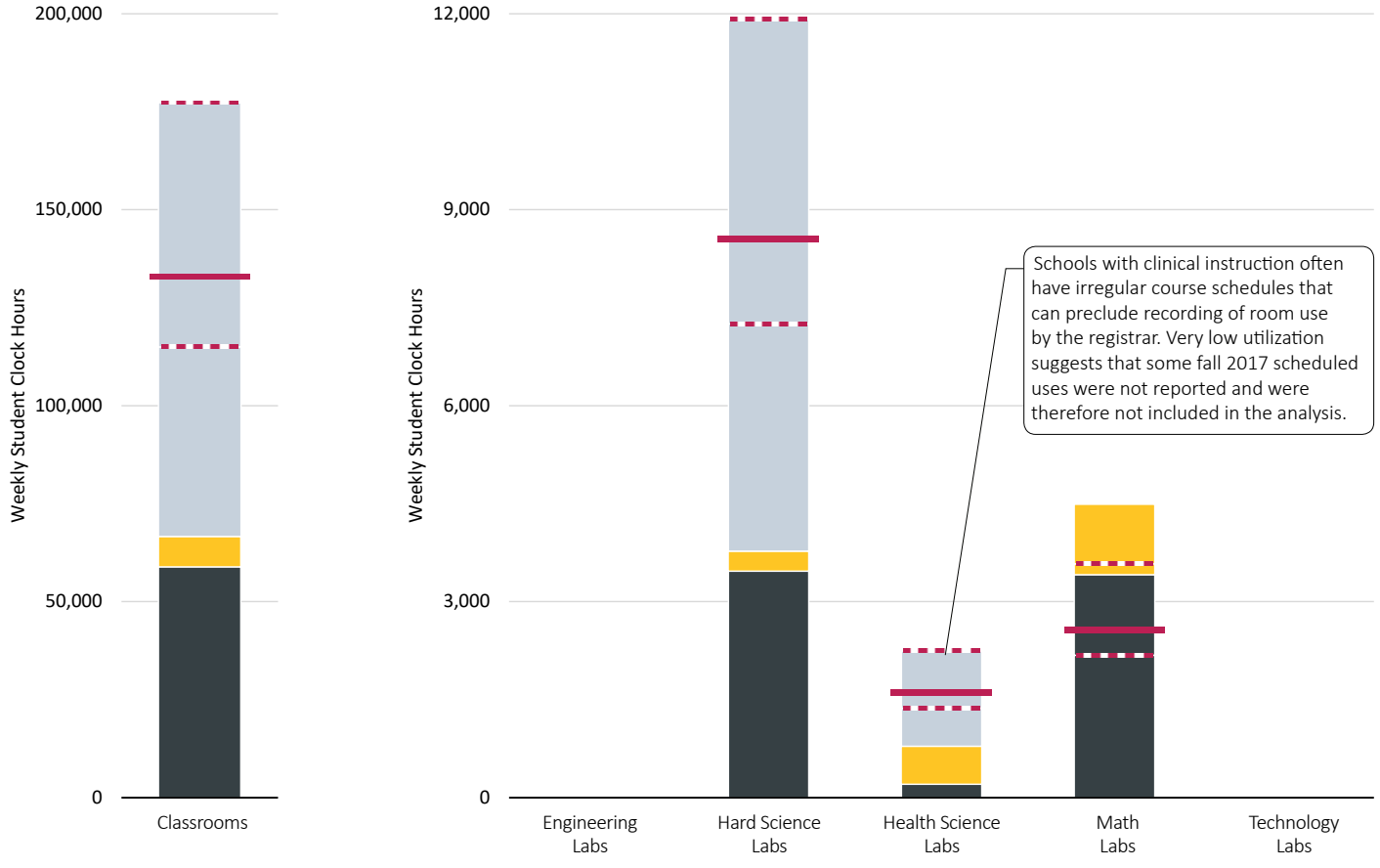


2017 Utilization and 2030 Projections



Space Implications of Enrollment Growth

Undergraduate

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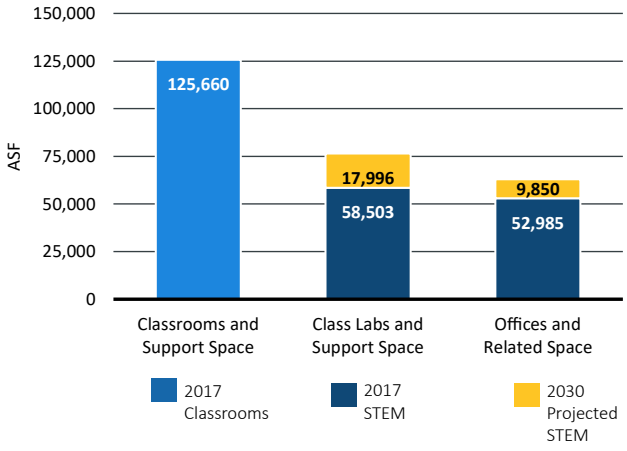
Academic Space by Category



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	Labs (Inventory)	Labs Not Scheduled	Total Labs Needed	Underutilized Labs
Engineering				
Hard Science	28	10	33	13
Health Science	3	2	3	1
Math	5	1	12	
Technology				
Total	36	13	48	14

Building Area (ASF)
- Existing STEM (2017)
- Projected STEM (2030)

Building Condition / Renovation Cost as percent of Building Replacement Cost
- 1 - Satisfactory
- 2 - Remodeling A — Less than 25%
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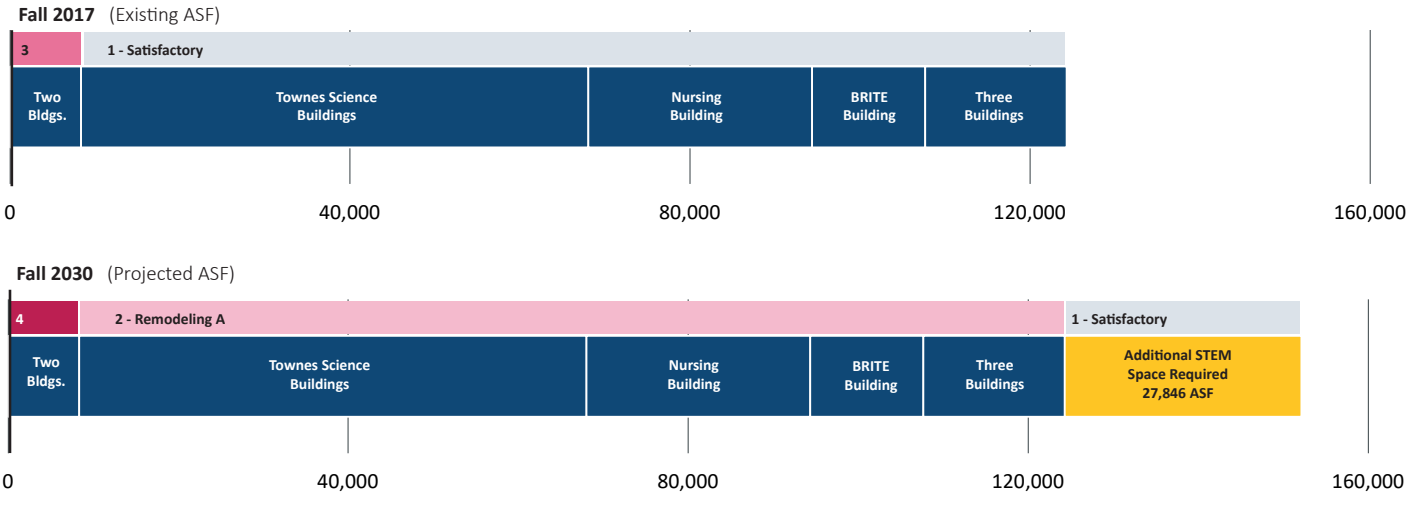
STEM Academic Space by Building



Space Implications of Enrollment Growth

Graduate

Understanding the Data Set

- Graduate enrollment growth rates in this report were established using historical enrollment patterns and UNC System guidance. Graduate programs were not included in the MGT analysis.
- Without knowledge of specific graduate program curricula, it is assumed that all graduate students use on-campus space every semester.
- Projected 2030 instructional space demand for graduate students was layered on top of undergraduate demand. If the sum of 2030 undergraduate and graduate instruction would cause classrooms or labs to exceed target capacity, a space need for an additional room of the same type was generated.

Graduate Students by Category

Headcount

STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering				
Hard Science	47	57	*10*	*1.6%*
Health Science	236	281	*45*	*1.5%*
Math	8	16	*8*	*5.9%*
Technology	75	155	*80*	*6.2%*
Total	**366**	**509**	***143***	***2.8%***

Undergraduate and Graduate Instruction

STEM Category		WSCH 2017	WSCH 2030	*Annual Percent Change*
Engineering	Undergraduate			
	Graduate			
Subtotal				
Hard Science	Undergraduate	12,433	13,594	*0.7%*
	Graduate	576	700	*1.6%*
Subtotal		***13,009***	***14,294***	***0.8%***
Health Science	Undergraduate	17,600	22,757	*2.2%*
	Graduate			
Subtotal		***17,600***	***22,757***	***2.2%***
Math	Undergraduate	5,063	6,469	*2.1%*
	Graduate	68	146	*6.6%*
Subtotal		***5,130***	***6,615***	***2.1%***
Technology	Undergraduate	1,451	4,208	*9.3%*
	Graduate	46	103	*7.1%*
Subtotal		***1,497***	***4,311***	***9.2%***
Total STEM		**37,235**	**47,977**	***2.1%***

Space Implications

Classrooms

No additional classrooms will be required to accommodate projected STEM graduate enrollment growth in 2030.

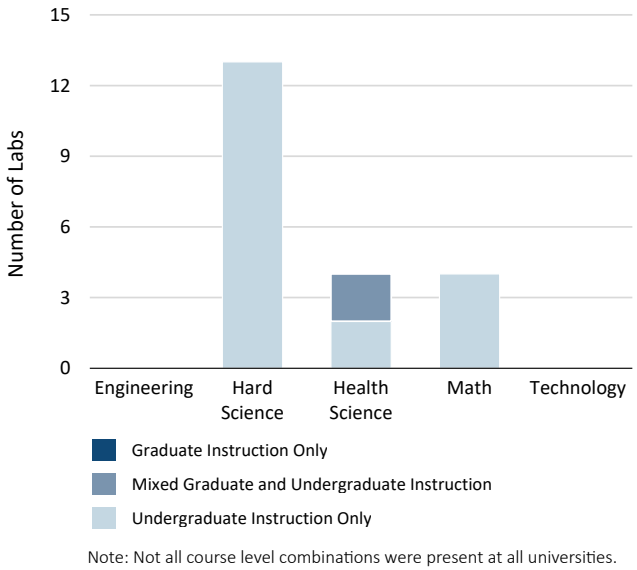
Class Labs

Most scheduled labs were used exclusively for undergraduate instruction; only two were used for both undergraduate and graduate courses. The additional lab space recommended to accommodate STEM undergraduate enrollment growth will likely satisfy the space needs of future STEM graduate students as well.

Offices

An additional 13,585 ASF of office space should be allocated to STEM in the next decade to house 143 new STEM graduate students.

2017 Use of Scheduled Labs by Course Level



Note: Not all course level combinations were present at all universities.

University Summary

Space Utilization Opportunities

Classrooms

- There will be sufficient capacity in the University's 152 classrooms to meet 2030 demand if utilization targets are met.
- There were 71 classrooms with station sizes smaller than 18 square feet. If stations in these rooms were right-sized to 22 square feet or larger, lecture capacity (WSCH) overall would be reduced.
- If enrollment surges, North Carolina Central University could increase seat fill targets to 80 percent in its 45 classrooms with station sizes greater than 22 square feet.

Hard Science Labs

The University scheduled 18 of its 28 Hard Science Labs. Some spaces coded as class labs may serve as class lab support or open labs. If spaces are incorrectly classified as class labs, they could contribute to the apparent excess of capacity in Hard Science Labs.

Four additional labs will be needed to meet Biology and Chemistry demand if enrollment projections are met.

Health Science Labs

There was one Health Science Lab, Nursing Building 2123, in the inventory. This room was scheduled for two hours per week. An open lab, Miller-Morgan room 115, was scheduled for 18 hours per week. Due to low scheduled use of the existing labs, no additional Health Science lab space is recommended.

Math Labs

Four of the University's five Math class labs were scheduled. Three of them were scheduled for 30 or more hours per week. Seven additional labs will be needed to meet 2030 demand if enrollment projections are met.

Next Steps

Data Accuracy

Information presented in this report is based, in part, on standard data submitted annually by individual universities to the UNC System. Inaccuracies in reported data could affect these results. Where possible, inconsistencies were identified, confirmed with the System, and corrected. However, room-by-room auditing of space data was beyond the scope of this study.

If the University believes a conclusion was drawn in error, the related data should be corrected by the university before its next submission to the System to ensure the validity of future studies.

Maximize Utilization at Pressure Points

Underutilized classrooms provide an opportunity to repurpose space to create additional labs and offices. While there is an apparent surplus of classrooms at the University, underutilized space may not be in the right location or configuration to offset STEM space needs.

As enrollment grows, the University may need additional STEM lab space before funding is available to build or renovate. The University should plan strategically to identify enrollment thresholds that, when met, prompt actions such as scheduling evening lab courses, increasing target seat utilization in labs (within safe limits), and/or sharing lab space among disciplines (where pedagogically feasible).

Supplemental Information from the University

University comments can be found in Appendix C.

NC STATE UNIVERSITY

University Analysis

Purpose of this Study

In March 2019 the UNC System commissioned a ***Systemwide STEM Program Needs Assessment,*** which was prepared by MGT Consulting Group. This report, the ***Systemwide STEM Capital Planning Study,*** builds upon MGT's work and provides a projection of the physical space required to accommodate future STEM enrollment. The UNC System will use this capital planning study to guide the development of a systemwide STEM capital improvement plan.

By 2030, North Carolina State University is projected to gain nearly 2,000 additional upper division undergraduate STEM majors. NC State will add the most engineering majors in the North Central Region. The analysis on the following pages can help the university fine tune its space utilization and prepare campus facilities to accommodate STEM growth.

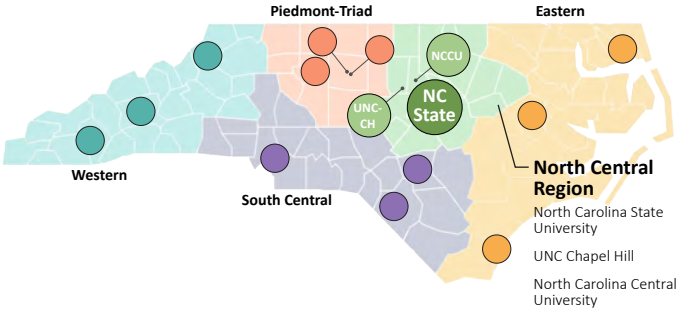
STEM Categories

MGT's study divided STEM majors into five categories: engineering, hard science, health science, math, and technology. In this study, physical space is sorted into the same five categories.

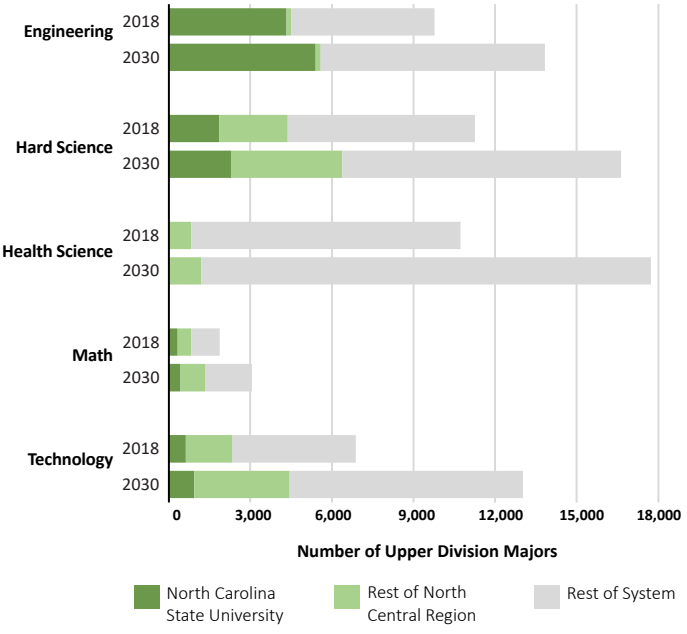
- Engineering space is dedicated to a broad range of engineering subjects, including hands-on technical instruction related to engineering programs.
- Hard science space houses lab-based sciences such as biology, chemistry, physics, geology, and anatomy and physiology. Social sciences are excluded.
- Health science space is dedicated to clinically-oriented, non-research health professions such as nursing and occupational therapy.
- Math space supports all math instruction.
- Technology space accommodates instruction in computer science and data analytics.

Most, but not all, fall 2017 instruction in designated STEM spaces was in STEM subjects. All instruction delivered in STEM spaces counted toward STEM weekly space utilization.

UNC System Regional Map



NC State University STEM Majors

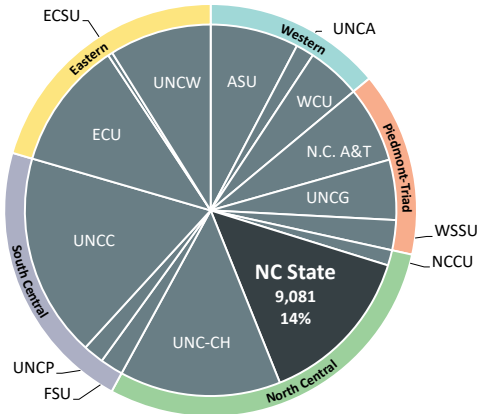


Undergraduate Enrollment

Understanding the Data Set

- MGT's enrollment analyses projected 2018 to 2028 enrollment growth of upper division majors only. JMZ extrapolated to 2030 using the MGT enrollment growth rate for the 2023-2028 period with some minor adjustments from the UNC System.
- While lower division and graduate STEM students were not included in MGT's enrollment projections, space needs associated with STEM growth of these groups are accounted for in this study.

Systemwide 2030 STEM Upper Division Enrollment



North Central Region STEM Enrollment Outlook

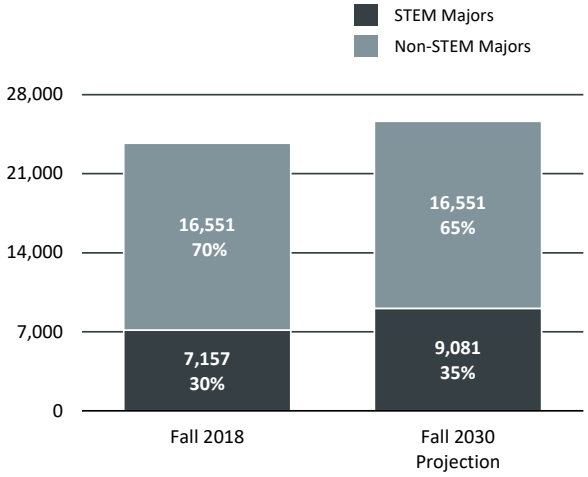
MGT considered industry growth, expected population change, and individual universities' enrollment targets in its enrollment analysis.

The North Central Region population is expected to grow 16 percent overall between 2020 and 2030. The population of traditional-age students (age 18 to 24) is expected to grow more slowly at nine percent in the next decade.

Technology programs in the North Central Region are expected to grow by nearly 2,100 students by 2030, more than any other region in the state. Hard science programs will also gain over 2,000 students. Through the next decade, there will be good job prospects for nurses, software developers, and management analysts.

NC State Upper Division STEM Majors

Headcount



North Carolina State University STEM Highlights

(Source: Appendix E of the MGT Report)

- The university has intentionally fostered an interdisciplinary environment.
- Interest in sustainability, energy, health, and cybersecurity are reportedly driving growth in STEM programs.
- The Wilson College of Textiles is the only school of its kind in North America. Enrollment growth has outpaced faculty growth.
- NC State strategically monitors enrollment to maintain focus on student success, faculty teaching loads, and not overutilizing its physical space.

NC State Upper Division STEM Majors by Category

Headcount

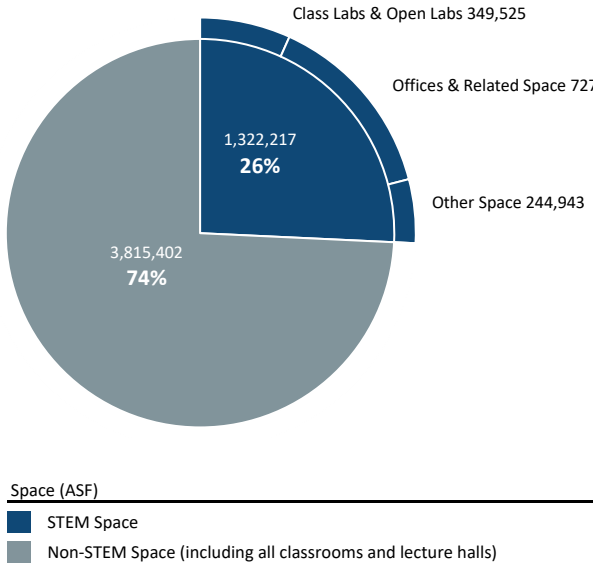
STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering	4,330	5,410	*1,080*	*1.9%*
Hard Science	1,862	2,296	*434*	*1.8%*
Health Science				
Math	334	431	*97*	*2.1%*
Technology	631	944	*313*	*3.4%*
Total	**7,157**	**9,081**	***1,924***	***2.0%***

2017 Space Allocation

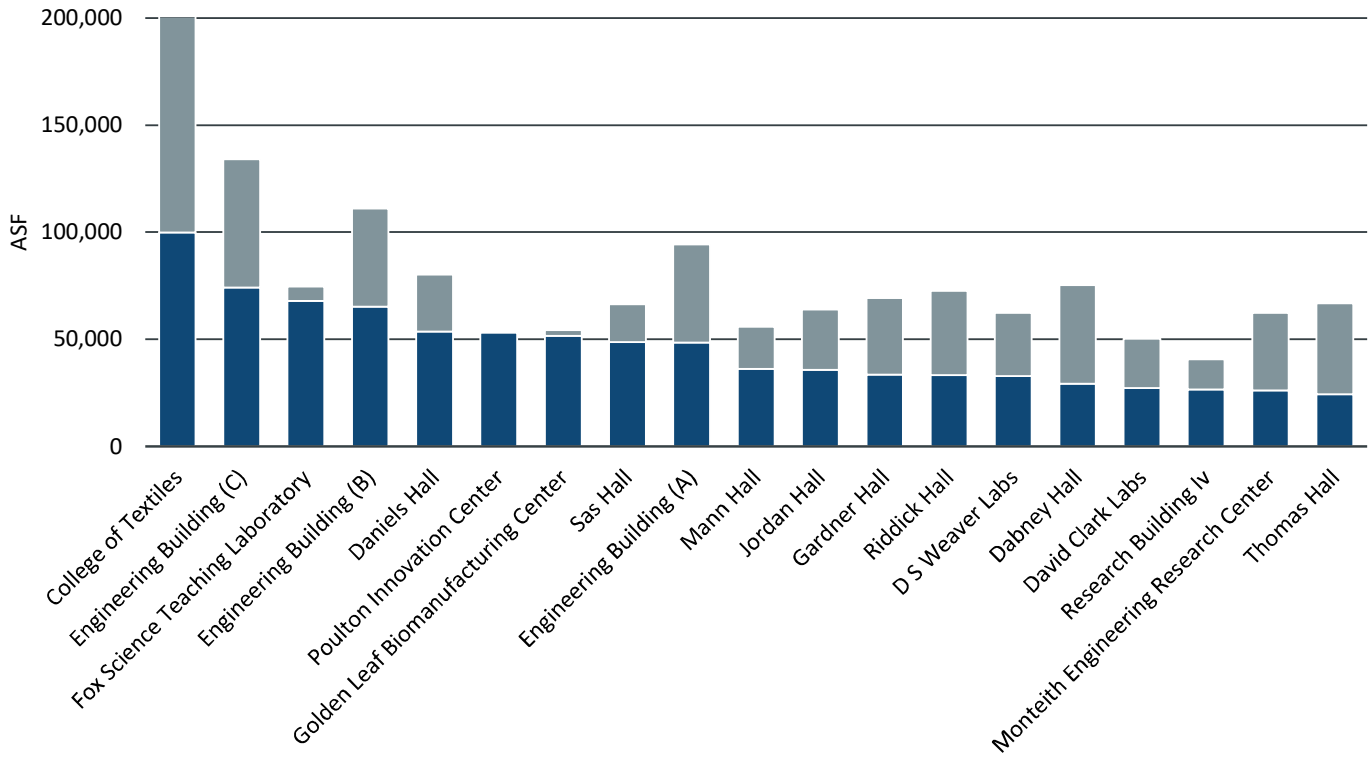
Understanding the Data Set

- Space allocation is based on 2017 UNC System data, self-reported by each university.
- Only buildings where space is allocated to STEM programs are included in this study.
- Space prorated for any amount of STEM is captured as 100 percent STEM since it is capable of supporting STEM education.
- General use classrooms are not counted as STEM-dedicated space. See Appendix B for a list of UNC System category codes considered STEM.
- The study does not include research or related space. However, the instructional spaces in the study may support research activities during unscheduled hours.
- Program space is quantified in assignable square feet (ASF).

STEM Space Summary

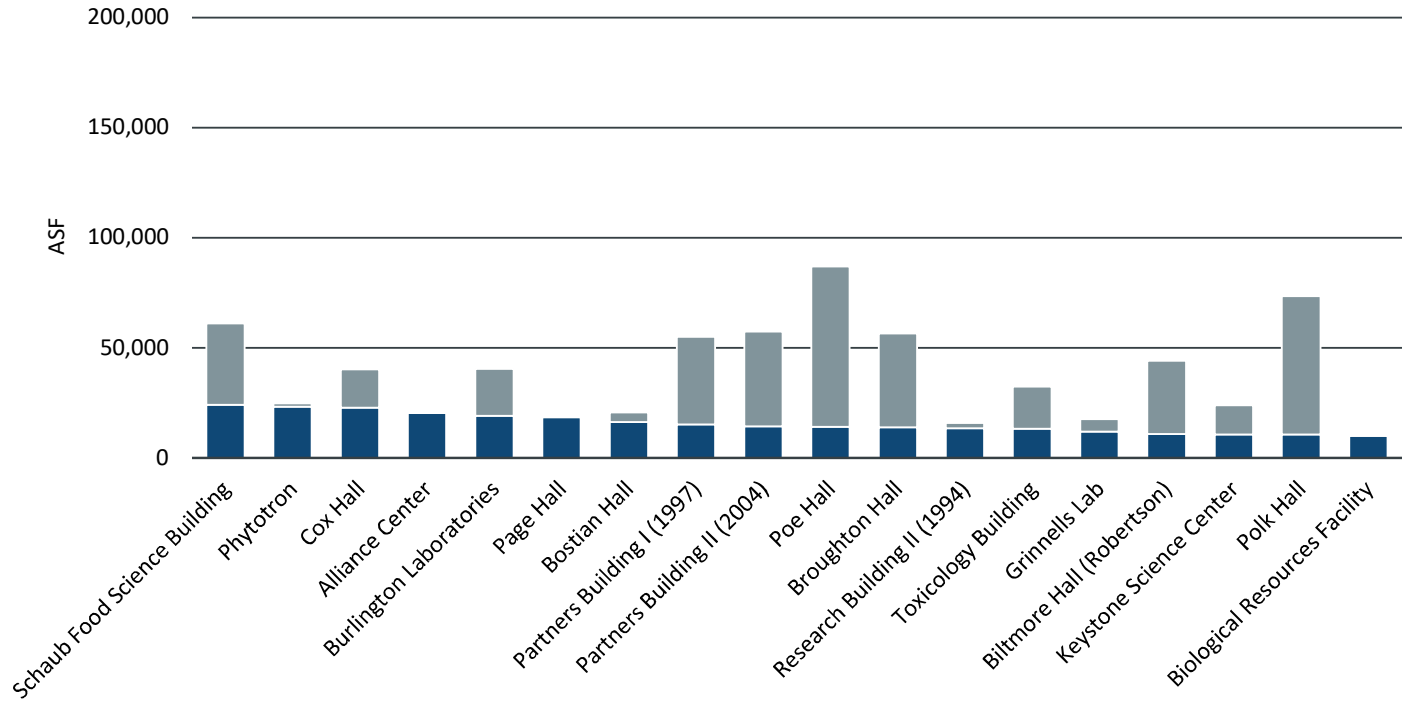


2017 STEM Academic Space by Building (chart 1 of 3)

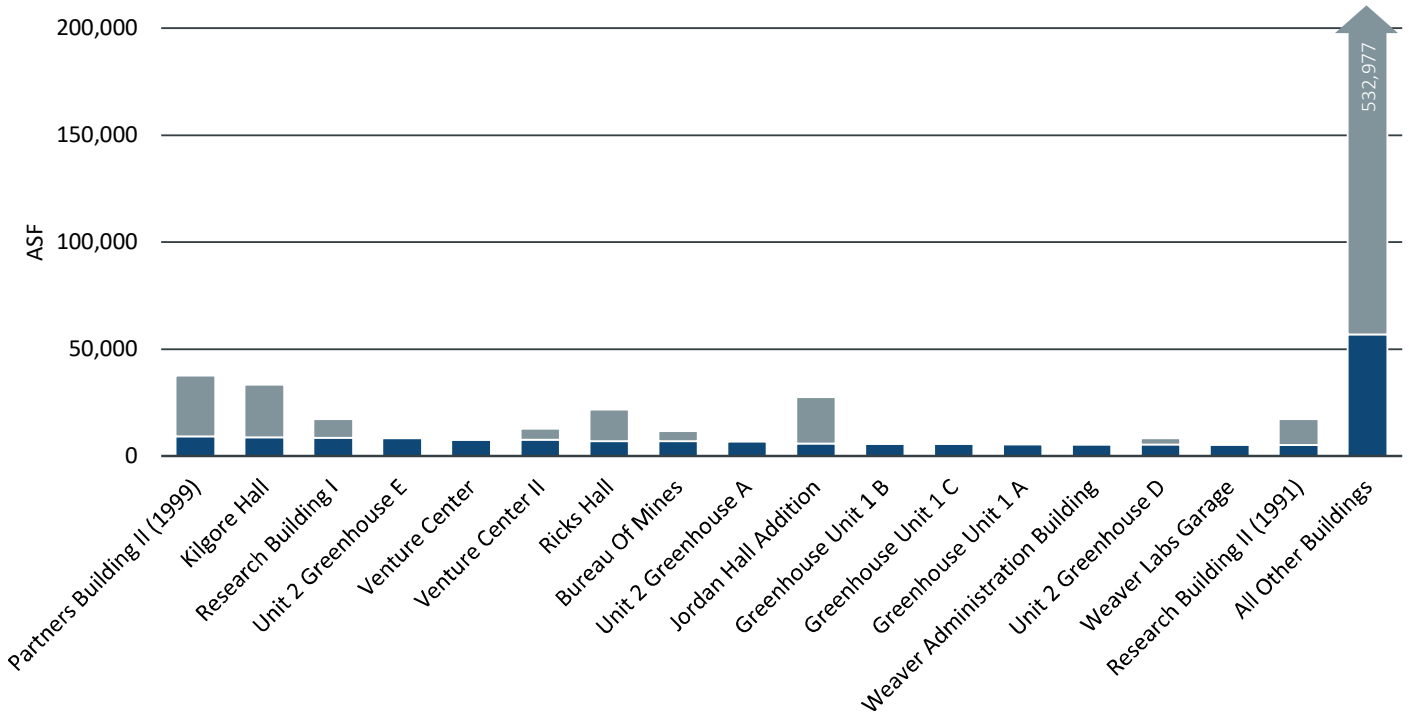


2017 Space Allocation

2017 STEM Academic Space by Building (chart 2 of 3)



2017 STEM Academic Space by Building (chart 3 of 3)



Instructional Space Utilization

NC STATE UNIVERSITY

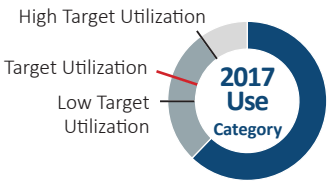
Understanding the Data Set

- Instructional space utilization is based on the fall 2017 course schedule (the most recent, fully vetted course schedule available at the time of this study).
- The study considered daytime room use in a 45-hour week based on the target criteria below from the Association for Learning Environments.
- While the study targets are ideal, a utilization range of five percent below or 10 percent above each target is considered reasonable.
- In a dedicated STEM space, all instruction delivered in that space was counted toward its fall 2017 utilization, including non-STEM courses.

Space Utilization Targets

	Seat Fill			Hours Used		
Space Type	Low	**Target**	High	Low	**Target**	High
Classrooms	62%	**67%**	77%	29	**31**	35
Class Labs	75%	**80%**	90%	19	**21**	26

Understanding the Results



Darkest tone: Fall 2017 space use (hourly or seat fill)

Middle tone: Remaining capacity within target range

Lightest tone: Remaining capacity above target range; use at this level is not expected

Utilization Summary

Classrooms

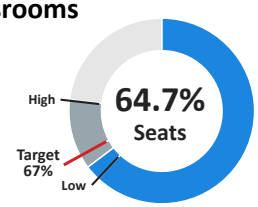
- On average, classroom seat fill met the target range.
- The lowest hourly target of 29 hours per week was nearly met.

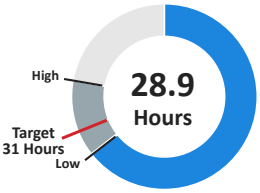
Class Labs

- Hard Science and Math labs reached target seat utilization, on average. Engineering and Technology labs did not.
- In no STEM category did labs meet the low hourly target of 19 hours per week.

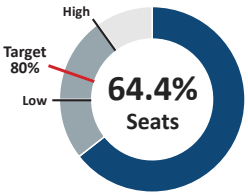
2017 Weekly Utilization - Seats and Hours

Classrooms

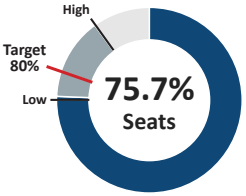




Engineering Labs

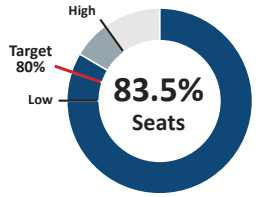


Hard Science Labs

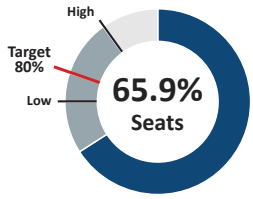


Health Science Labs

Math Labs



Technology Labs



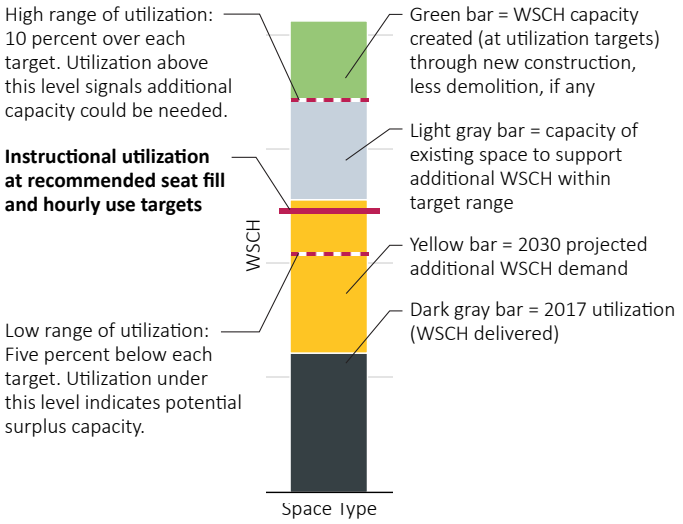
Weekly Instructional Capacity and Projections

NC STATE UNIVERSITY

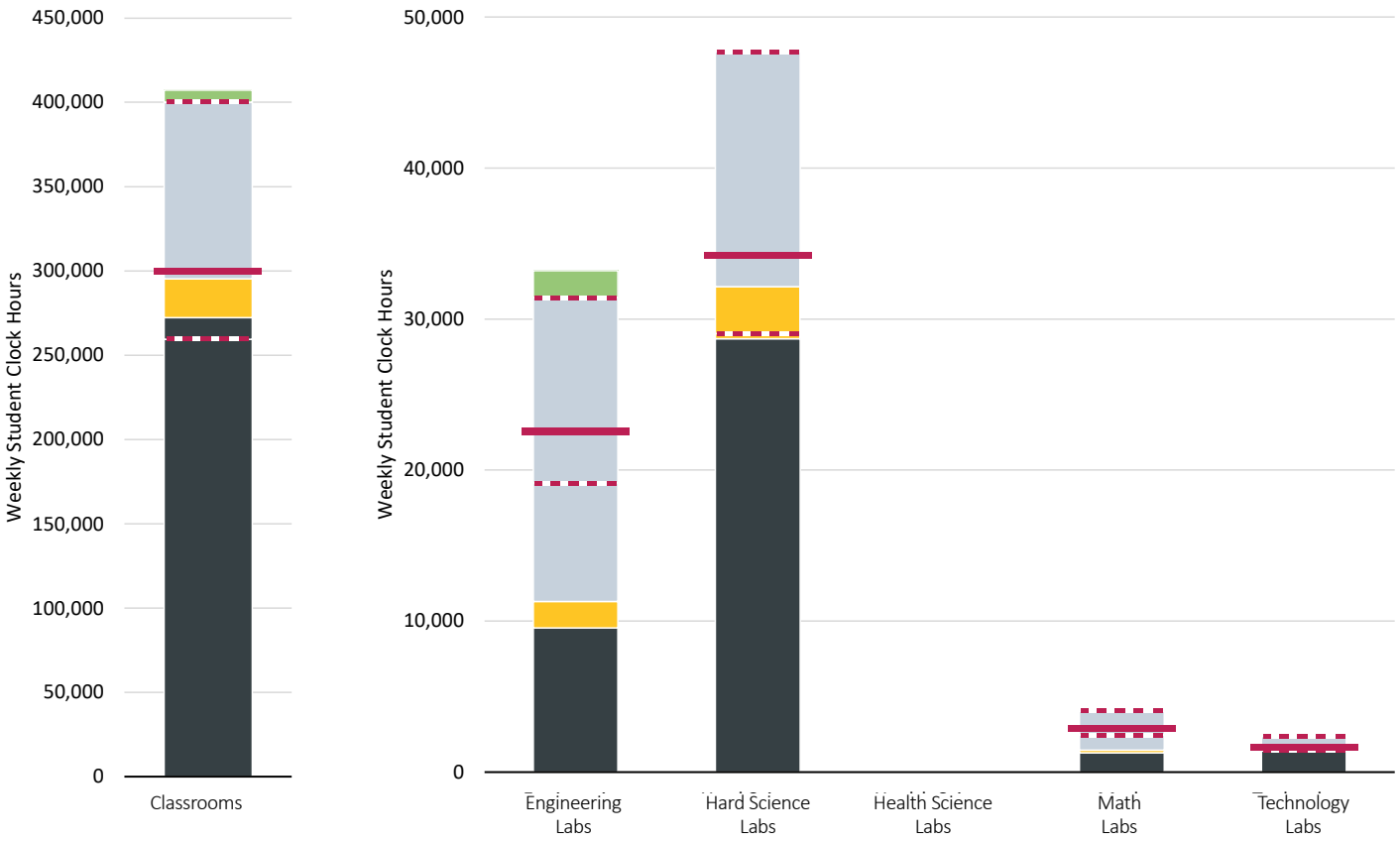
Understanding the Data Set

- An institution's capacity to accommodate future instruction is measured in weekly student clock hours (WSCH). One WSCH equals one student occupying one station for one hour.
- WSCH capacity is calculated using the number of stations in the 2017 space inventory with seat and hourly utilization target criteria applied.
- 2030 STEM course demand is projected to grow according to enrollment projections. Non-STEM course demand was held at the fall 2017 level.
- Graduate programs are evaluated separately. The effect of their growth on instructional demand is included later in this report.
- Future lab demand is based on the assumption that fall 2017 courses were scheduled in the labs best suited to deliver the required instruction.

Understanding the Results



Utilization, Capacity, and Projections



Space Implications of Enrollment Growth
Undergraduate

NC STATE UNIVERSITY

Understanding the Data Set

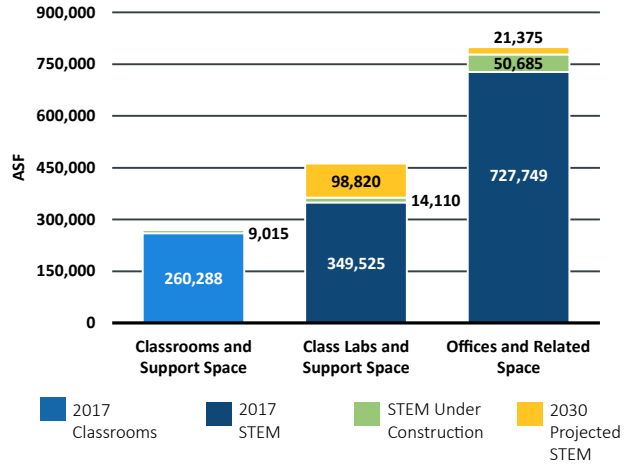
- Station sizes conform to UNC System standards. Projections were made for classrooms, class labs, and office space only.

Instructional Space	Station Size (ASF)
Classrooms	22
Engineering	108
Hard Science	70
Health Science	70
Math	33
Technology	50

Offices	Station Size (ASF)
Faculty	190
Staff (blended size)	140
Graduate Student	95

- If the projected 2030 instructional demand for an individual lab exceeded target capacity, a space need for an additional lab of the same type was generated. If a lab was not scheduled in 2017 or is projected to be underutilized in 2030, it could potentially offset future space demand.
- For each university, the 2018 STEM student:faculty and STEM faculty:staff ratios were maintained within System parameters. Since reliable data for current faculty and staff office space is not available, projections reflect the space needed for additional 2030 STEM faculty and staff only.
- The 2017 building condition codes were self-reported by each university to the UNC System. Building conditions were downgraded by one level in 2030 to reflect the presumed deterioration of structures if no substantial facilities improvements occur. None were reduced to demolition status.

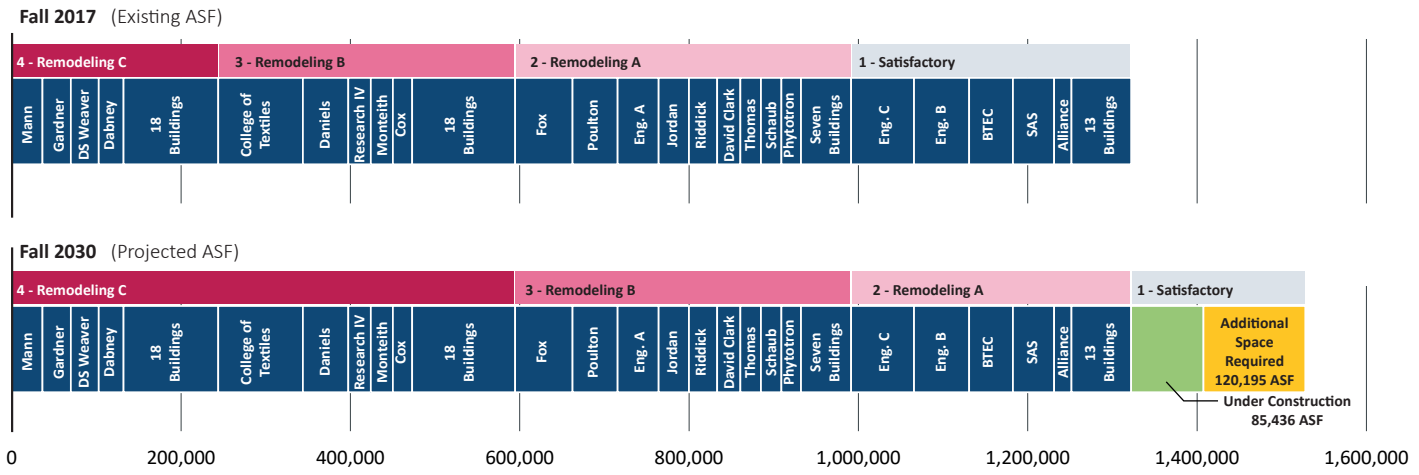
Academic Space by Category



Potential Space Offsets

	2017 Number of Labs		2030 Number of Labs	
	Labs (Inventory)	Labs Not Scheduled	Total Labs Needed	Underutilized Labs
Engineering	58	24	63	29
Hard Science	87	14	125	40
Health Science				
Math	7	3	10	2
Technology	11	7	13	3
Total	163	48	211	74

STEM Academic Space by Building



Space Implications of Enrollment Growth
Graduate

NC STATE UNIVERSITY

Understanding the Data Set

- Graduate enrollment growth rates in this report were established using historical enrollment patterns and UNC System guidance. Graduate programs were not included in the MGT analysis.
- Without knowledge of specific graduate program curricula, it is assumed that all graduate students use on-campus space every semester.
- Projected 2030 instructional space demand for graduate students was layered on top of undergraduate demand. If the sum of 2030 undergraduate and graduate instruction would cause classrooms or labs to exceed target capacity, a space need for an additional room of the same type was generated.

Graduate Students by Category

Headcount

STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering	2,791	3,242	*451*	*1.3%*
Hard Science	1,005	1,156	*151*	*1.2%*
Health Science				
Math	465	552	*87*	*1.4%*
Technology	717	941	*224*	*2.3%*
Total	**4,978**	**5,891**	***913***	***1.4%***

Instruction by Course Level

STEM Category		WSCH 2017	WSCH 2030	*Annual Percent Change*
Engineering	Undergraduate	48,763	60,926	*1.9%*
	Graduate	11,036	12,912	*1.3%*
Subtotal		***59,799***	***73,837***	***1.8%***
Hard Science	Undergraduate	80,565	90,343	*1.0%*
	Graduate	5,862	6,800	*1.2%*
Subtotal		***86,427***	***97,143***	***1.0%***
Health Science	Undergraduate			
	Graduate			
Subtotal				
Math	Undergraduate	37,279	43,222	*1.2%*
	Graduate	4,748	5,650	*1.5%*
Subtotal		***42,027***	***48,872***	***1.3%***
Technology	Undergraduate	8,436	12,621	*3.4%*
	Graduate	5,909	7,859	*2.4%*
Subtotal		***14,345***	***20,480***	***3.0%***
Total STEM		**202,597**	**240,331**	***1.4%***

Space Implications

Classrooms

If graduate enrollment projections are met, 24 additional seats in classrooms could be needed by 2030. This need could be met by extending hours of use in existing classrooms or scheduling graduate level lectures in conference rooms.

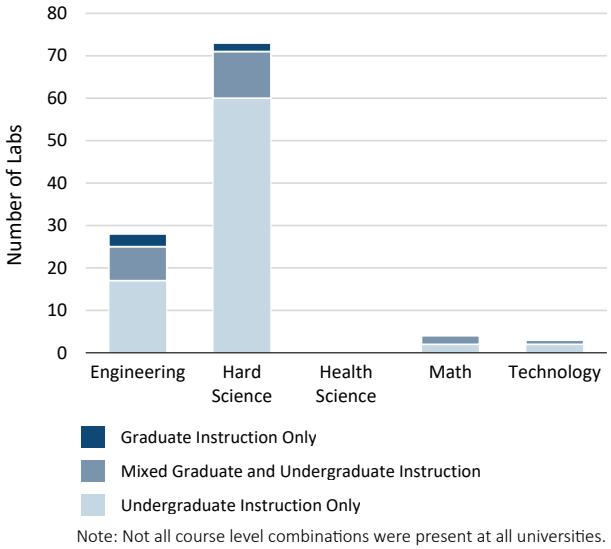
Class Labs

Most labs were used exclusively for undergraduate instruction in fall 2017. Twenty-two labs at NC State were scheduled for both undergraduate and graduate instruction. Five labs were used for graduate instruction only. The additional lab space recommended to accommodate STEM undergraduate enrollment growth will likely satisfy the space needs of future STEM graduate students as well.

Offices

If enrollment projections are met, 86,735 ASF of additional graduate office space should be allocated to STEM to accommodate 913 additional graduate students.

2017 Use of Scheduled Labs by Course Level



Note: Not all course level combinations were present at all universities.

University Summary

Space Utilization Opportunities

Classrooms

- There will be sufficient capacity in the University's 231 classrooms to meet 2030 STEM demand if utilization targets are met. However, aggregate utilization will approach the target classroom capacity. The University may perceive a lack of classrooms if utilization targets are not met.
- There were 85 classrooms with station sizes smaller than 18 square feet. If stations in these rooms were right-sized to 22 square feet or larger, lecture capacity (WSCH) overall would be reduced. Because the University may approach target classroom utilization, reduction of capacity could prompt a need for additional classrooms.
- If enrollment surges, NC State could increase seat fill targets to 80 percent in its 69 classrooms with station sizes greater than 22 square feet.

Engineering Labs

Thirty-four of the University's 58 Engineering labs were scheduled in daytime, fall 2017. Five labs are projected to exceed target capacity by 2030. Five additional labs will be needed if enrollment targets are met:

- Two in the College of Textiles
- One Electrical and Computer Engineering Lab
- One Mechanical and Aerospace Lab
- One lab for multiple Engineering disciplines: Electrical and Computer Engineering, Computer Science, Mechanical and Aerospace Engineering, Chemical Engineering, and Biomedical Engineering

Hard Science Labs

Of the University's 90 Hard Science labs, 73 were scheduled. Ten labs in the BTEC-Golden Leaf building; one Geology lab in Jordan Hall; and six horticulture labs in the Fox Science Teaching building, Gardner Hall, and the greenhouses were not scheduled.

By 2030, additional instructional capacity equivalent to 38 labs will be required to accommodate hard science instruction if enrollment projections are met:

- 12 Chemistry
- 10 Biology
- Five Physics
- Three Biotechnology
- Two Microbiology
- Two Plant Biology
- Four in other disciplines

Schedule data shows that 40 spaces coded as class labs may not reach recommended utilization targets in 2030. These labs could be candidates to meet future needs through sharing or reassignment of space.

Math Labs

Four out of seven Math labs were scheduled for Math courses and other instruction. Three labs are expected to exceed capacity if enrollment projections are met. Three additional labs are recommended to meet projected demand.

Technology Labs

Out of the University's 11 technology labs, four were scheduled. Only one, Daniels Hall room 255, is expected to exceed capacity in 2030 if enrollment projections are met. Two additional labs could be needed.

University Summary

Next Steps

Data Accuracy

Information presented in this report is based, in part, on standard data submitted annually by individual universities to the UNC System. Inaccuracies in reported data could affect these results. Where possible, inconsistencies were identified, confirmed with the System, and corrected. However, room-by-room auditing of space data was beyond the scope of this study.

If the University believes a conclusion was drawn in error, the related data should be corrected by the university before its next submission to the System to ensure the validity of future studies.

Maximize Utilization at Pressure Points

Underutilized classrooms provide an opportunity to repurpose space to create additional labs and offices. However, if STEM enrollment projections are met, the University could approach target utilization, on average, within its existing classrooms. This may allow certain underutilized classrooms to be repurposed, yet may not yield sufficient surplus space to offset future STEM space needs.

The anticipated STEM space need can be addressed in multiple ways:

- Repurpose existing unscheduled or underutilized space campuswide.
- Maximize utilization in existing labs.
- Construct new labs in an addition or new building, if the previous options do not satisfy the full future need.

As enrollment grows, the University may need additional STEM lab space before funding is available to build or renovate. The University should plan strategically to identify enrollment thresholds that, when met, prompt actions such as scheduling evening lab courses, increasing target seat utilization in labs (within safe limits), and/or sharing lab space among disciplines (where pedagogically feasible).

Supplemental Information from the University

University comments can be found in Appendix C.

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

University Analysis

Purpose of this Study

In March 2019 the UNC System commissioned a *Systemwide STEM Program Needs Assessment,* which was prepared by MGT Consulting Group. This report, the *Systemwide STEM Capital Planning Study,* builds upon MGT's work and provides a projection of the physical space required to accommodate future STEM enrollment. The UNC System will use this capital planning study to guide the development of a systemwide STEM capital improvement plan.

By 2030, UNC Chapel Hill is projected to gain nearly 4,000 STEM upper division majors. Chapel Hill is expected to grow by more Hard Science, Math, and Technology majors than any other university in the system. The analysis on the following pages can help the university fine tune its space utilization and prepare campus facilities to accommodate STEM growth.

STEM Categories

MGT's study divided STEM majors into five categories: engineering, hard science, health science, math, and technology. In this study, physical space is sorted into the same five categories.

- Engineering space is dedicated to a broad range of engineering subjects, including hands-on technical instruction related to engineering programs.
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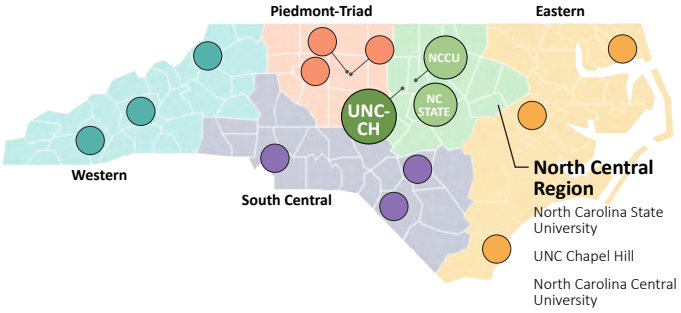
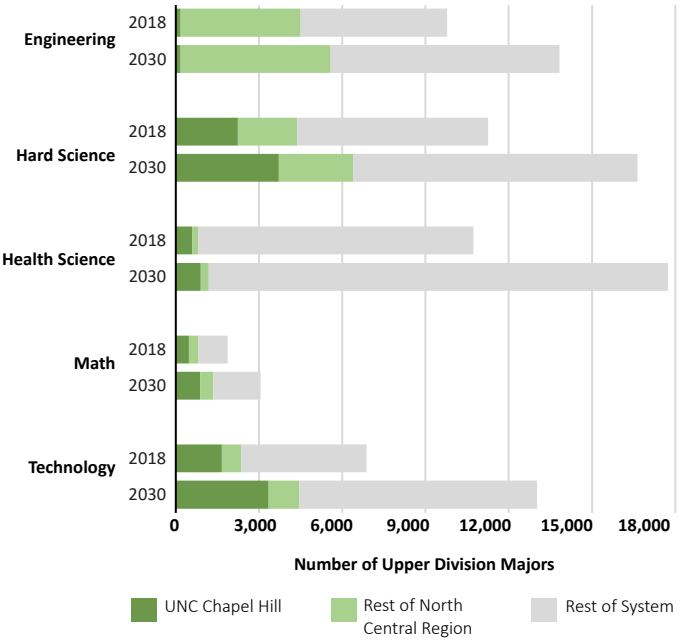
UNC System Regional Map



UNC Chapel Hill STEM Majors

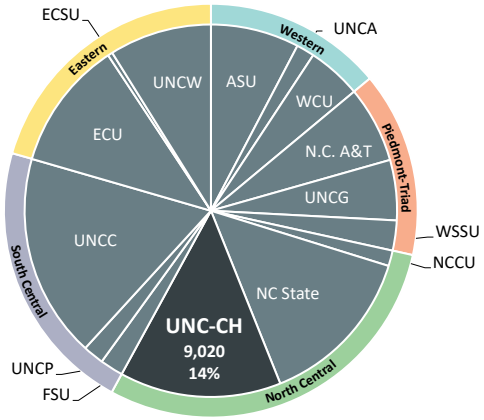


Undergraduate Enrollment

Understanding the Data Set

- MGT's enrollment analyses projected 2018 to 2028 enrollment growth of upper division majors only. JMZ extrapolated to 2030 using the MGT enrollment growth rate for the 2023-2028 period with some minor adjustments from the UNC System.
- While lower division and graduate STEM students were not included in MGT's enrollment projections, space needs associated with STEM growth of these groups are accounted for in this study.

Systemwide 2030 STEM Upper Division Enrollment



North Central Region STEM Enrollment Outlook

MGT considered industry growth, expected population change, and individual universities' enrollment targets in its enrollment analysis.

The North Central Region population is expected to grow 16 percent overall between 2020 and 2030. The population of traditional-age students (age 18 to 24) is expected to grow more slowly at nine percent in the next decade.

Technology programs in the North Central Region are expected to grow by nearly 2,100 students by 2030, more than any other region in the state. Hard science programs will also gain over 2,000 students. Through the next decade, there will be good job prospects for nurses, software developers, and management analysts.

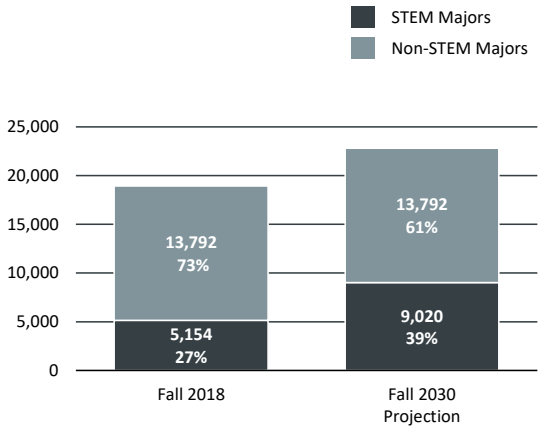
UNC Chapel Hill STEM Highlights

(Source: Appendix E of the MGT Report)

- There are 174 students in a new Biomedical Engineering program at UNC Chapel Hill, and the university hopes to add over 60 additional students by 2030.
- The university envisions a new Institute for Convergent Science near the center of campus. The Institute would be a site for interdisciplinary science collaboration. A capital request has already been submitted to the UNC System.

UNC Chapel Hill Upper Division STEM Majors

Headcount



UNC Chapel Hill
Upper Division STEM Majors by Category

Headcount

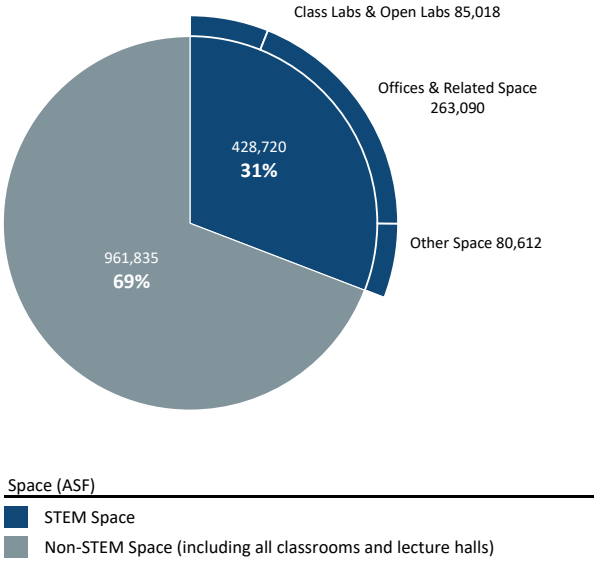
STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering	174	240	*66*	*2.7%*
Hard Science	2,238	3,694	*1,456*	*4.3%*
Health Science	596	894	*298*	*3.4%*
Math	478	875	*397*	*5.2%*
Technology	1,668	3,317	*1,649*	*5.9%*
Total	**5,154**	**9,020**	***3,866***	***4.8%***

2017 Space Allocation

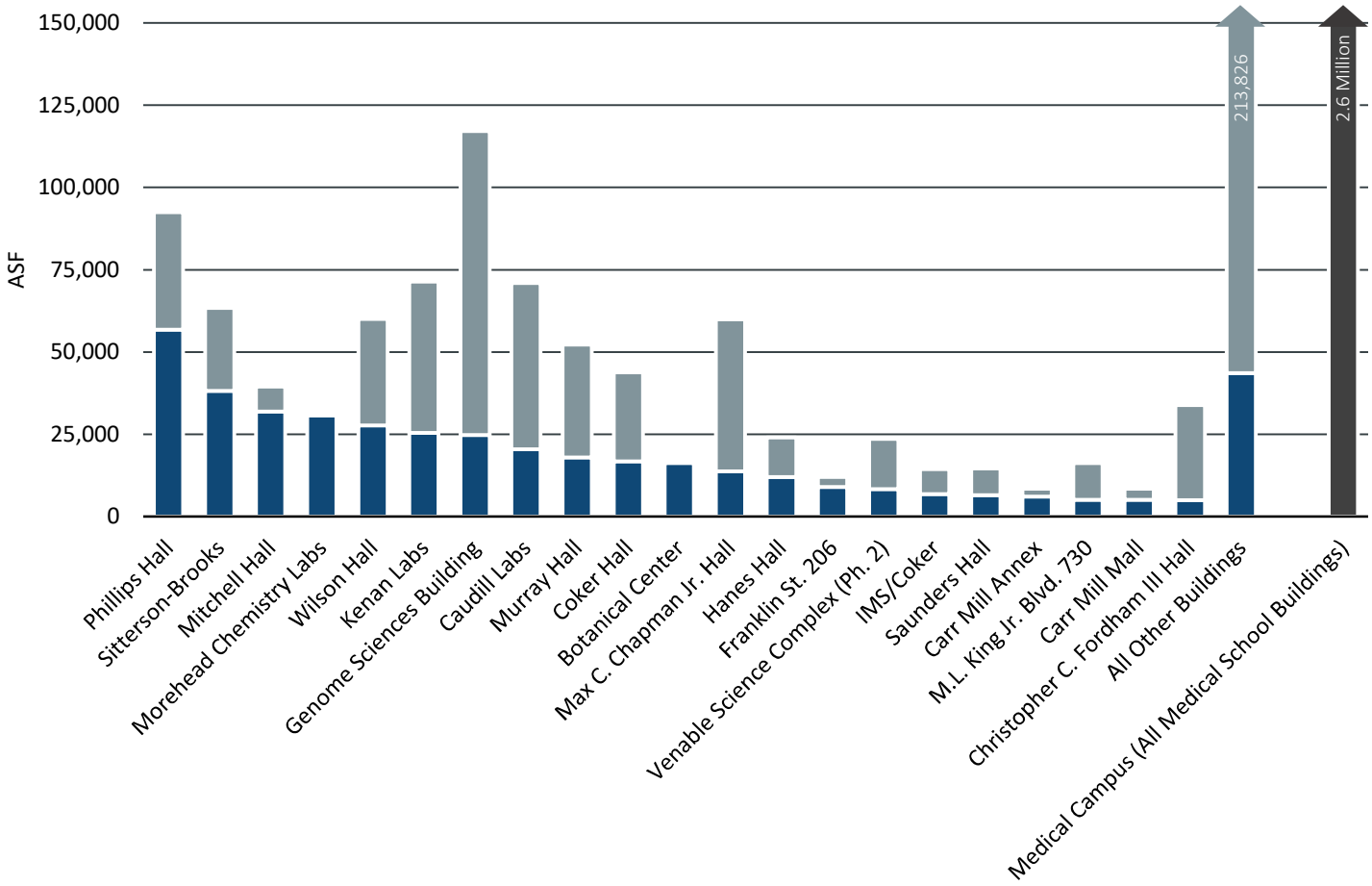
Understanding the Data Set

- Space allocation is based on 2017 UNC System data, self-reported by each university.
- Only buildings where space is allocated to STEM programs are included in this study.
- Space prorated for any amount of STEM is captured as 100 percent STEM since it is capable of supporting STEM education.
- General use classrooms are not counted as STEM-dedicated space. See Appendix B for a list of UNC System category codes considered STEM.
- The study does not include research or related space. However, the instructional spaces in the study may support research activities during unscheduled hours.
- Program space is quantified in assignable square feet (ASF).

STEM Space Summary



2017 STEM Academic Space by Building



Instructional Space Utilization

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

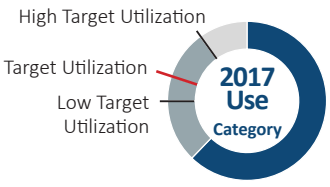
Understanding the Data Set

- Instructional space utilization is based on the fall 2017 course schedule (the most recent, fully vetted course schedule available at the time of this study).
- The study considered daytime room use in a 45-hour week based on the target criteria below from the Association for Learning Environments.
- While the study targets are ideal, a utilization range of five percent below or 10 percent above each target is considered reasonable.
- In a dedicated STEM space, all instruction delivered in that space was counted toward its fall 2017 utilization, including non-STEM courses.

Space Utilization Targets

	Seat Fill			Hours Used		
Space Type	Low	**Target**	High	Low	**Target**	High
Classrooms	62%	**67%**	77%	29	**31**	35
Class Labs	75%	**80%**	90%	19	**21**	26

Understanding the Results



Darkest tone: Fall 2017 space use (hourly or seat fill)

Middle tone: Remaining capacity within target range

Lightest tone: Remaining capacity above target range; use at this level is not expected

Utilization Summary

Classrooms

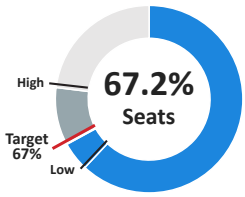
On average, classrooms met the 67 percent seat fill target when they were in use. The lowest hourly target of 29 hours was not met.

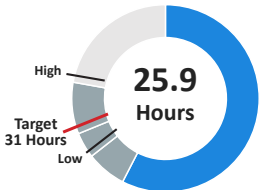
Class Labs

Hard Science labs did not meet the low seat fill target or the low hourly target.

2017 Weekly Utilization - Seats and Hours

Classrooms



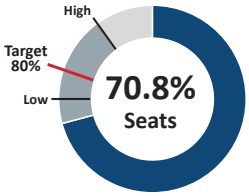


Engineering Labs

No Engineering Labs

No Engineering Labs

Hard Science Labs



Health Science Labs

No Health Science Labs

No Health Science Labs

Math Labs

No Math Labs

No Math Labs

Technology Labs

No Technology Labs

No Technology Labs

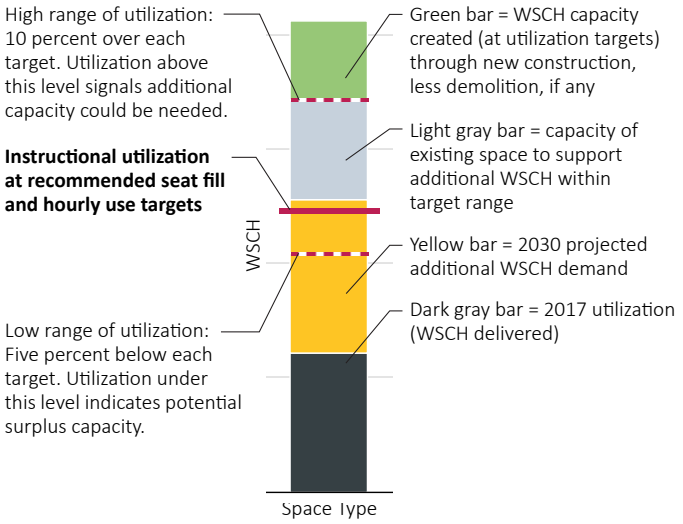
Weekly Instructional Capacity and Projections

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

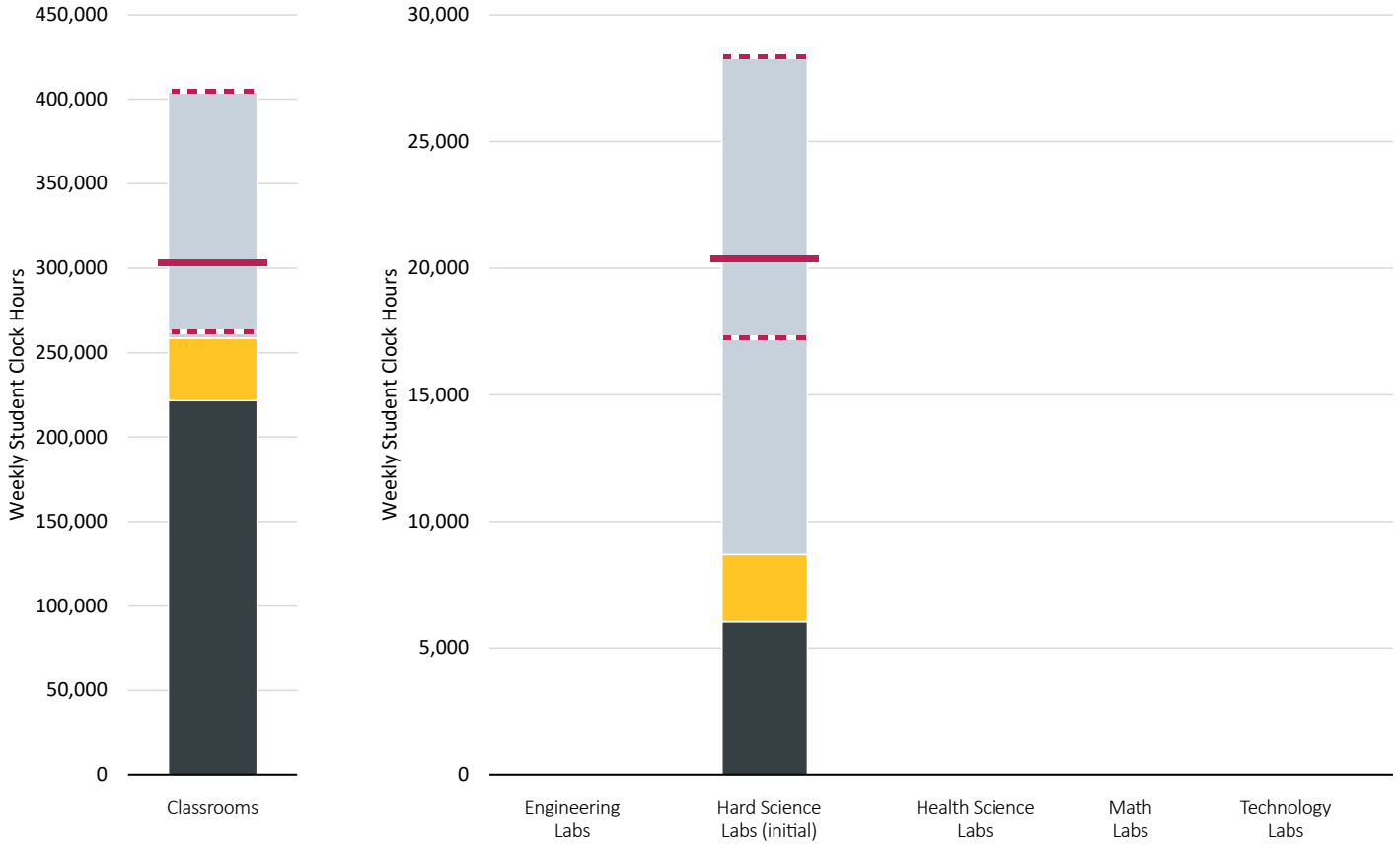
Understanding the Data Set

- An institution's capacity to accommodate future instruction is measured in weekly student clock hours (WSCH). One WSCH equals one student occupying one station for one hour.
- WSCH capacity is calculated using the number of stations in the 2017 space inventory with seat and hourly utilization target criteria applied.
- 2030 STEM course demand is projected to grow according to enrollment projections. Non-STEM course demand was held at the fall 2017 level.
- Graduate programs are evaluated separately. The effect of their growth on instructional demand is included later in this report.
- Future lab demand is based on the assumption that fall 2017 courses were scheduled in the labs best suited to deliver the required instruction.

Understanding the Results



2017 Utilization and 2030 Projections



Space Implications of Enrollment Growth
Undergraduate

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Understanding the Data Set

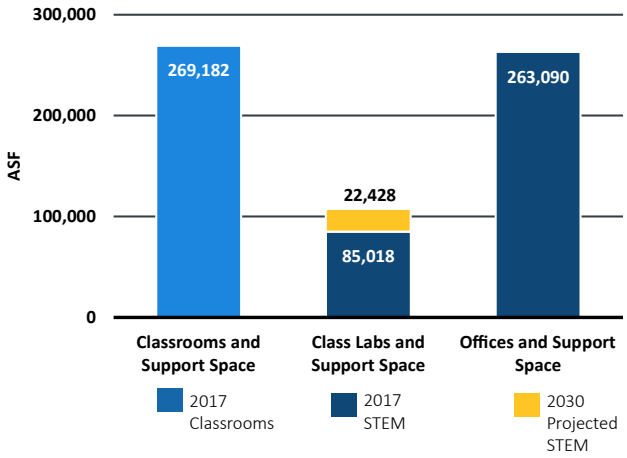
- Projections were made for classrooms, class labs, and office space only. Station sizes conform to UNC System standards.

Instructional Space	Station Size (ASF)
Classrooms	22
Engineering	108
Hard Science	70
Health Science	70
Math	33
Technology	50

Offices	Station Size (ASF)
Faculty	190
Staff (blended size)	140
Graduate Student	95

- If the projected 2030 instructional demand for an individual lab exceeded target capacity, a space need for an additional lab of the same type was generated. If a lab was not scheduled in 2017 or is projected to be underutilized in 2030, it could potentially offset future space demand.
- For each university, the 2018 STEM student:faculty and STEM faculty:staff ratios were maintained within System parameters. Since reliable data for current faculty and staff office space is not available, projections reflect the space needed for additional 2030 STEM faculty and staff only.
- The 2017 building condition codes were self-reported by each university to the UNC System. Building conditions were downgraded by one level in 2030 to reflect the presumed deterioration of structures if no substantial facilities improvements occur. None were reduced to demolition status.

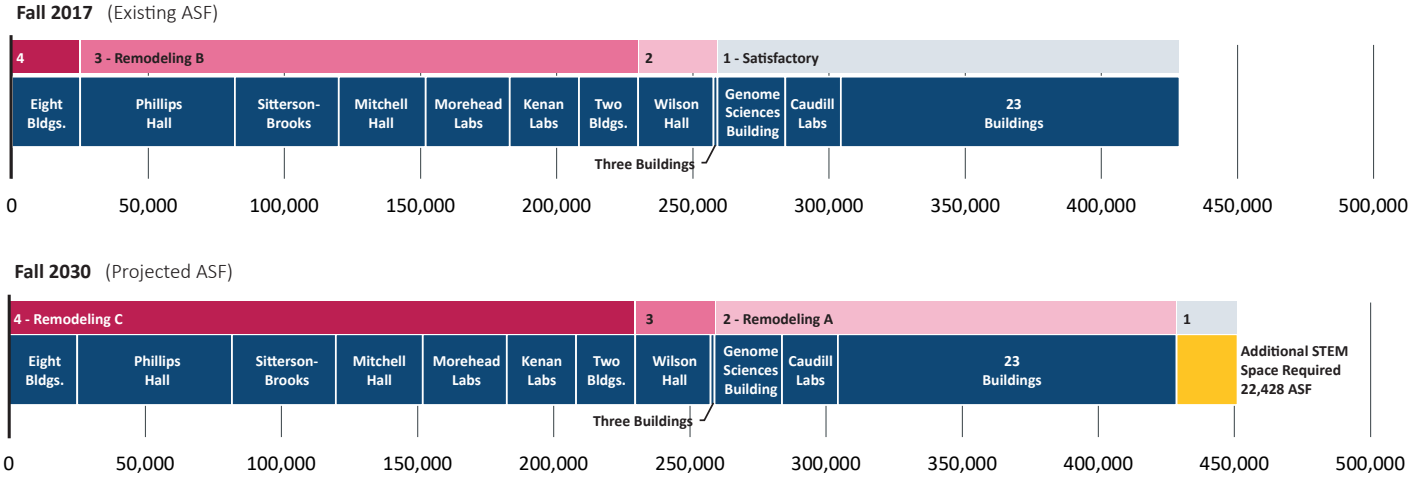
Academic Space by Category



Potential Space Offsets

	2017 Number of Labs		2030 Number of Labs	
	Labs (Inventory)	Labs Not Scheduled	Total Labs Needed	Underutilized Labs
Engineering				
Hard Science	54	30	65	15
Health Science				
Math				
Technology				
Total	54	30	65	15

STEM Academic Space by Building



Space Implications of Enrollment Growth
Graduate

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Understanding the Data Set

- Graduate enrollment growth rates in this report were established using historical enrollment patterns and UNC System guidance. Graduate programs were not included in the MGT analysis.
- Without knowledge of specific graduate program curricula, it is assumed that all graduate students use on-campus space every semester.
- Projected 2030 instructional space demand for graduate students was layered on top of undergraduate demand. If the sum of 2030 undergraduate and graduate instruction would cause classrooms or labs to exceed target capacity, a space need for an additional room of the same type was generated.

Graduate Students by Category

Headcount

STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering	90	104	*14*	*1.2%*
Hard Science	976	1,369	*393*	*2.9%*
Health Science	316	414	*98*	*2.3%*
Math	87	131	*44*	*3.5%*
Technology	335	533	*198*	*3.9%*
Total	**1,804**	**2,551**	***747***	***2.9%***

Undergraduate and Graduate Instruction

STEM Category		WSCH 2017	WSCH 2030	*Annual Percent Change*
Engineering	Undergraduate	1,334	1,334	*0.0%*
	Graduate	455	610	*2.5%*
Subtotal		***1,789***	***1,943***	***0.7%***
Hard Science	Undergraduate	43,417	64,179	*3.3%*
	Graduate	3,537	5,093	*3.1%*
Subtotal		***46,954***	***69,272***	***3.3%***
Health Science	Undergraduate	7,169	10,821	*3.5%*
	Graduate	495	663	*2.5%*
Subtotal		***7,663***	***11,484***	***3.4%***
Math	Undergraduate	13,965	23,812	*4.5%*
	Graduate	2,031	3,189	*3.8%*
Subtotal		***15,996***	***27,001***	***4.5%***
Technology	Undergraduate	8,644	17,341	*6.0%*
	Graduate	1,439	2,403	*4.4%*
Subtotal		***10,083***	***19,744***	***5.8%***
Total STEM		**82,484**	**129,444**	***3.8%***

Space Implications

Classrooms

No additional classrooms will be required to accommodate projected STEM graduate enrollment growth in 2030.

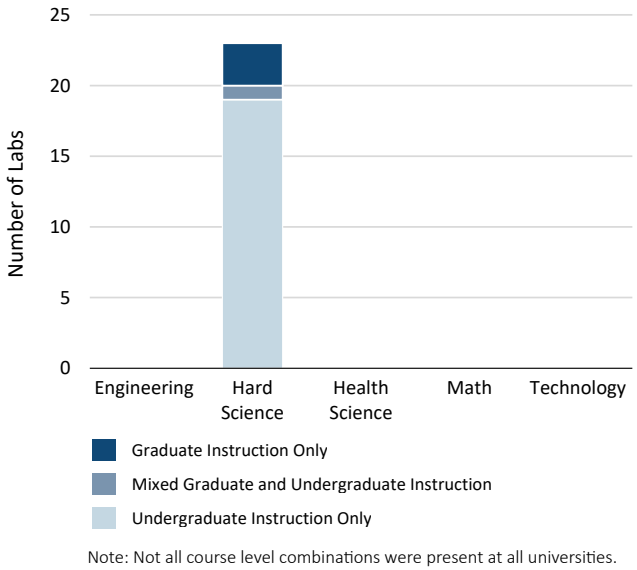
Class Labs

Most scheduled labs were used exclusively for undergraduate instruction; one was used for mixed undergraduate and graduate instruction and three were used for graduate instruction only. The additional lab space recommended to accommodate STEM undergraduate enrollment growth will likely satisfy the space needs of future STEM graduate students as well.

Offices

If enrollment projections are met, 70,965 ASF of additional graduate office space should be allocated to STEM to accommodate 747 additional graduate students.

2017 Use of Scheduled Labs by Course Level



Note: Not all course level combinations were present at all universities.

University Summary

Space Utilization Opportunities

Classrooms

- Existing classrooms can meet 2030 demand if utilization targets are met.
- 100 classrooms had stations smaller than 18 SF. There is capacity to enlarge stations in some classrooms.
- The University offers courses in Engineering, yet they were taught in classrooms. Dedicated class labs for Biomedical Engineering, Aerospace, and Materials Science were not reported.
- Technology classes were scheduled in classrooms in Sitterson, F. Brooks-Sitterson, Genome Science Building, Hamilton, and the Hanes Art Building. Dedicated Technology class labs were not reported.

Class Labs

- Fewer than half the University's 54 hard science class labs had scheduled instruction in fall 2017.
- Of the 24 labs that were scheduled, eight are expected to exceed target capacity by 2030 if enrollment projections are met. An additional eight biology labs, two chemistry labs, and one geology lab could be needed.

Next Steps

Data Accuracy

Information presented in this report is based, in part, on standard data submitted annually by individual universities to the UNC System. Inaccuracies in reported data could affect these results. Where possible, inconsistencies were identified, confirmed with the System, and corrected. However, room-by-room auditing of space data was beyond the scope of this study.

If the university believes a conclusion was drawn in error, the related data should be corrected by the university before its next submission to the System to ensure the validity of future studies.

Maximize Utilization at Pressure Points

Underutilized classrooms provide an opportunity to repurpose space to create additional labs and offices. However, if STEM enrollment projections are met, the University could approach target utilization, on average, within its existing classrooms. This may allow certain underutilized classrooms to be repurposed, yet may not yield sufficient surplus space to offset future STEM space needs.

The anticipated STEM space need can be addressed in multiple ways:

- Repurpose existing unscheduled or underutilized space campuswide.
- Maximize utilization in existing labs.
- Construct new labs in an addition or new building, if the previous options do not satisfy the full future need.

As enrollment grows, the University may need additional STEM lab space before funding is available to build or renovate. The University should plan strategically to identify enrollment thresholds that, when met, prompt actions such as scheduling evening lab courses, increasing target seat utilization in labs (within safe limits), and/or sharing lab space among disciplines (where pedagogically feasible).

Supplemental Information from the University

University comments can be found in Appendix C.

University Analysis

Purpose of this Study

In March 2019 the UNC System commissioned a ***Systemwide STEM Program Needs Assessment,*** which was prepared by MGT Consulting Group. This report, the ***Systemwide STEM Capital Planning Study,*** builds upon MGT's work and provides a projection of the physical space required to accommodate future STEM enrollment. The UNC System will use this capital planning study to guide the development of a systemwide STEM capital improvement plan.

By 2030, Fayetteville State University is expected to gain nearly 450 upper division STEM majors. Its share of systemwide STEM students will remain the same at two percent. Health Science degrees are the largest growth group in Fayetteville STEM majors; over 300 additional majors are projected. The analysis on the following pages can help the university fine tune its space utilization and prepare campus facilities to accommodate STEM growth.

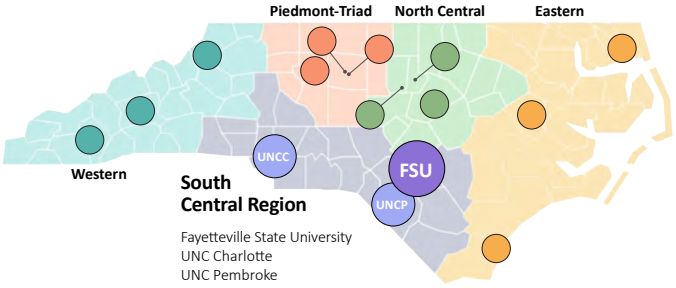
STEM Categories

MGT's study divided STEM majors into five categories: engineering, hard science, health science, math, and technology. In this study, physical space is sorted into the same five categories.

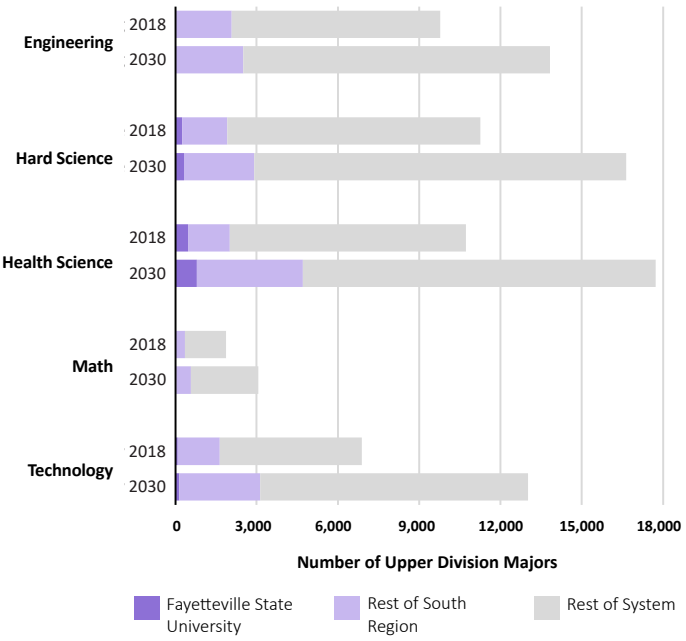
- Engineering space is dedicated to a broad range of engineering subjects, including hands-on technical instruction related to engineering programs.
- Hard science space houses lab-based sciences such as biology, chemistry, physics, geology, and anatomy and physiology. Social sciences are excluded.
- Health science space is dedicated to clinically-oriented, non-research health professions such as nursing and occupational therapy.
- Math space supports all math instruction.
- Technology space accommodates instruction in computer science and data analytics.

Most, but not all, fall 2017 instruction in designated STEM spaces was in STEM subjects. All instruction delivered in STEM spaces counted toward STEM weekly space utilization.

UNC System Regional Map



Fayetteville State University STEM Majors

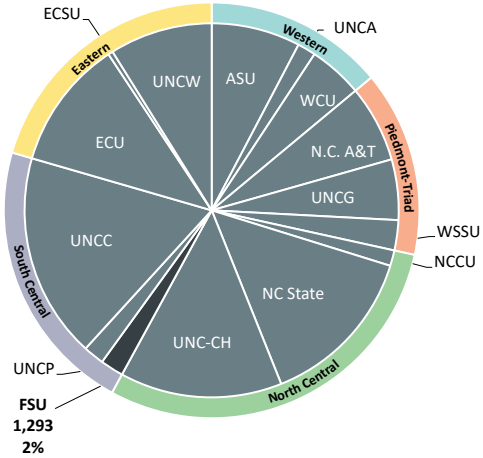


Undergraduate Enrollment

Understanding the Data Set

- MGT's enrollment analyses projected 2018 to 2028 enrollment growth of upper division majors only. JMZ extrapolated to 2030 using the MGT enrollment growth rate for the 2023-2028 period with some minor adjustments from the UNC System.
- While lower division and graduate STEM students were not included in MGT's enrollment projections, space needs associated with STEM growth of these groups are accounted for in this study.

Systemwide 2030 STEM Upper Division Enrollment



South Central STEM Enrollment Outlook

MGT considered industry growth, expected population change, and individual universities' enrollment targets in its enrollment analysis.

Between 2020 and 2030, the South Central Region population as a whole is expected to grow by 12 percent. The traditional college-age population, 18 to 24 year olds, is expected to grow more slowly at six percent over the decade.

There is strong regional demand for workers in computer science and health care management professions. Nursing, biological/environmental sciences, and mechanical engineering professionals are also expected to be in demand. Universities in the South Central Region are expected to add nearly 2,700 health science majors, more than any other region in the UNC System.

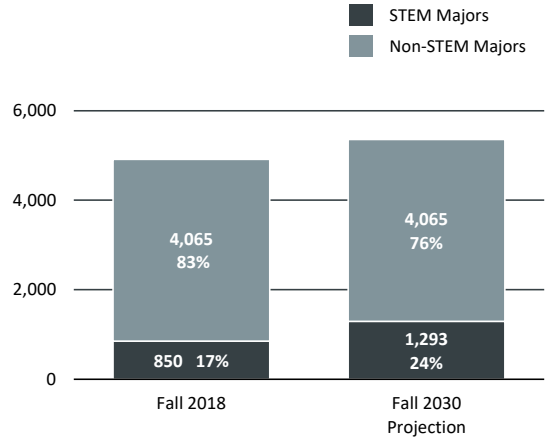
Fayetteville State STEM Highlights

(Source: Appendix E of the MGT Report)

- A planned renovation of the Science Building will provide instructional space for hard sciences.
- The Health Care Administration program is reportedly growing quickly to keep pace with workforce demand.
- The chemistry program is popular and the university is using adaptive learning to enhance student success in this and other demanding STEM programs.

FSU Upper Division STEM Majors

Headcount



FSU Upper Division STEM Majors by Category

Headcount

STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering				
Hard Science	257	325	*68*	*2.0%*
Health Science	471	791	*320*	*4.4%*
Math	26	34	*8*	*2.3%*
Technology	96	143	*47*	*3.4%*
Total	**850**	**1,293**	***443***	***3.6%***

2017 Space Allocation

FAYETTEVILLE STATE UNIVERSITY

Understanding the Data Set

- Space allocation is based on 2017 UNC System data, self-reported by each university.
- Only buildings where space is allocated to STEM programs are included in this study.
- Space prorated for any amount of STEM is captured as 100 percent STEM since it is capable of supporting STEM education.
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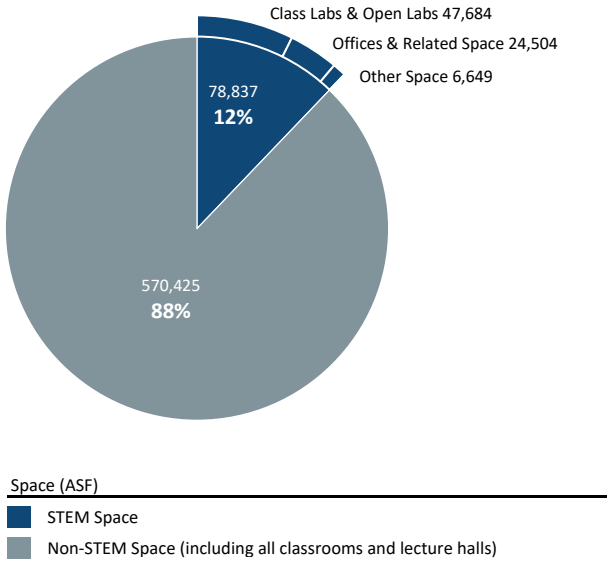
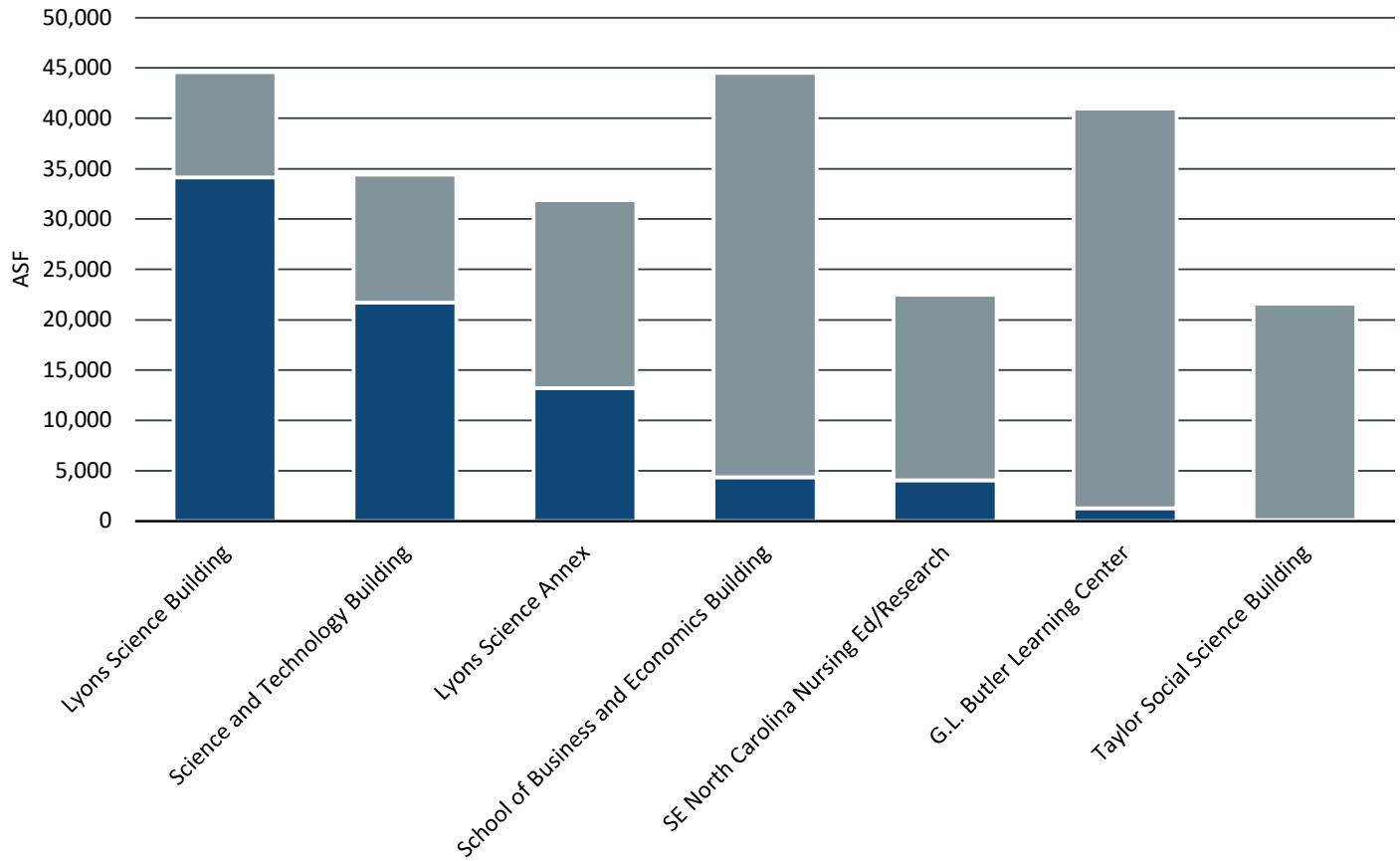
STEM Space Summary



2017 STEM Academic Space by Building



Instructional Space Utilization

FAYETTEVILLE STATE UNIVERSITY

Understanding the Data Set

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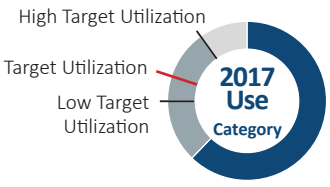
Understanding the Results



Darkest tone: Fall 2017 space use (hourly or seat fill)

Middle tone: Remaining capacity within target range

Lightest tone: Remaining capacity above target range; use at this level is not expected

Utilization Summary

Classrooms

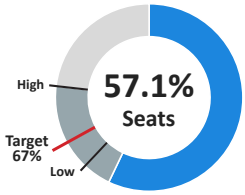
On average, classrooms did not reach the 67 percent seat fill target when they were in use. The lowest hourly target of 29 hours was not met.

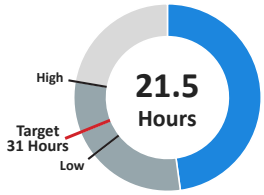
Class Labs

When in use, all class labs met or exceeded the seat utilization target range. Only math labs reached the hourly target utilization range. Health Science and Hard Science labs had hourly capacity remaining.

2017 Weekly Utilization - Seats and Hours

Classrooms



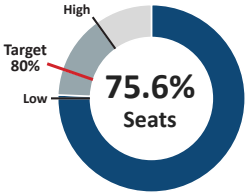


Engineering Labs

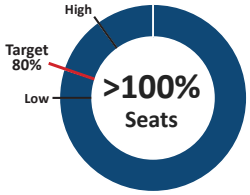
No Engineering Labs

No Engineering Labs

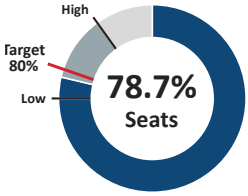
Hard Science Labs



Health Science Labs



Math Labs



Technology Labs

No Technology Labs

No Technology Labs

Weekly Instructional Capacity and Projections

FAYETTEVILLE STATE UNIVERSITY

Understanding the Data Set

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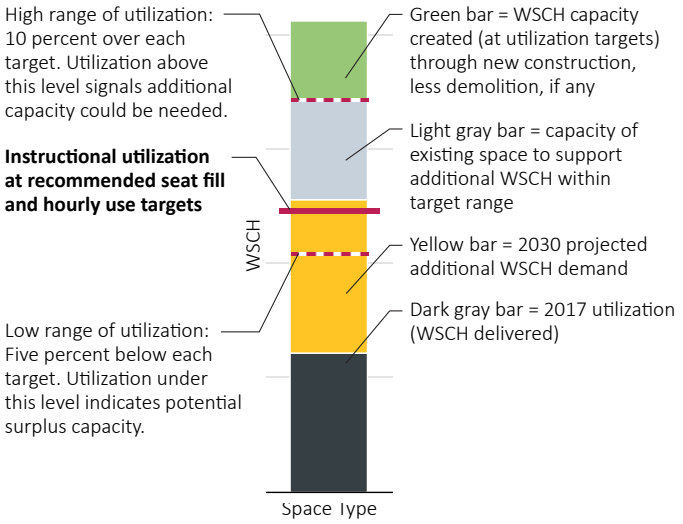
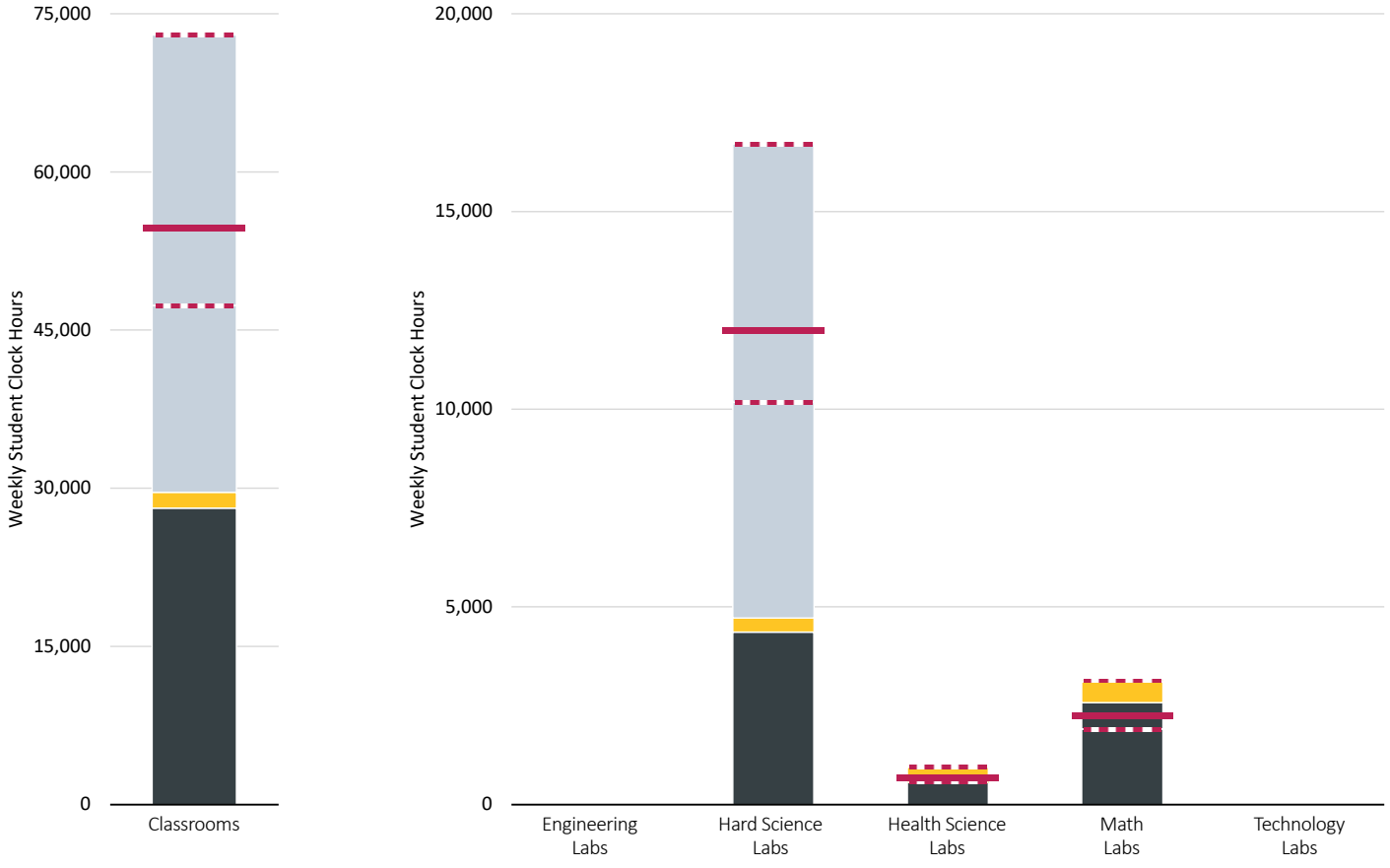
- Future lab demand is based on the assumption that fall 2017 courses were scheduled in the labs best suited to deliver the required instruction.

Understanding the Results



2017 Utilization and 2030 Projections



Space Implications of Enrollment Growth
Undergraduate

FAYETTEVILLE STATE UNIVERSITY

Understanding the Data Set

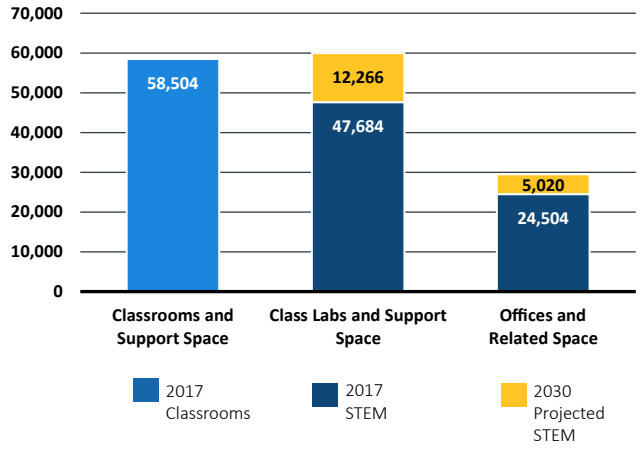
- Projections were made for classrooms, class labs, and office space only. Stations sizes conform to UNC System standards.

Instructional Space	Station Size (ASF)
Classrooms	22
Engineering	108
Hard Science	70
Health Science	70
Math	33
Technology	50

Offices	Station Size (ASF)
Faculty	190
Staff (blended size)	140
Graduate Student	95

- If the projected 2030 instructional demand for an individual lab exceeded target capacity, a space need for an additional lab of the same type was generated. If a lab was not scheduled in 2017 or is projected to be underutilized in 2030, it could potentially offset future space demand.
- For each university, the 2018 STEM student:faculty and STEM faculty:staff ratios were maintained within System parameters. Since reliable data for current faculty and staff office space is not available, projections reflect the space needed for additional 2030 STEM faculty and staff only.
- The 2017 building condition codes were self-reported by each university to the UNC System. Building conditions were downgraded by one level in 2030 to reflect the presumed deterioration of structures if no substantial facilities improvements occur. None were reduced to demolition status.

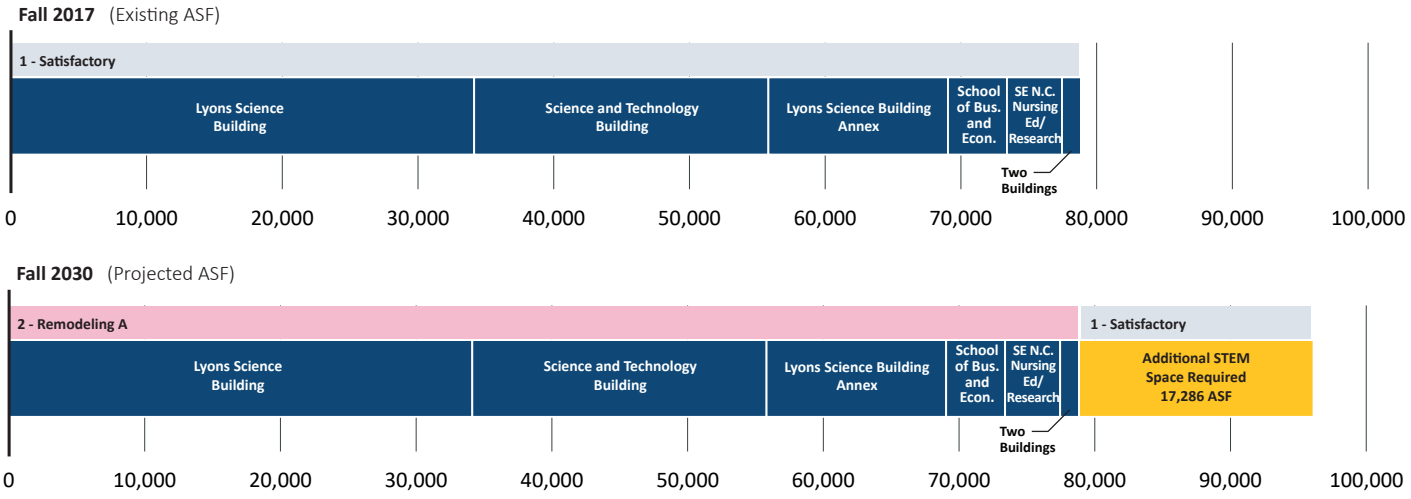
Academic Space by Category



Potential Space Offsets

	2017 Number of Labs		2030 Number of Labs	
	Labs (Inventory)	Labs Not Scheduled	Total Labs Needed	Underutilized Labs
Engineering				
Hard Science	29	9	31	18
Health Science	2	1	5	
Math	4		7	1
Technology				
Total	35	10	43	19

STEM Academic Space by Building



Space Implications of Enrollment Growth
Graduate

Understanding the Data Set

- Graduate enrollment growth rates in this report were established using historical enrollment patterns and UNC System guidance. Graduate programs were not included in the MGT analysis.
- Without knowledge of specific graduate program curricula, it is assumed that all graduate students use on-campus space every semester.
- Projected 2030 instructional space demand for graduate students was layered on top of undergraduate demand. If the sum of 2030 undergraduate and graduate instruction would cause classrooms or labs to exceed target capacity, a space need for an additional room of the same type was generated.

Space Implications

Classrooms

No additional classrooms will be required to accommodate projected STEM graduate enrollment growth in 2030.

Class Labs

Most scheduled labs were used exclusively for undergraduate instruction; only two were used for both undergraduate and graduate courses. The additional lab space recommended to accommodate undergraduate STEM enrollment growth will likely satisfy the space needs of future STEM graduate students as well.

Offices

If enrollment projections are met, 285 ASF of additional STEM graduate office space should be allocated to accommodate three additional graduate students.

Graduate Students by Category

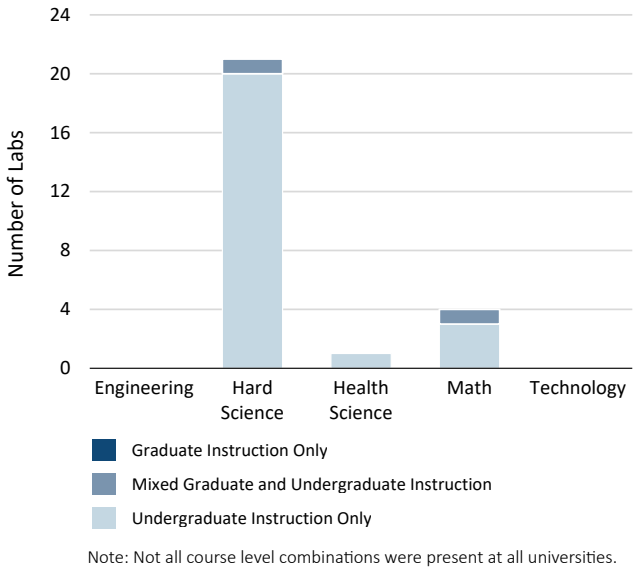
Headcount

STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering				
Hard Science				
Health Science				
Math				
Technology	11	14	*3*	*2.0%*
Total	**11**	**14**	***3***	***2.0%***

Undergraduate and Graduate Instruction

STEM Category		WSCH 2017	WSCH 2030	*Annual Percent Change*
Engineering	Undergraduate			
	Graduate			
Subtotal				
Hard Science	Undergraduate	7,450	8,137	*0.7%*
	Graduate			
Subtotal		***7,450***	***8,137***	***0.7%***
Health Science	Undergraduate	2,175	3,652	*4.4%*
	Graduate			
Subtotal		***2,175***	***3,652***	***4.4%***
Math	Undergraduate	4,457	4,827	*0.7%*
	Graduate	10	12	
Subtotal		***4,467***	***4,839***	***0.7%***
Technology	Undergraduate	1,317	1,961	*3.4%*
	Graduate	30	40	*2.4%*
Subtotal		***1,347***	***2,001***	***3.4%***
Total STEM		**15,437**	**18,629**	***1.6%***

2017 Use of Scheduled Labs by Course Level



Note: Not all course level combinations were present at all universities.

University Summary

Space Utilization Opportunities

Classrooms

- Based on schedule data, the University's existing classrooms can accommodate growth through 2030.
- There may be opportunities to repurpose classrooms to meet the projected need for additional STEM space.
- There were three classrooms for which no scheduled use was reported:
  - Lyons Science Building room 304W
  - Health & Physical Education room 186
  - J. Knuckles Science Annex room 133
- The University has an opportunity to right-size classroom stations. There were 27 classrooms with station sizes smaller than 18 ASF per station. Increasing station sizes to around 24 ASF per station facilitates project-based learning and better accommodates students with laptops.

Hard Science Labs

By 2030, two additional labs will be required to accommodate Biology demand if enrollment projections are met. Out of 29 Hard Science class labs, 21 were scheduled. Six labs in the Lyons Science Building, one in the Lyons Annex, and one in the Science & Technology Building did not have scheduled instruction in fall 2017.

If the unscheduled class labs were, indeed, in use in fall 2017, the unreported utilization could prompt an additional need for class lab space in 2030.

Health Science Labs

Of the University's two Health Science class labs, only room 330 in the Southeast North Carolina Nursing Education Building was scheduled. Because the hourly utilization is an average of all available labs, the 34 weekly hours scheduled in SE NC Nursing room 330 averages to 17 hours per lab.

This room's seat fill and hourly utilization exceeded utilization targets. An additional three Health Science labs would be needed to meet the projected 2030 demand on SE NC Nursing room 330.

Math and Technology Labs

There are four labs dedicated to Math and Technology instruction. All four were scheduled. Two labs (Science & Technology 237 and 342) met both hourly and seat fill utilization targets. Science & Technology room 238 met the hourly utilization target. Three additional labs will be needed by 2030 to satisfy the Math and Technology instructional demand.

Some data for Math and Computer Science instruction were reported together. Additional insight could be gained if the disciplines were differentiated.

Next Steps

Data Accuracy

Information presented in this report is based, in part, on standard data submitted annually by individual universities to the UNC System. Inaccuracies in reported data could affect these results. Where possible, inconsistencies were identified, confirmed with the System, and corrected. However, room-by-room auditing of space data was beyond the scope of this study.

If the University believes a conclusion was drawn in error, the related data should be corrected by the university before its next submission to the System to ensure the validity of future studies.

Maximize Utilization at Pressure Points

Underutilized classrooms provide an opportunity to repurpose space to create additional labs and offices. While there is an apparent surplus of classrooms at the University, underutilized space may not be in the right location or configuration to offset STEM needs.

The anticipated STEM space need can be addressed in multiple ways:

- Repurpose existing unscheduled or underutilized space campuswide.
- Maximize utilization in labs and reassign space based on demand, where possible.
- Construct new labs and offices in an addition or new building, if the previous options do not satisfy the full future need.

As enrollment grows, the University may need additional STEM lab space before funding is available to build or renovate. The University should plan strategically to identify enrollment thresholds that, when met, prompt actions such as scheduling evening lab courses, increasing target seat utilization in labs (within safe limits), and/or sharing lab space among disciplines (where pedagogically feasible).

University Summary

Supplemental Information from the University

University comments can be found in Appendix C.

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University Analysis

Purpose of this Study

In March 2019 the UNC System commissioned a *Systemwide STEM Program Needs Assessment,* which was prepared by MGT Consulting Group. This report, the *Systemwide STEM Capital Planning Study,* builds upon MGT's work and provides a projection of the physical space required to accommodate future STEM enrollment. The UNC System will use this capital planning study to guide the development of a systemwide STEM capital improvement plan.

By 2030, the University of North Carolina at Charlotte is projected to gain nearly 5,000 upper level undergraduate STEM majors. Nearly half of them will be health science majors. The analysis on the following pages can help the university fine tune its space utilization and prepare campus facilities to accommodate STEM growth.

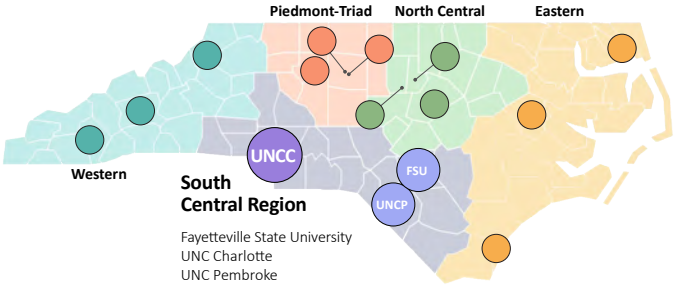
STEM Categories

MGT's study divided STEM majors into five categories: engineering, hard science, health science, math, and technology. In this study, physical space is sorted into the same five categories.

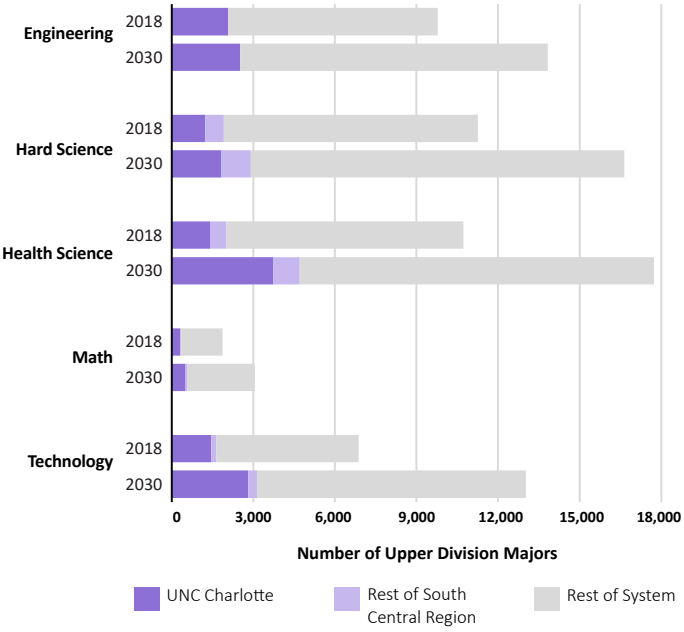
- Engineering space is dedicated to a broad range of engineering subjects, including hands-on technical instruction related to engineering programs.
- Hard science space houses lab-based sciences such as biology, chemistry, physics, geology, and anatomy and physiology. Social sciences are excluded.
- Health science space is dedicated to clinically-oriented, non-research health professions such as nursing and occupational therapy.
- Math space supports all math instruction.
- Technology space accommodates instruction in computer science and data analytics.

Most, but not all, fall 2017 instruction in designated STEM spaces was in STEM subjects. All instruction delivered in STEM spaces counted toward STEM weekly space utilization.

UNC System Regional Map



UNC Charlotte STEM Majors



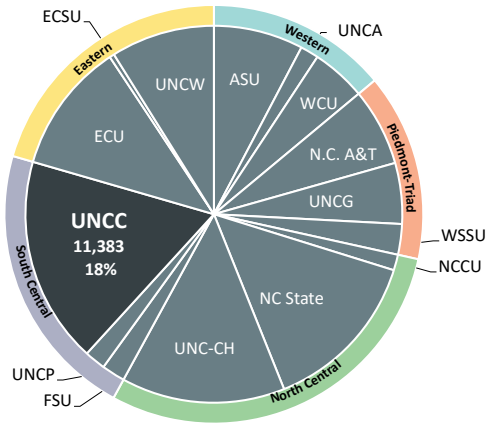
Undergraduate Enrollment

UNC CHARLOTTE

Understanding the Data Set

- MGT's enrollment analyses projected 2018 to 2028 enrollment growth of upper division majors only. JMZ extrapolated to 2030 using the MGT enrollment growth rate for the 2023-2028 period with some minor adjustments from the UNC System.
- While lower division and graduate STEM students were not included in MGT's enrollment projections, space needs associated with STEM growth of these groups are accounted for in this study.

Systemwide 2030 STEM Upper Division Enrollment



South Central Region STEM Enrollment Outlook

MGT considered industry growth, expected population change, and individual universities' enrollment targets in its enrollment analysis.

Between 2020 and 2030, the South Central Region population as a whole is expected to grow by 12 percent. The traditional college-age population, age 18 to 24, is expected to grow more slowly at six percent over the decade.

There is strong regional demand for workers in computer science and health care management professions. Nursing, biological/environmental sciences, and mechanical engineering professionals are also expected to be in demand. Universities in the South Central Region are expected to add nearly 2,700 health science majors, more than any other region in the UNC System.

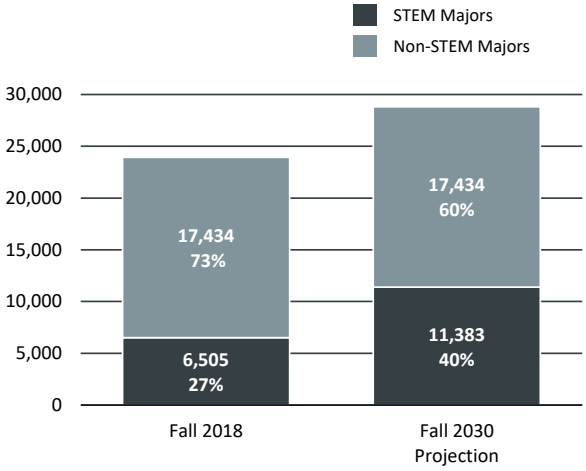
UNC Charlotte STEM Highlights

(Source: Appendix E of the MGT Report)

- UNCC is growing its internship programs, university-wide.
- The healthcare administration and management program is reportedly growing quickly; growth is expected to continue.
- Many computer science sections are offered online in an effort to meet growing demand.
- Embedded tutoring and adaptive learning have been implemented to increase student engagement in chemistry and physics.

UNC Charlotte Upper Division STEM Majors

Headcount



UNC Charlotte Upper Division STEM Majors by Category

Headcount

STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering	2,078	2,513	*435*	*1.6%*
Hard Science	1,244	1,812	*568*	*3.2%*
Health Science	1,412	3,730	*2,318*	*8.4%*
Math	317	509	*192*	*4.0%*
Technology	1,454	2,818	*1,364*	*5.7%*
Total	**6,505**	**11,383**	***4,878***	***4.8%***

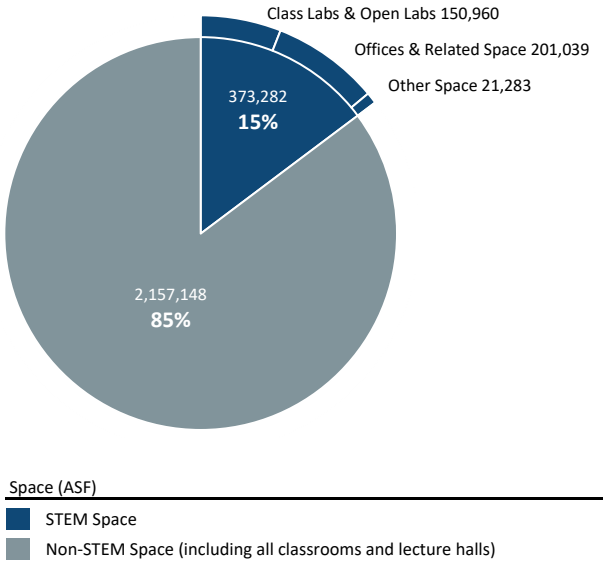
2017 Space Allocation

UNC CHARLOTTE

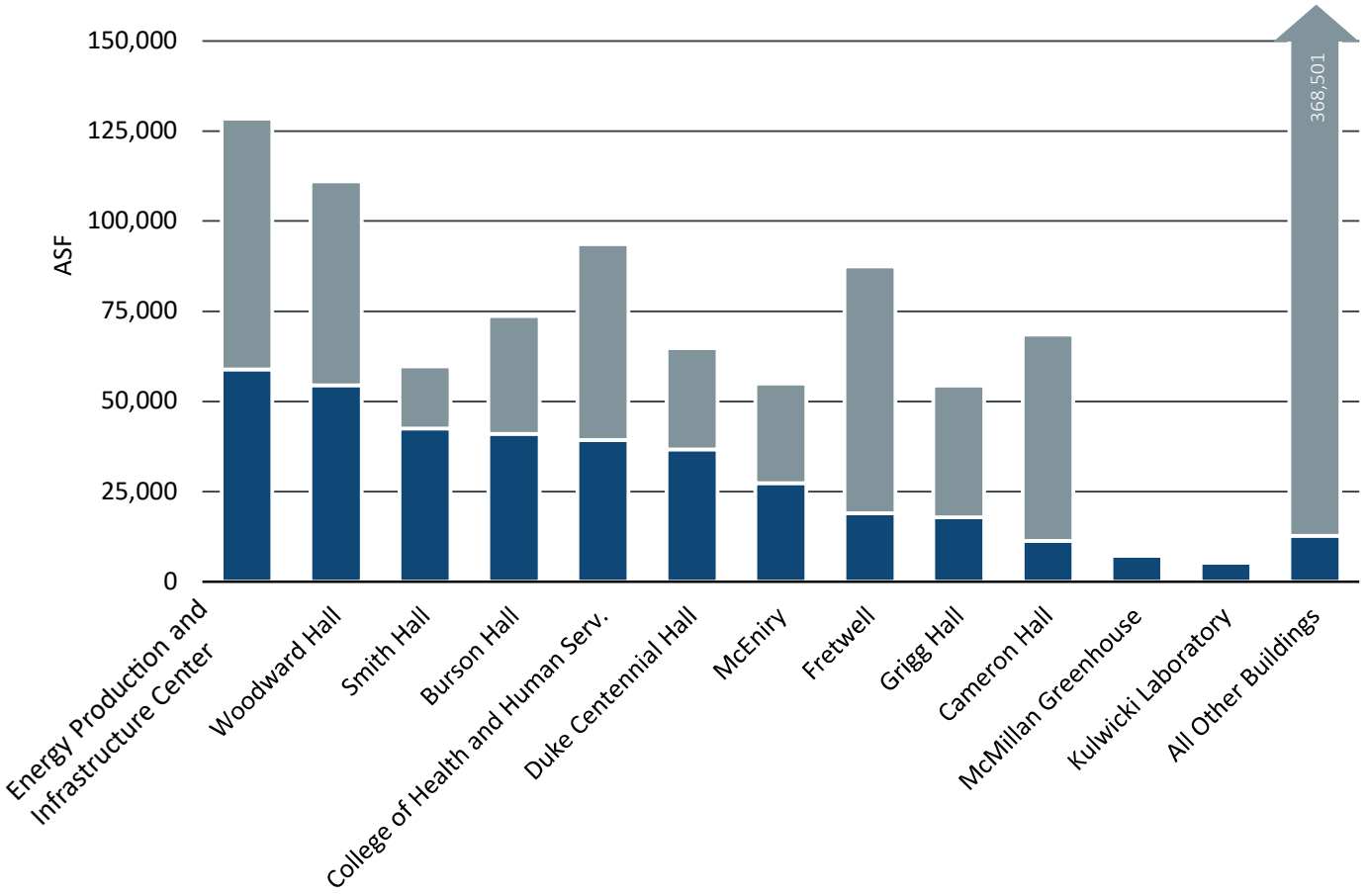
Understanding the Data Set

- Space allocation is based on 2017 UNC System data, self-reported by each university.
- Only buildings where space is allocated to STEM programs are included in this study.
- Space prorated for any amount of STEM is captured as 100 percent STEM since it is capable of supporting STEM education.
- General use classrooms are not counted as STEM-dedicated space. See Appendix B for a list of UNC System category codes considered STEM.
- The study does not include research or related space. However, the instructional spaces in the study may support research activities during unscheduled hours.
- Program space is quantified in assignable square feet (ASF).

STEM Space Summary



2017 STEM Academic Space by Building



Instructional Space Utilization

UNC CHARLOTTE

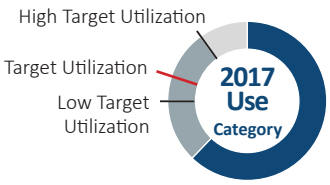
Understanding the Data Set

- Instructional space utilization is based on the fall 2017 course schedule (the most recent, fully vetted course schedule available at the time of this study).
- The study considered daytime room use in a 45-hour week based on the target criteria below from the Association for Learning Environments.
- While the study targets are ideal, a utilization range of five percent below or 10 percent above each target is considered reasonable.
- In a dedicated STEM space, all instruction delivered in that space was counted toward its fall 2017 utilization, including non-STEM courses.

Space Utilization Targets

	Seat Fill			Hours Used		
Space Type	Low	**Target**	High	Low	**Target**	High
Classrooms	62%	**67%**	77%	29	**31**	35
Class Labs	75%	**80%**	90%	19	**21**	26

Understanding the Results



Darkest tone: Fall 2017 space use (hourly or seat fill)

Middle tone: Remaining capacity within target range

Lightest tone: Remaining capacity above target range; use at this level is not expected

Utilization Summary

Classrooms

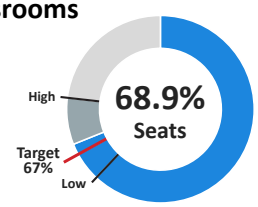
On average, classroom seats were filled slightly above target utilization when they were in use. However, the lowest hourly target of 29 hours per week was not met.

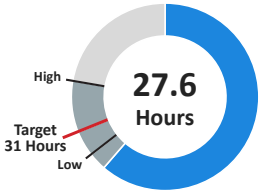
Class Labs

- Labs in all categories except engineering met the seat fill target range. Hard Science and Health Science labs were overfilled.
- Technology labs exceeded the high target hourly use. All other labs had remaining hours available for instruction before reaching the target range.

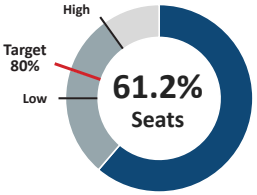
2017 Weekly Utilization - Seats and Hours

Classrooms

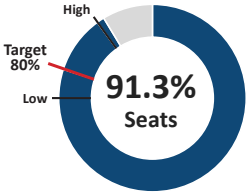




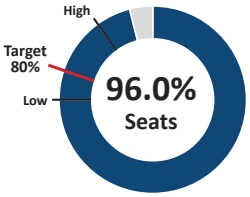
Engineering Labs



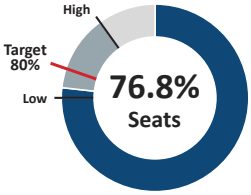
Hard Science Labs

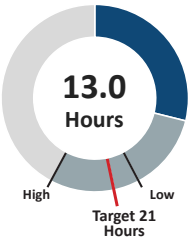


Health Science Labs

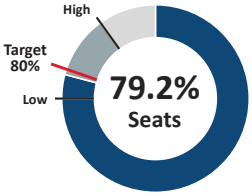


Math Labs





Technology Labs



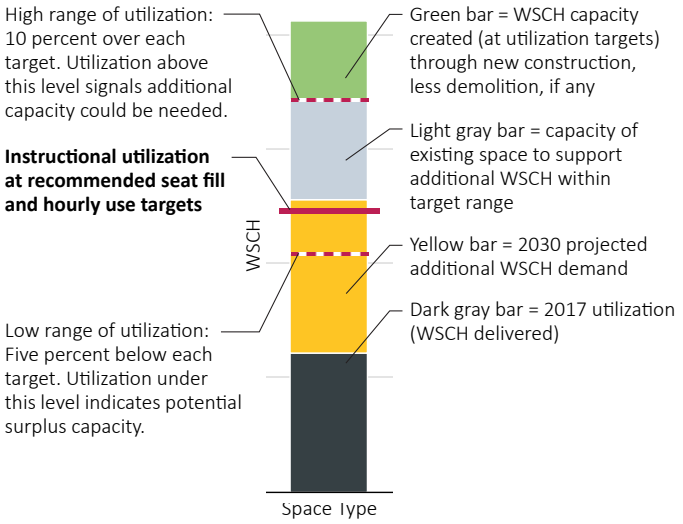
Weekly Instructional Capacity and Projections

UNC CHARLOTTE

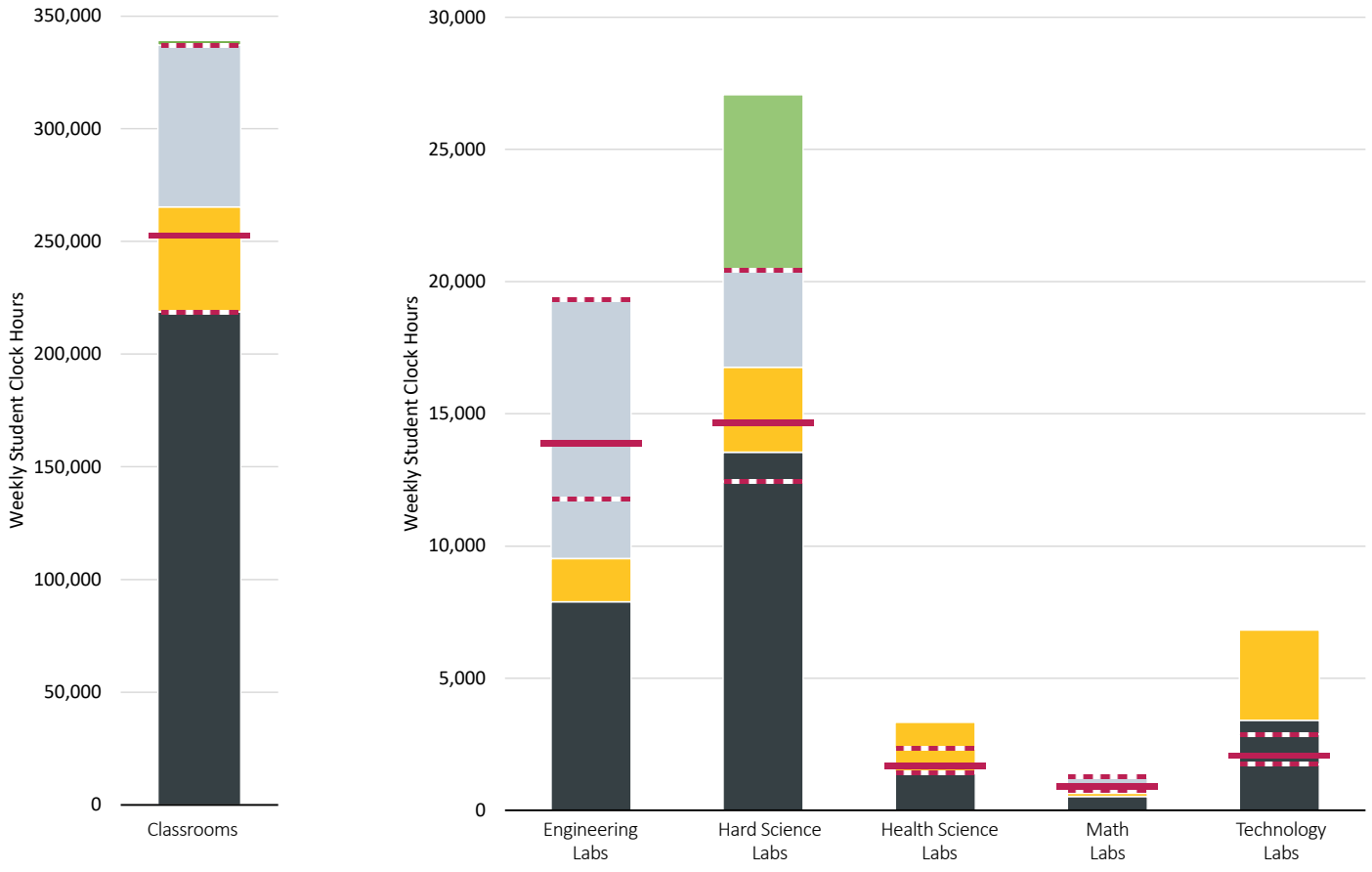
Understanding the Data Set

- An institution's capacity to accommodate future instruction is measured in weekly student clock hours (WSCH). One WSCH equals one student occupying one station for one hour.
- WSCH capacity is calculated using the number of stations in the 2017 space inventory with seat and hourly utilization target criteria applied.
- 2030 STEM course demand is projected to grow according to enrollment projections. Non-STEM course demand was held at the fall 2017 level.
- Graduate programs are evaluated separately. The effect of their growth on instructional demand is included later in this report.
- Future lab demand is based on the assumption that fall 2017 courses were scheduled in the labs best suited to deliver the required instruction.

Understanding the Results



Utilization, Capacity, and Projections



Space Implications of Enrollment Growth
Undergraduate

Understanding the Data Set

- Station sizes conform to UNC System standards. Projections were made for classrooms, class labs, and office space only.

Instructional Space	Station Size (ASF)
Classrooms	22
Engineering	108
Hard Science	70
Health Science	70
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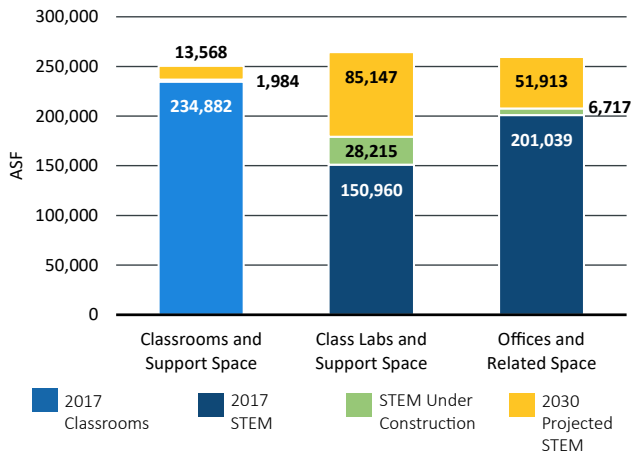
Technology	50

Offices	Station Size (ASF)
Faculty	190
Staff (blended size)	140
Graduate Student	95

- If the projected 2030 instructional demand for an individual lab exceeded target capacity, a space need for an additional lab of the same type was generated. If a lab was not scheduled in 2017 or is projected to be underutilized in 2030, it could potentially offset future space demand.
- For each university, the 2018 STEM student:faculty and STEM faculty:staff ratios were maintained within System parameters. Since reliable data for current faculty and staff office space is not available, projections reflect the space needed for additional 2030 STEM faculty and staff only.
- The 2017 building condition codes were self-reported by each university to the UNC System. Building conditions were downgraded by one level in 2030 to reflect the presumed deterioration of structures if no substantial facilities improvements occur. None were reduced to demolition status.

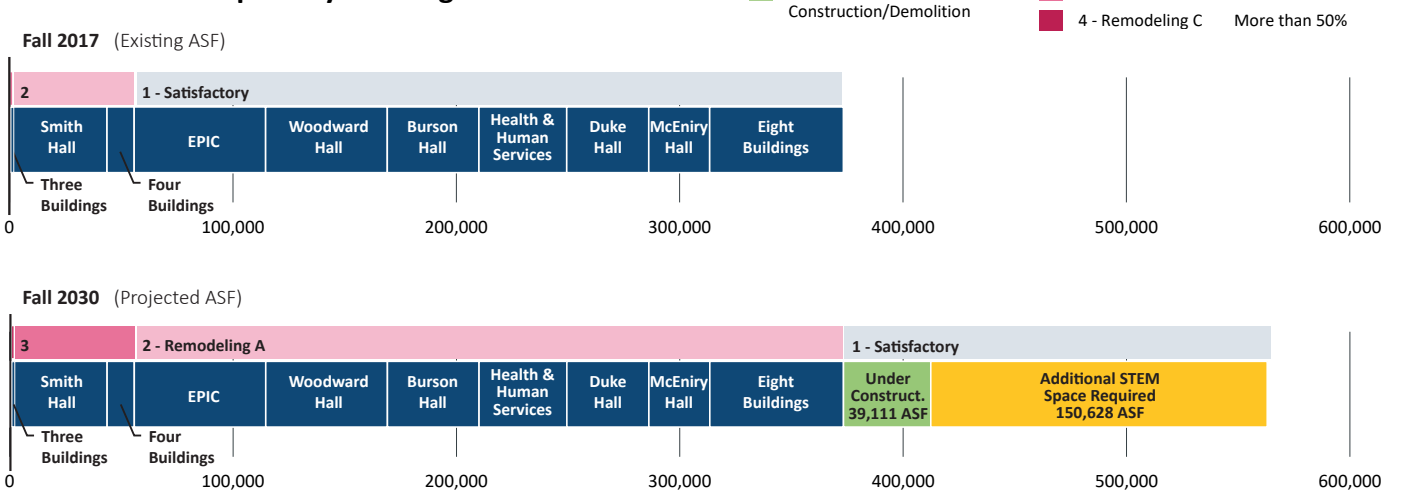
Academic Space by Category



Potential Space Offsets

	2017 Number of Labs		2030 Number of Labs	
	Labs (Inventory)	Labs Not Scheduled	Total Labs Needed	Underutilized Labs
Engineering	28	1	36	21
Hard Science	37	2	63	18
Health Science	3		10	2
Math	2		3	1
Technology	3		12	
Total	73	3	124	42

STEM Academic Space by Building



Space Implications of Enrollment Growth
Graduate

Understanding the Data Set

- Graduate enrollment growth rates in this report were established using historical enrollment patterns and UNC System guidance. Graduate programs were not included in the MGT analysis.
- Without knowledge of specific graduate program curricula, it is assumed that all graduate students use on-campus space every semester.
- Projected 2030 instructional space demand for graduate students was layered on top of undergraduate demand. If the sum of 2030 undergraduate and graduate instruction would cause classrooms or labs to exceed target capacity, a space need for an additional room of the same type was generated.

Graduate Students by Category

Headcount

STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering	544	618	*74*	*1.1%*
Hard Science	259	334	*75*	*2.1%*
Health Science	509	984	*475*	*5.6%*
Math	165	227	*62*	*2.7%*
Technology	944	1,477	*533*	*3.8%*
Total	**2,421**	**3,640**	***1,219***	***3.5%***

Instruction by Course Level

STEM Category		WSCH 2017	WSCH 2030	*Annual Percent Change*
Engineering	Undergraduate	31,761	38,414	*1.6%*
	Graduate	2,164	2,467	*1.1%*
Subtotal		***33,925***	***40,881***	***1.6%***
Hard Science	Undergraduate	44,940	55,396	*1.8%*
	Graduate	1,450	1,893	*2.2%*
Subtotal		***46,390***	***57,289***	***1.8%***
Health Science	Undergraduate	15,637	41,308	*8.4%*
	Graduate	1,673	1,840	*0.8%*
Subtotal		***17,310***	***43,148***	***7.9%***
Math	Undergraduate	29,682	38,136	*2.1%*
	Graduate	543	763	*2.9%*
Subtotal		***30,225***	***38,899***	***2.1%***
Technology	Undergraduate	16,247	31,495	*5.7%*
	Graduate	5,085	8,283	*4.2%*
Subtotal		***21,332***	***39,779***	***5.3%***
Total STEM		**149,180**	**219,996**	***3.3%***

Space Implications

Classrooms

If graduate enrollment projections are met, up to three additional classrooms could be needed to serve graduate instruction in 2030. These are above and beyond the additional classroom space needed to accommodate undergraduate STEM growth.

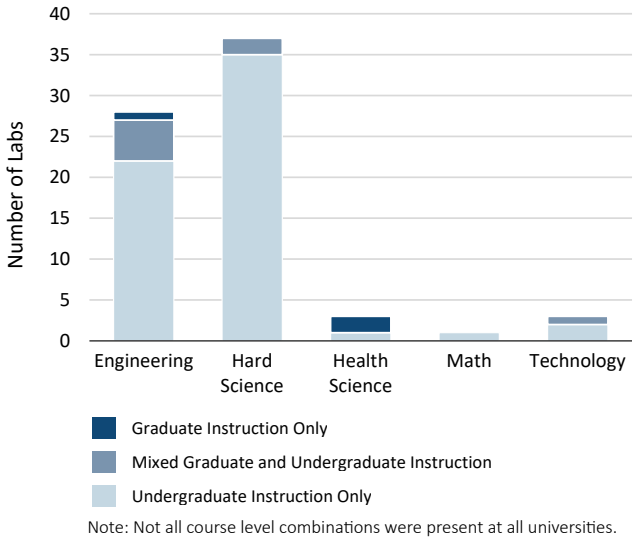
Class Labs

Most labs were used exclusively for undergraduate instruction in fall 2017. Eight labs were used for both undergraduate and graduate instruction. Three labs were scheduled for graduate instruction only. The additional lab space recommended to accommodate STEM undergraduate enrollment growth will likely satisfy the space needs of future STEM graduate students as well.

Offices

If enrollment projections are met, and all graduate students are studying on campus, 115,805 ASF of additional graduate office space should be allocated to STEM to accommodate 1,219 additional graduate students.

2017 Use of Scheduled Labs by Course Level



Note: Not all course level combinations were present at all universities.

Space Utilization Opportunities

Classrooms

- All 215 classrooms were scheduled in fall 2017. Demand for classrooms will exceed capacity by 2030 if enrollment projections are met.
- There were 74 classrooms with station sizes smaller than 18 square feet. If stations in these rooms were right-sized to 22 square feet or larger, lecture capacity (WSCH) overall would be reduced.
- If enrollment surges,UNC Charlotte could increase seat fill targets to 80 percent in the 85 classrooms that have station sizes greater than 22 square feet.

Engineering Labs

- There were 28 Engineering labs at UNC Charlotte in fall 2017. Only one lab, Cameron Hall room 154 (an Engineering Systems lab), was not scheduled.
- Eight additional labs will be needed to meet the projected need:
  - Six Mechanical Engineering
  - One Engineering Technology and Construction Management
  - One Electrical and Computer Engineering

Hard Science Labs

Of the University's 37 Hard Science labs, 35 were scheduled in fall 2017. By 2030, additional instructional capacity equivalent to 26 labs will be required to accommodate hard science instruction if enrollment projections are met.

- Five Geography and Earth Science
- Seven Physics and Optical Science
- Seven Chemistry
- Seven Biology

The capacity need can be addressed multiple ways:

- Repurpose existing unscheduled or underutilized space within Hard Science disciplines or campus-wide. Burson 114, a Chemistry lab, and McEniry 217, a Geography and Earth Science lab, were not scheduled.
- Maximize utilization in existing Hard Science labs. Schedule data shows that 18 labs may not reach recommended utilization targets in 2030. These labs could be candidates to meet future needs through sharing or reassignment of space.
- Construct new labs in an addition or new building if the previous options cannot be employed.

Health Science Labs

All three class labs in the College of Health and Human Services building were scheduled. Two were very lightly scheduled, yet the third, Anatomy & Physiology Lab 297, was scheduled to nearly three times its instructional capacity. By 2030, an additional seven Anatomy & Physiology Labs would be needed to meet daytime course demand.

Math Labs

The University's two Math labs were both scheduled. One additional lab is recommended to accommodate STEM growth.

Technology Labs

Three class labs were dedicated to Technology in fall 2017. Nine additional labs would be needed by 2030 if enrollment projections were met:

- Seven to accommodate demand for Cone University Center rooms 164 and 165
- Two to accommodate demand for Woodward Hall room 140

University Summary

Next Steps

Data Accuracy

Information presented in this report is based, in part, on standard data submitted annually by individual universities to the UNC System. Inaccuracies in reported data could affect these results. Where possible, inconsistencies were identified, confirmed with the System, and corrected. However, room-by-room auditing of space data was beyond the scope of this study.

If the University believes a conclusion was drawn in error, the related data should be corrected by the university before its next submission to the System to ensure the validity of future studies.

Maximize Utilization at Pressure Points

Underutilized classrooms provide an opportunity to repurpose space to create additional labs and offices. However, if STEM enrollment projections are met, the University will exceed target utilization, on average, within its existing classrooms. This may still allow certain underutilized classrooms to be repurposed, yet will not yield sufficient surplus space to offset all future STEM space needs.

As enrollment grows, the University may need additional STEM lab space before funding is available to build or renovate. The University should plan strategically to identify enrollment thresholds that, when met, prompt actions such as scheduling additional evening or weekend lab courses, increasing target seat utilization in labs (within safe limits), and/or sharing lab space among disciplines (where pedagogically feasible).

Supplemental Information from the University

University comments can be found in Appendix C.

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University Analysis

Purpose of this Study

In March 2019 the UNC System commissioned a ***Systemwide STEM Program Needs Assessment,*** which was prepared by MGT Consulting Group. This report, the ***Systemwide STEM Capital Planning Study,*** builds upon MGT's work and provides a projection of the physical space required to accommodate future STEM enrollment. The UNC System will use this capital planning study to guide the development of a systemwide STEM capital improvement plan.

By 2030, UNC Pembroke will gain over 500 additional STEM upper division undergraduate majors. Math programs at Pembroke are expected to be among the fastest-growing in the UNC System. The analysis on the following pages can help the university fine tune its space utilization and prepare campus facilities to accommodate STEM growth.

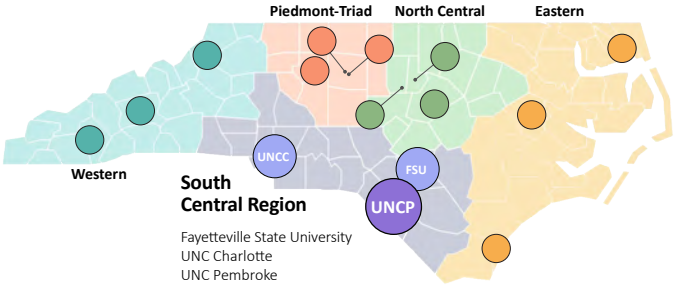
STEM Categories

MGT's study divided STEM majors into five categories: engineering, hard science, health science, math, and technology. In this study, physical space is sorted into the same five categories.

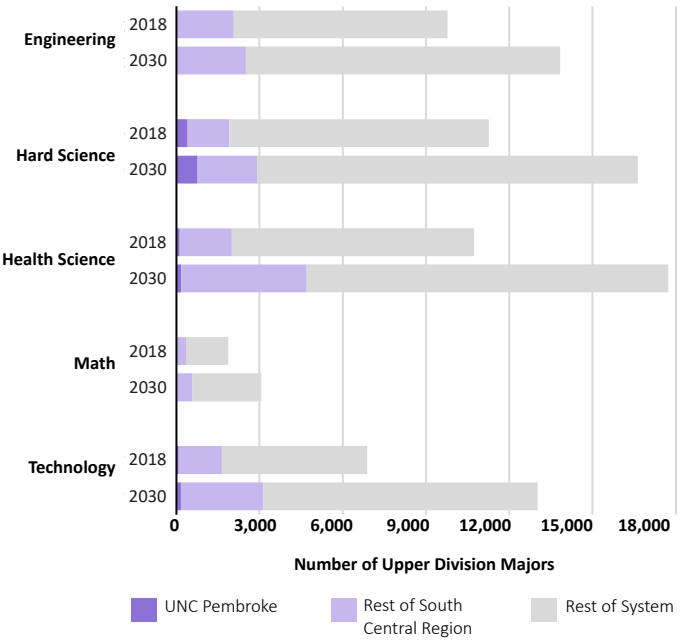
- Engineering space is dedicated to a broad range of engineering subjects, including hands-on technical instruction related to engineering programs.
- Hard science space houses lab-based sciences such as biology, chemistry, physics, geology, and anatomy and physiology. Social sciences are excluded.
- Health science space is dedicated to clinically-oriented, non-research health professions such as nursing and occupational therapy.
- Math space supports all math instruction.
- Technology space accommodates instruction in computer science and data analytics.

Most, but not all, fall 2017 instruction in designated STEM spaces was in STEM subjects. All instruction delivered in STEM spaces counted toward STEM weekly space utilization.

UNC System Regional Map



UNC Pembroke STEM Majors

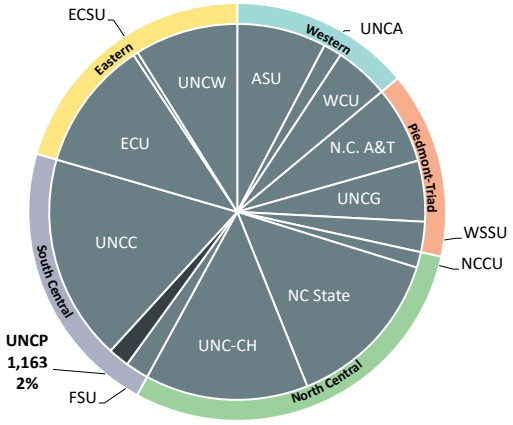


Undergraduate Enrollment

Understanding the Data Set

- MGT's enrollment analyses projected 2018 to 2028 enrollment growth of upper division majors only. JMZ extrapolated to 2030 using the MGT enrollment growth rate for the 2023-2028 period with some minor adjustments from the UNC System.
- While lower division and graduate STEM students were not included in MGT's enrollment projections, space needs associated with STEM growth of these groups are accounted for in this study.

Systemwide 2030 STEM Upper Division Enrollment



South Central Region STEM Enrollment Outlook

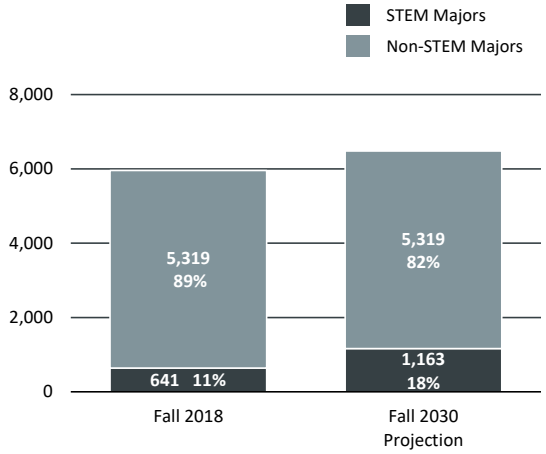
MGT considered industry growth, expected population change, and individual universities' enrollment targets in its enrollment analysis.

Between 2020 and 2030, the South Central Region population as a whole is expected to grow by 12 percent. The traditional college-age population, age 18 to 24, is expected to grow more slowly at six percent over the decade.

There is strong regional demand for workers in computer science and health care management professions. Nursing, biological/environmental sciences, and mechanical engineering professionals are also expected to be in demand. Universities in the South Central Region are expected to add nearly 2,700 health science majors, more than any other region in the UNC System.

UNCP Upper Division STEM Majors

Headcount



UNC Pembroke STEM Highlights

(Source: Appendix E of the MGT Report)

- The university's nursing program routinely fills its 200-student enrollment cap.
- Partnerships with NC State in applied physics and engineering offer five-year tracks that grow enrollment at both institutions.
- Growth in technology programs has prompted a lab renovation to support information technology and cybersecurity instruction.

UNCP Upper Division STEM Majors by Category

Headcount

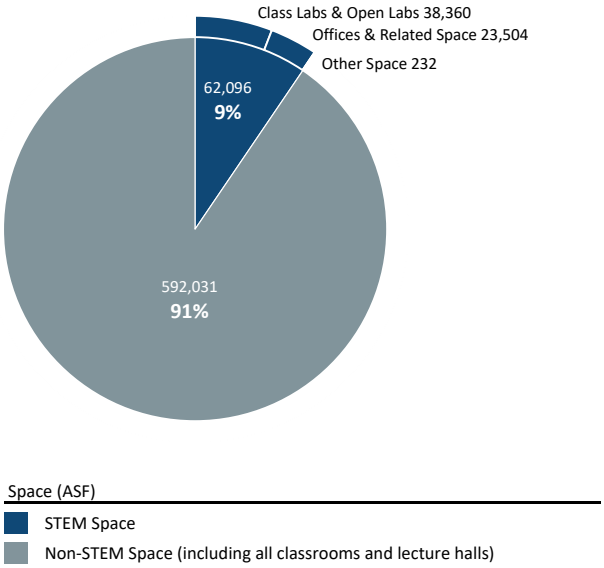
STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering				
Hard Science	416	772	*356*	*5.3%*
Health Science	123	183	*60*	*3.4%*
Math	9	33	*24*	*11.4%*
Technology	93	175	*82*	*5.4%*
Total	**641**	**1,163**	***522***	***5.1%***

2017 Space Allocation

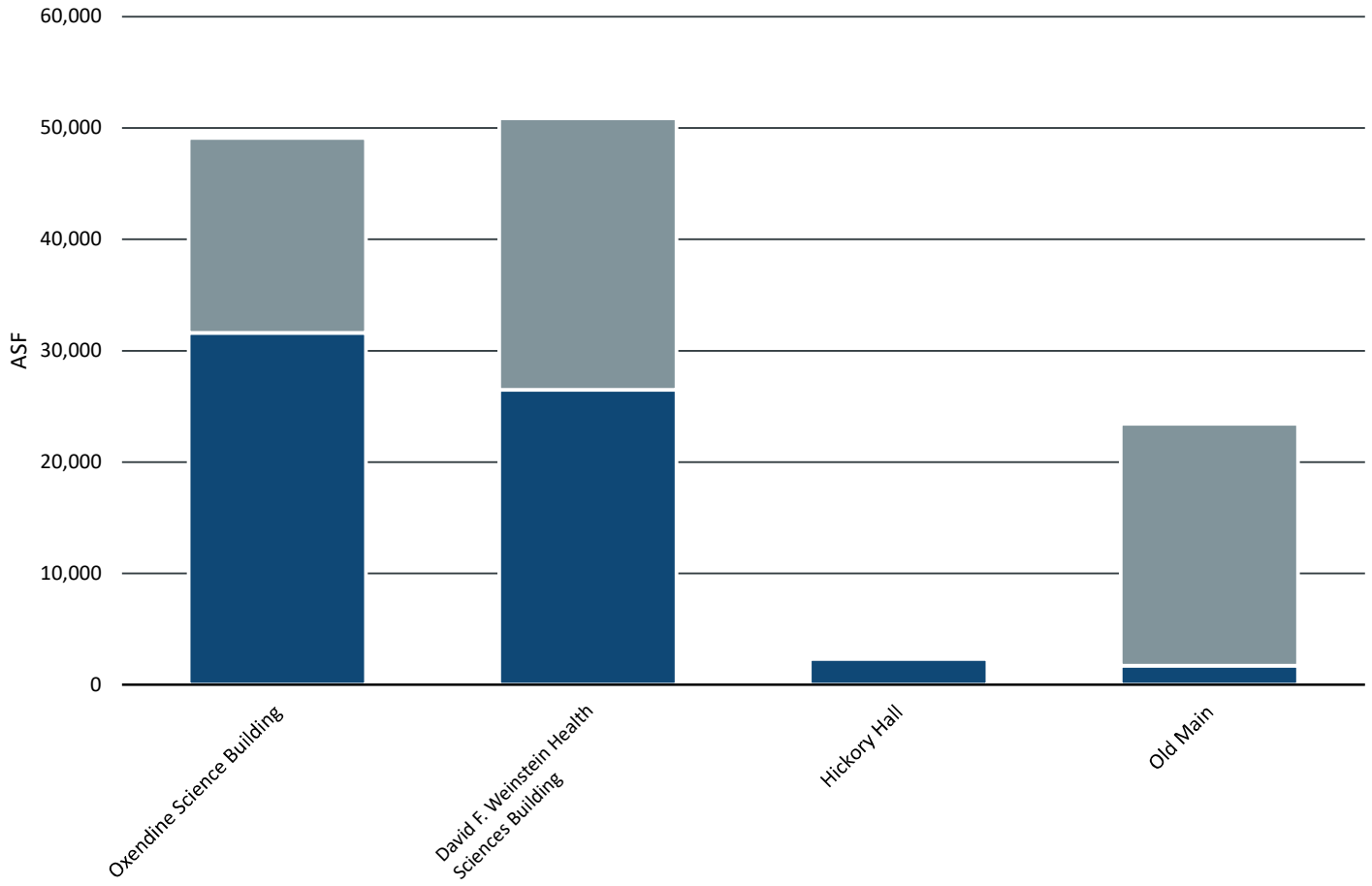
Understanding the Data Set

- Space allocation is based on 2017 UNC System data, self-reported by each university.
- Only buildings where space is allocated to STEM programs are included in this study.
- Space prorated for any amount of STEM is captured as 100 percent STEM since it is capable of supporting STEM education.
- General use classrooms are not counted as STEM-dedicated space. See Appendix B for a list of UNC System category codes considered STEM.
- The study does not include research or related space. However, the instructional spaces in the study may support research activities during unscheduled hours.
- Program space is quantified in assignable square feet (ASF).

STEM Space Summary



2017 STEM Academic Space by Building



Instructional Space Utilization

Understanding the Data Set

- Instructional space utilization is based on the fall 2017 course schedule (the most recent, fully vetted course schedule available at the time of this study).
- The study considered daytime room use in a 45-hour week based on the target criteria below from the Association for Learning Environments.
- While the study targets are ideal, a utilization range of five percent below or 10 percent above each target is considered reasonable.
- In a dedicated STEM space, all instruction delivered in that space was counted toward its fall 2017 utilization, including non-STEM courses.

Space Utilization Targets

	Seat Fill			Hours Used		
Space Type	Low	**Target**	High	Low	**Target**	High
Classrooms	62%	**67%**	77%	29	**31**	35
Class Labs	75%	**80%**	90%	19	**21**	26

Understanding the Results

Darkest tone: Fall 2017 space use (hourly or seat fill)

Middle tone: Remaining capacity within target range

Lightest tone: Remaining capacity above target range; use at this level is not expected

Utilization Summary

Classrooms

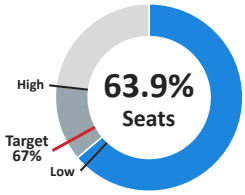
Classroom utilization met the lowest seat fill target of 62 percent. The low hourly utilization target of 29 hours per week was not met.

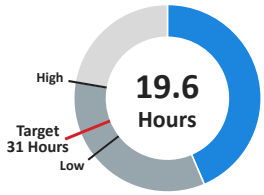
Class Labs

- Hard Science and Technology labs met the low seat fill target of 75 percent.
- Hard Science labs did not meet the hourly utilization target range, but Technology labs reached the 19 hours per week low target.

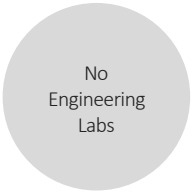
2017 Weekly Utilization - Seats and Hours

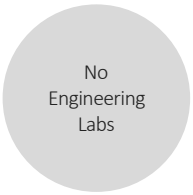
Classrooms



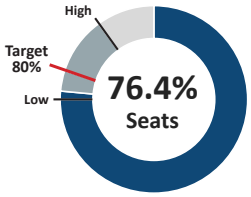


Engineering Labs



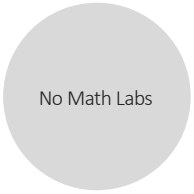


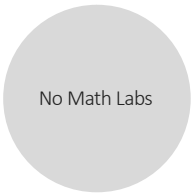
Hard Science Labs



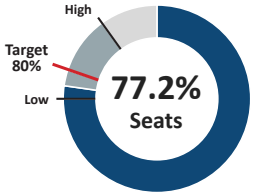
Health Science Labs

Math Labs





Technology Labs



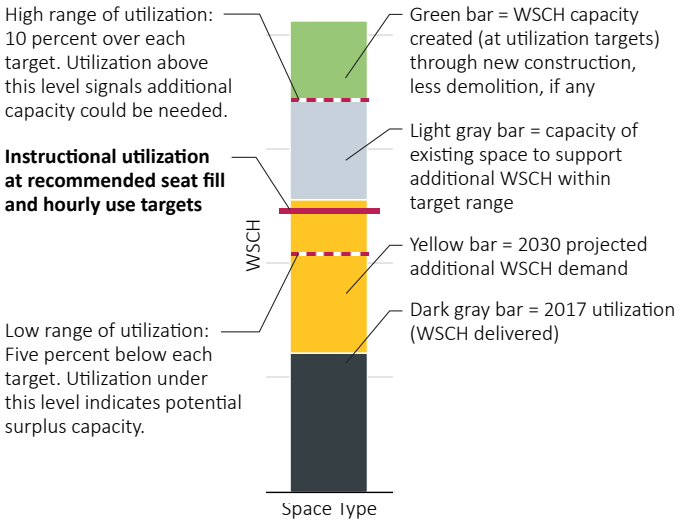
Weekly Instructional Capacity and Projections

UNC PEMBROKE

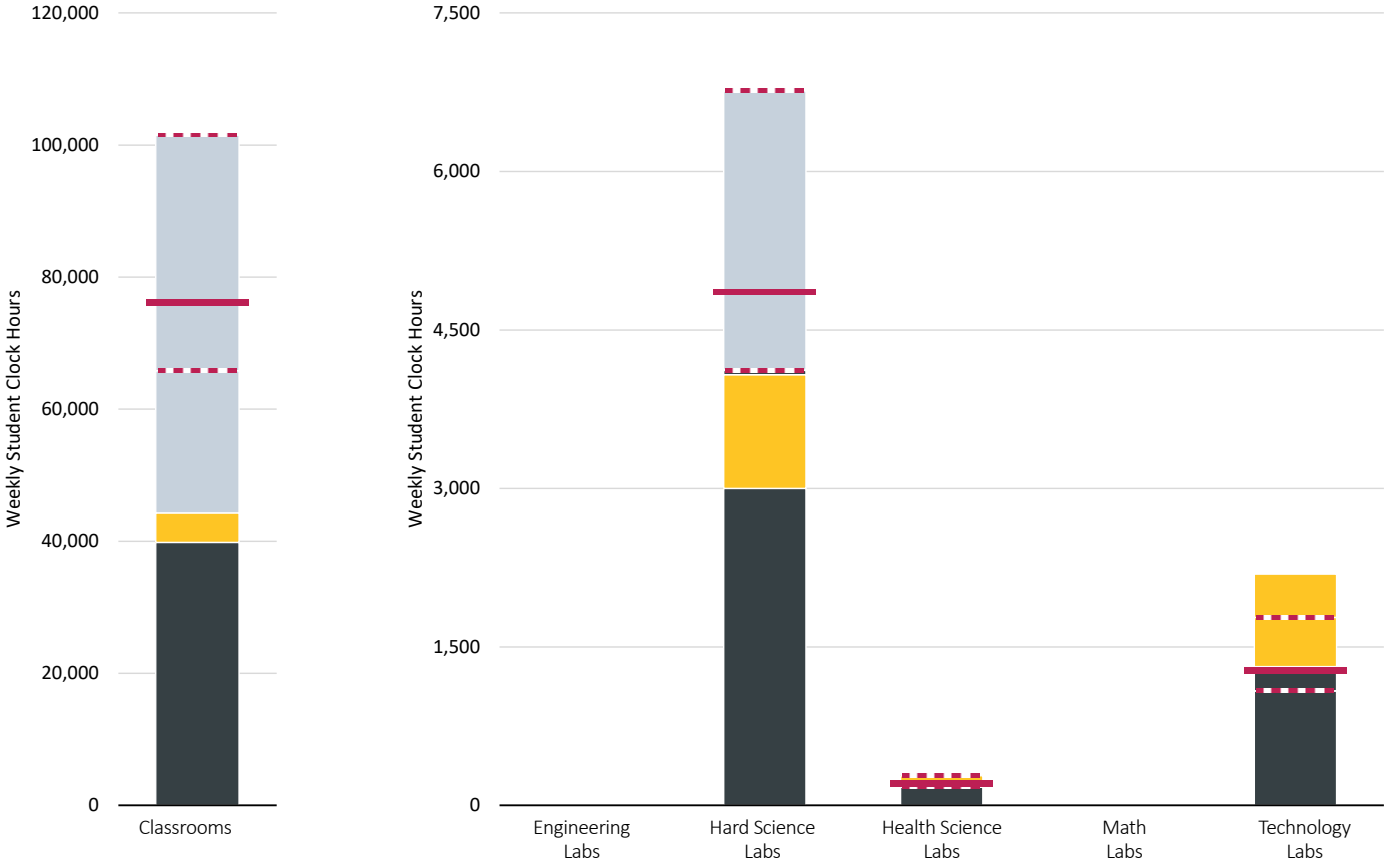
Understanding the Data Set

- An institution's capacity to accommodate future instruction is measured in weekly student clock hours (WSCH). One WSCH equals one student occupying one station for one hour.
- WSCH capacity is calculated using the number of stations in the 2017 space inventory with seat and hourly utilization target criteria applied.
- 2030 STEM course demand is projected to grow according to enrollment projections. Non-STEM course demand was held at the fall 2017 level.
- Graduate programs are evaluated separately. The effect of their growth on instructional demand is included later in this report.
- Future lab demand is based on the assumption that fall 2017 courses were scheduled in the labs best suited to deliver the required instruction.

Understanding the Results



2017 Utilization and 2030 Projections



Space Implications of Enrollment Growth
Undergraduate

Understanding the Data Set

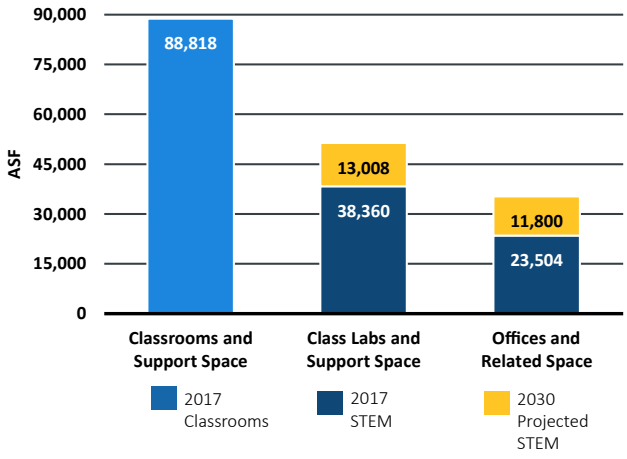
- Projections were made for classrooms, class labs, and office space only. Station sizes conform to UNC System standards.

Instructional Space	Station Size (ASF)
Classrooms	22
Engineering	108
Hard Science	70
Health Science	70
Math	33
Technology	50

Offices	Station Size (ASF)
Faculty	190
Staff (blended size)	140
Graduate Student	95

- If the projected 2030 instructional demand for an individual lab exceeded target capacity, a space need for an additional lab of the same type was generated. If a lab was not scheduled in 2017 or is projected to be underutilized in 2030, it could potentially offset future space demand.
- For each university, the 2018 STEM student:faculty and STEM faculty:staff ratios were maintained within System parameters. Since reliable data for current faculty and staff office space is not available, projections reflect the space needed for additional 2030 STEM faculty and staff only.
- The 2017 building condition codes were self-reported by each university to the UNC System. Building conditions were downgraded by one level in 2030 to reflect the presumed deterioration of structures if no substantial facilities improvements occur. None were reduced to demolition status.

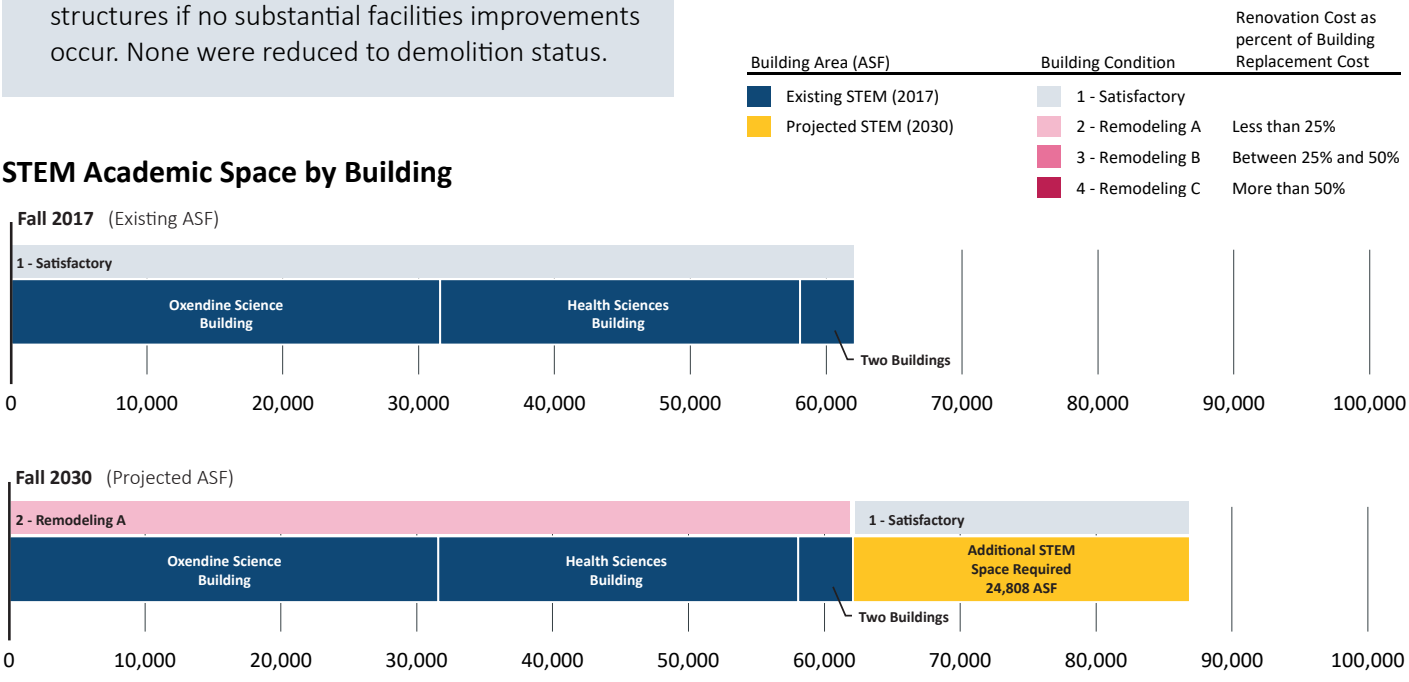
Academic Space by Category



Potential Space Offsets

	2017 Number of Labs		2030 Number of Labs	
	Labs (Inventory)	Labs Not Scheduled	Total Labs Needed	Underutilized Labs
Engineering				
Hard Science	12		15	9
Health Science	1	1	1	
Math				
Technology	2		5	
Total	15	1	21	9

STEM Academic Space by Building



Space Implications of Enrollment Growth
Graduate

Understanding the Data Set

- Graduate enrollment growth rates in this report were established using historical enrollment patterns and UNC System guidance. Graduate programs were not included in the MGT analysis.
- Without knowledge of specific graduate program curricula, it is assumed that all graduate students use on-campus space every semester.
- Projected 2030 instructional space demand for graduate students was layered on top of undergraduate demand. If the sum of 2030 undergraduate and graduate instruction would cause classrooms or labs to exceed target capacity, a space need for an additional room of the same type was generated.

Graduate Students by Category

Headcount

STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering				
Hard Science				
Health Science	22	26	*4*	*1.4%*
Math				
Technology				
Total	**22**	**26**	***4***	***1.4%***

Undergraduate and Graduate Instruction

STEM Category		WSCH 2017	WSCH 2030	*Annual Percent Change*
Engineering	Undergraduate			
	Graduate			
Subtotal				
Hard Science	Undergraduate	10,617	13,879	*2.3%*
	Graduate	73	115	
Subtotal		***10,690***	***13,993***	***2.3%***
Health Science	Undergraduate	5,761	8,570	*3.4%*
	Graduate	347	460	*2.4%*
Subtotal		***6,108***	***9,031***	***3.3%***
Math	Undergraduate	3,856	6,304	*4.2%*
	Graduate	36	100	
Subtotal		***3,892***	***6,405***	***4.2%***
Technology	Undergraduate	695	1,308	*5.4%*
	Graduate			
Subtotal		***695***	***1,308***	***5.4%***
Total STEM		**21,384**	**30,737**	***3.1%***

Space Implications

Classrooms

No additional classrooms will be required to accommodate projected STEM graduate enrollment growth in 2030.

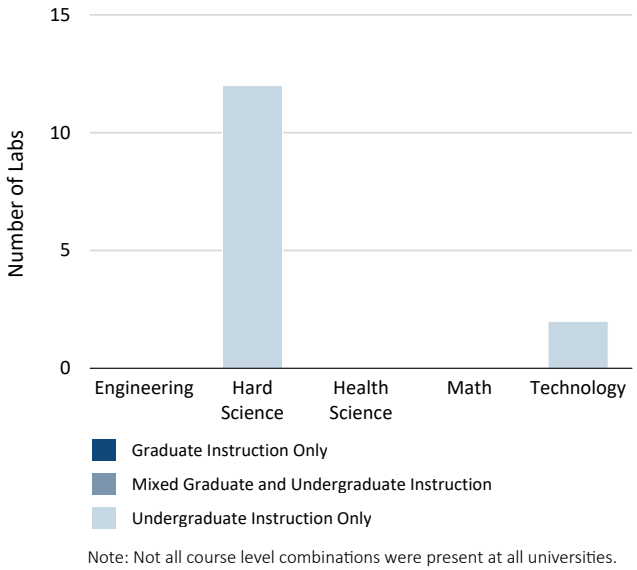
Class Labs

UNC Pembroke STEM labs were used exclusively for undergraduate instruction in fall 2017. One lab, room 1193 in the English. E. Jones Building, may have been miscoded as an exclusively physical education space. It was used for physiology instruction and will be sufficient to accommodate STEM graduate and undergraduate growth through 2030. The additional lab space recommended to serve future STEM undergraduate enrollment will likely satisfy the space needs of future STEM graduate students as well.

Offices

If enrollment projections are met, 380 ASF of additional graduate office space should be allocated to STEM to accommodate four additional graduate students.

2017 Use of Scheduled Labs by Course Level



Note: Not all course level combinations were present at all universities.

Space Utilization Opportunities

Classrooms

- The existing classrooms should be sufficient to meet 2030 lecture demand.
- Five of the University's 107 classrooms were not scheduled in fall 2017.
  - Givens Performing Arts Center 204
  - Canton Field House 140B
  - Health Sciences Building 258A
  - Health Sciences Building 264
  - Health Sciences Building 371
- There were 10 classrooms with station sizes smaller than 18 square feet. If stations in these rooms were right-sized to 22 square feet or larger, lecture capacity (WSCH) overall would be reduced.
- If enrollment surges, UNC Pembroke could increase seat fill targets to 80 percent in its 98 classrooms with station sizes greater than 22 square feet.

Hard Science Labs

All twelve Hard Science labs were scheduled. By 2030, three additional labs will be needed to meet the needs of Biology, Chemistry, and Physics.

The capacity need can be addressed multiple ways:

- Repurpose existing unscheduled or underutilized space within Hard Science disciplines or campus-wide. Because all Hard Science labs were scheduled, there may be little opportunity to repurpose these labs.
- Maximize utilization in Hard Science labs and reassign space based on demand. Based on schedule data, nine labs will not meet target utilization in 2030. If some lightly-scheduled labs could be shared by complementary disciplines, there is potential to reduce the need for additional space.
- Construct new labs in an addition or new building if the previous options cannot be employed.

Health Science Labs

There was one class lab coded as Health Science (Health Sciences Building 201) but it was not scheduled. Jones Center 1193 was coded as a Physical Education space but was used for Health Science; its use was captured and projected as a need for Health Science lab space.

Math and Technology Labs

Two class labs were classified as Technology labs: Oxendine 1246 and 1258. Math and Technology instruction was delivered in these labs. Three additional labs could be needed if enrollment meets projections.

Next Steps

Data Accuracy

Information presented in this report is based, in part, on standard data submitted annually by individual universities to the UNC System. Inaccuracies in reported data could affect these results. Where possible, inconsistencies were identified, confirmed with the System, and corrected. However, room-by-room auditing of space data was beyond the scope of this study.

If the University believes a conclusion was drawn in error, the related data should be corrected by the university before its next submission to the System to ensure the validity of future studies.

Maximize Utilization at Pressure Points

Underutilized classrooms provide an opportunity to repurpose space to create additional labs and offices. While there is an apparent surplus of classrooms at the University, underutilized space may not be in the right location or configuration to offset STEM needs.

As enrollment grows, the University may need additional STEM lab space before funding is available to build or renovate. The University should plan strategically to identify enrollment thresholds that, when met, prompt actions such as scheduling evening lab courses, increasing target seat utilization in labs (within safe limits), and/or sharing lab space among disciplines (where pedagogically feasible).

Supplemental Information from the University

University comments can be found in Appendix C.

University Analysis

Purpose of this Study

In March 2019 the UNC System commissioned a *Systemwide STEM Program Needs Assessment,* which was prepared by MGT Consulting Group. This report, the *Systemwide STEM Capital Planning Study,* builds upon MGT's work and provides a projection of the physical space required to accommodate future STEM enrollment. The UNC System will use this capital planning study to guide the development of a systemwide STEM capital improvement plan.

By 2030, East Carolina University is projected to gain nearly 2,500 STEM upper division majors. While ECU's share of systemwide STEM students will decrease slightly from 11.7 percent to 11.2 percent in the next decade, the university will gain more engineering majors than any other in the system. The analysis on the following pages can help the university fine tune its space utilization and prepare campus facilities to accommodate STEM growth.

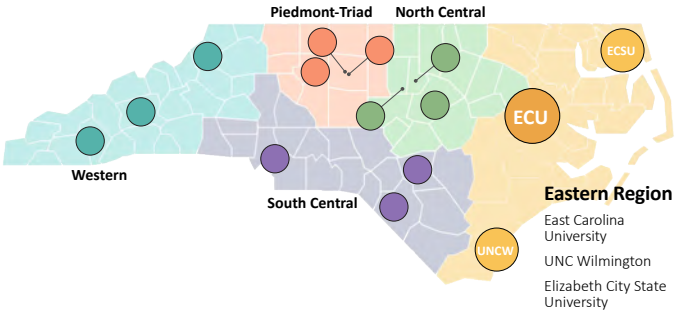
STEM Categories

MGT's study divided STEM majors into five categories: engineering, hard science, health science, math, and technology. In this study, physical space is sorted into the same five categories.

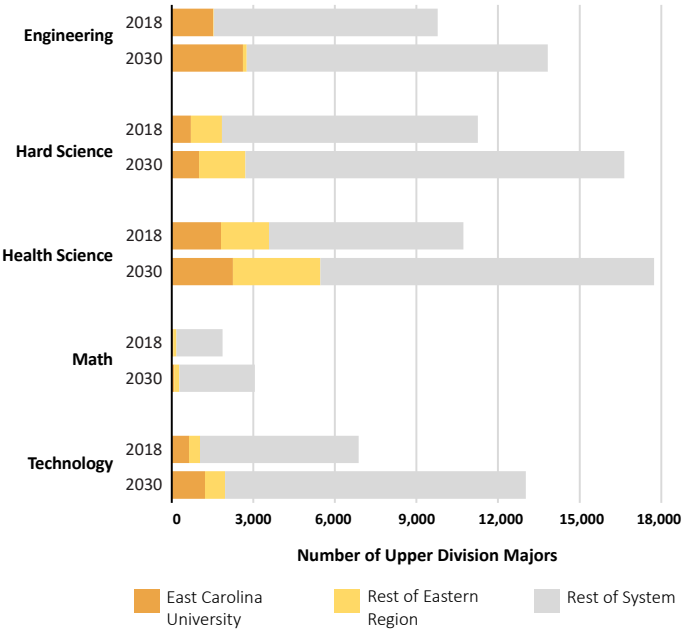
- Engineering space is dedicated to a broad range of engineering subjects, including hands-on technical instruction related to engineering programs.
- Hard science space houses lab-based sciences such as biology, chemistry, physics, geology, anatomy and physiology. Social sciences are excluded.
- Health science space is dedicated to clinically-oriented, non-research health professions such as nursing and occupational therapy.
- Math space supports all math instruction.
- Technology space accommodates instruction in computer science and data analytics.

Most, but not all, fall 2017 instruction in designated STEM spaces was in STEM subjects. All instruction delivered in STEM spaces counted toward STEM weekly space utilization.

UNC System Regional Map



East Carolina University STEM Majors

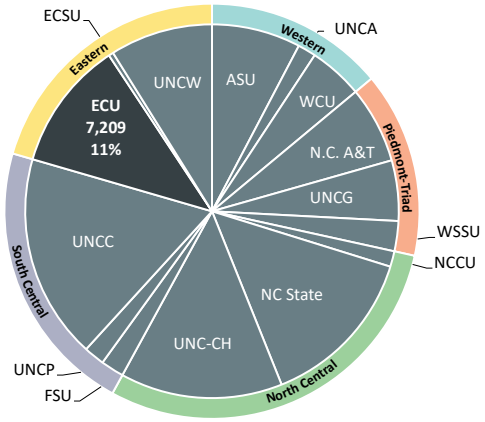


Undergraduate Enrollment

Understanding the Data Set

- MGT's enrollment analyses projected 2018 to 2028 enrollment growth of upper division majors only. JMZ extrapolated to 2030 using the MGT enrollment growth rate for the 2023-2028 period with some minor adjustments from the UNC System.
- While lower division and graduate STEM students were not included in MGT's enrollment projections, space needs associated with STEM growth of these groups are accounted for in this study.

Systemwide 2030 STEM Upper Division Enrollment



Eastern Region STEM Enrollment Outlook

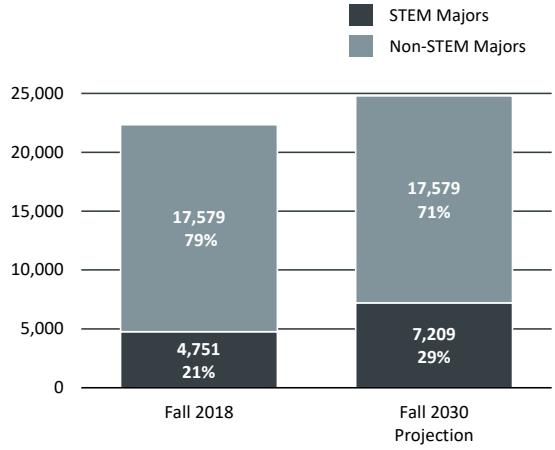
MGT considered industry growth, expected population change, and individual universities' enrollment targets in its enrollment analysis.

Overall population in the Eastern Region is projected to increase by eight percent between 2020 and 2030. The number of the region's traditional college-age residents (age 18 to 24) is expected to grow faster than the population as a whole at eleven percent over the decade.

There is high demand for nurses statewide. The Eastern Region also offers opportunities in other health professions and engineering fields. Engineering programs in the Eastern Region are expected to add over 1,200 majors, more than any other region in the state.

ECU Upper Division STEM Majors

Headcount



East Carolina University STEM Highlights

(Source: Appendix E of the MGT Report)

- The university seeks to increase its offerings in advanced manufacturing, specifically within the pharmaceutical industry.
- ECU is developing relationships within the local agriculture sector to support the growing roles of the life sciences and bioprocessing in agriculture.
- The university anticipates rapid growth in data analytics. In response, the university is emphasizing problem-solving pedagogies in STEM.
- The need for rural health care professionals will reportedly spur increased demand for hard science and mathematics education.

ECU Upper Division STEM Majors by Category

Headcount

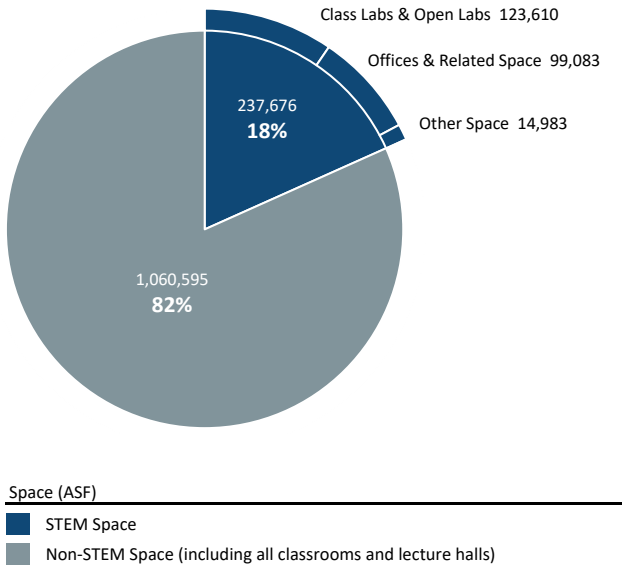
STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering	1,532	2,619	*1,087*	*4.6%*
Hard Science	708	1,012	*304*	*3.0%*
Health Science	1,810	2,256	*446*	*1.9%*
Math	62	97	*35*	*3.8%*
Technology	639	1,225	*586*	*5.6%*
Total	**4,751**	**7,209**	***2,458***	***3.5%***

2017 Space Allocation

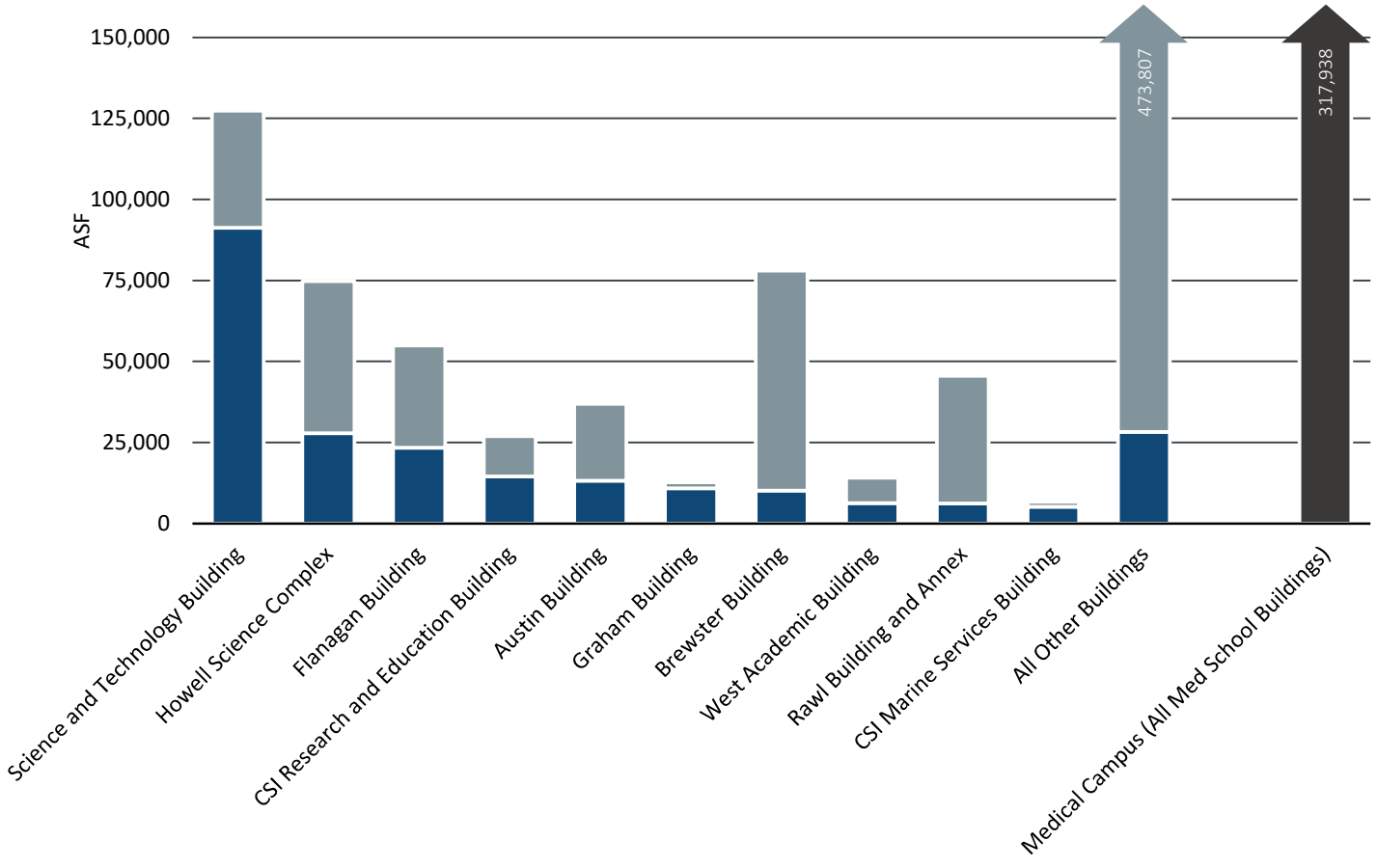
Understanding the Data Set

- Space allocation is based on 2017 UNC System data, self-reported by each university.
- Only buildings where space is allocated to STEM programs are included in this study.
- Space prorated for any amount of STEM is captured as 100 percent STEM since it is capable of supporting STEM education.
- General use classrooms are not counted as STEM-dedicated space. See Appendix B for a list of UNC System category codes considered STEM.
- The study does not include research or related space. However, the instructional spaces in the study may support research activities during unscheduled hours.
- Program space is quantified in assignable square feet (ASF).

STEM Space Summary



2017 STEM Academic Space by Building



Instructional Space Utilization

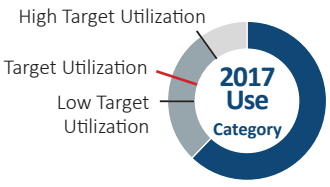
Understanding the Data Set

- Instructional space utilization is based on the fall 2017 course schedule (the most recent, fully vetted course schedule available at the time of this study).
- The study considered daytime room use in a 45-hour week based on the target criteria below from the Association for Learning Environments.
- While the study targets are ideal, a utilization range of five percent below or 10 percent above each target is considered reasonable.
- In a dedicated STEM space, all instruction delivered in that space was counted toward its fall 2017 utilization, including non-STEM courses.

Space Utilization Targets

	Seat Fill			Hours Used		
Space Type	Low	**Target**	High	Low	**Target**	High
Classrooms	62%	**67%**	77%	29	**31**	35
Class Labs	75%	**80%**	90%	19	**21**	26

Understanding the Results



Darkest tone: Fall 2017 space use (hourly or seat fill)

Middle tone: Remaining capacity within target range

Lightest tone: Remaining capacity above target range; use at this level is not expected

Utilization Summary

Classrooms

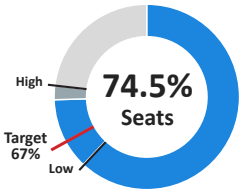
On average, classrooms nearly reached the high target seat fill rate (77 percent) when in use, but did not meet the low hourly use target (29 hours per week).

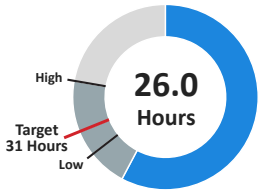
Class Labs

- The university's two math labs met the seat fill and hourly utilization targets.
- Labs in all other STEM categories did not meet low seat fill or hourly targets.

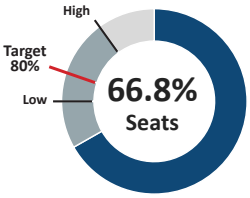
2017 Weekly Utilization - Seats and Hours

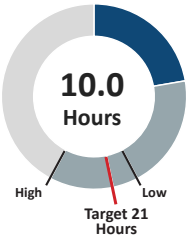
Classrooms



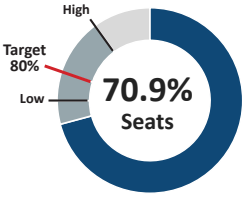


Engineering Labs

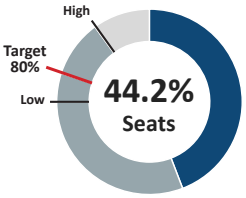




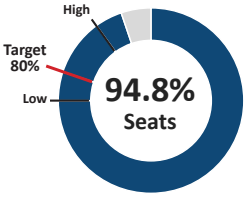
Hard Science Labs

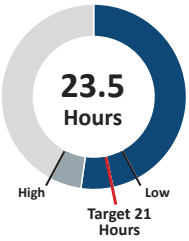


Health Science Labs

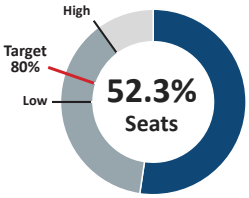


Math Labs





Technology Labs

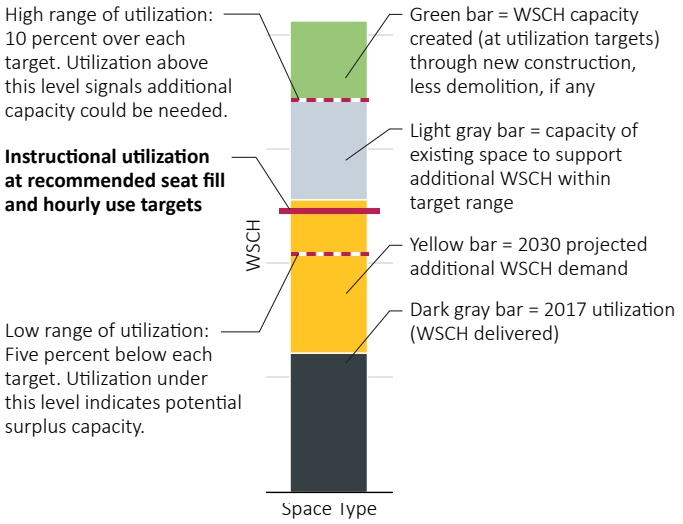


Weekly Instructional Capacity and Projections

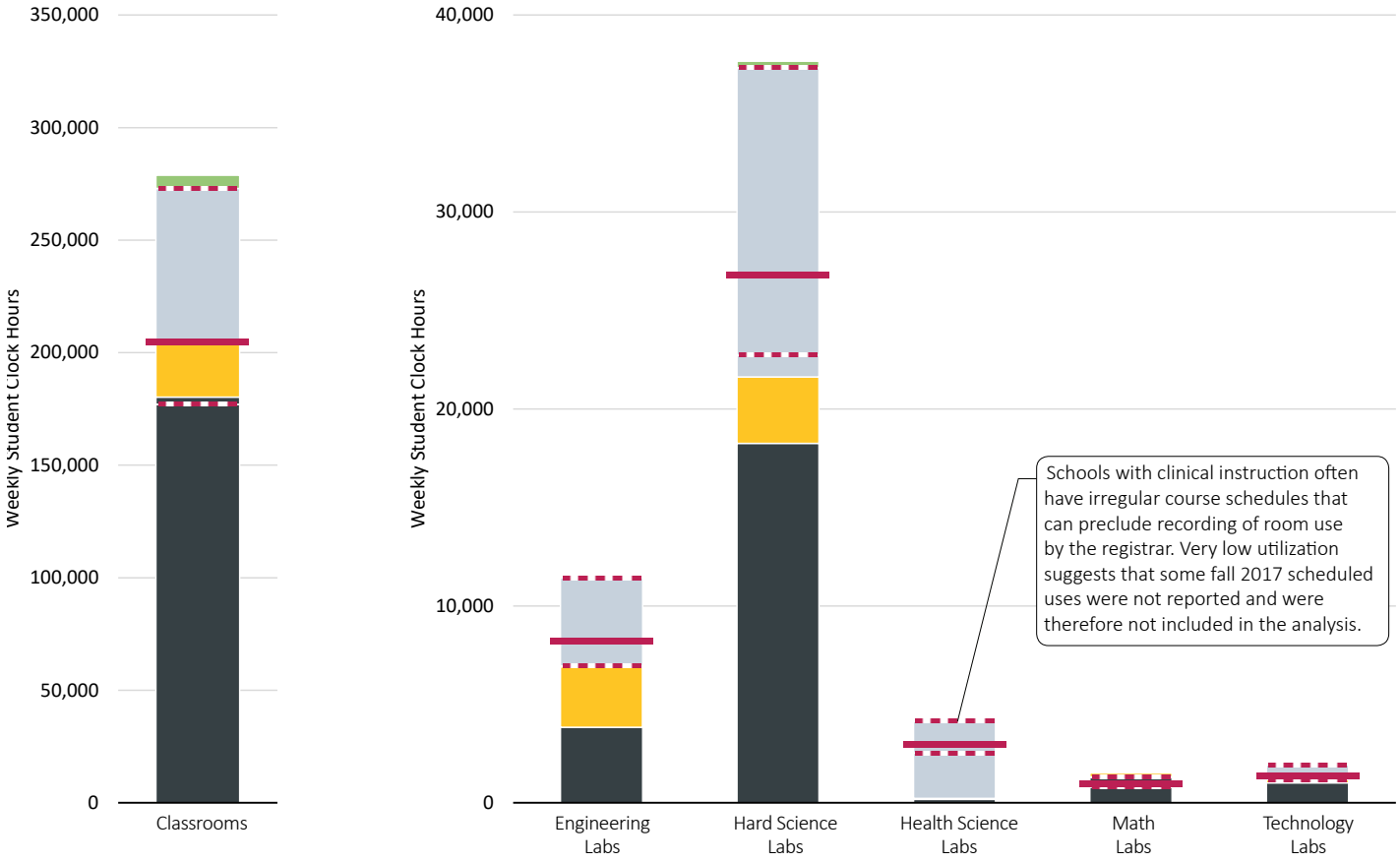
Understanding the Data Set

- An institution's capacity to accommodate future instruction is measured in weekly student clock hours (WSCH). One WSCH equals one student occupying one station for one hour.
- WSCH capacity is calculated using the number of stations in the 2017 space inventory with seat and hourly utilization target criteria applied.
- 2030 STEM course demand is projected to grow according to enrollment projections. Non-STEM course demand was held at the fall 2017 level.
- Graduate programs are evaluated separately. The effect of their growth on instructional demand is included later in this report.
- Future lab demand is based on the assumption that fall 2017 courses were scheduled in the labs best suited to deliver the required instruction.

Understanding the Results



2017 Utilization and 2030 Projections



Space Implications of Enrollment Growth
Undergraduate

Understanding the Data Set

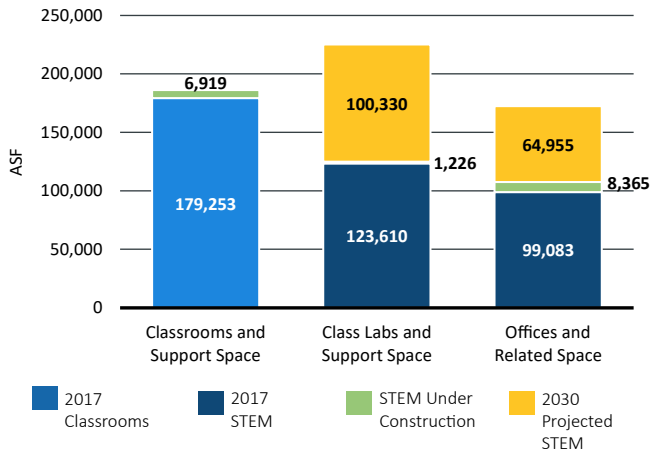
- Station sizes conform to UNC System standards. Projections were made for classrooms, class labs, and office space only.

Instructional Space	Station Size (ASF)
Classrooms	22
Engineering	108
Hard Science	70
Health Science	70
Math	33
Technology	50

Offices	Station Size (ASF)
Faculty	190
Staff (blended size)	140
Graduate Student	95

- If the projected 2030 instructional demand for an individual lab exceeded target capacity, a space need for an additional lab of the same type was generated. If a lab was not scheduled in 2017 or is projected to be underutilized in 2030, it could potentially offset future space demand.
- For each university, the 2018 STEM student:faculty and STEM faculty:staff ratios were maintained within System parameters. Since reliable data for current faculty and staff office space is not available, projections reflect the space needed for additional 2030 STEM faculty and staff only.
- The 2017 building condition codes were self-reported by each university to the UNC System. Building conditions were downgraded by one level in 2030 to reflect the presumed deterioration of structures if no substantial facilities improvements occur. None were reduced to demolition status.

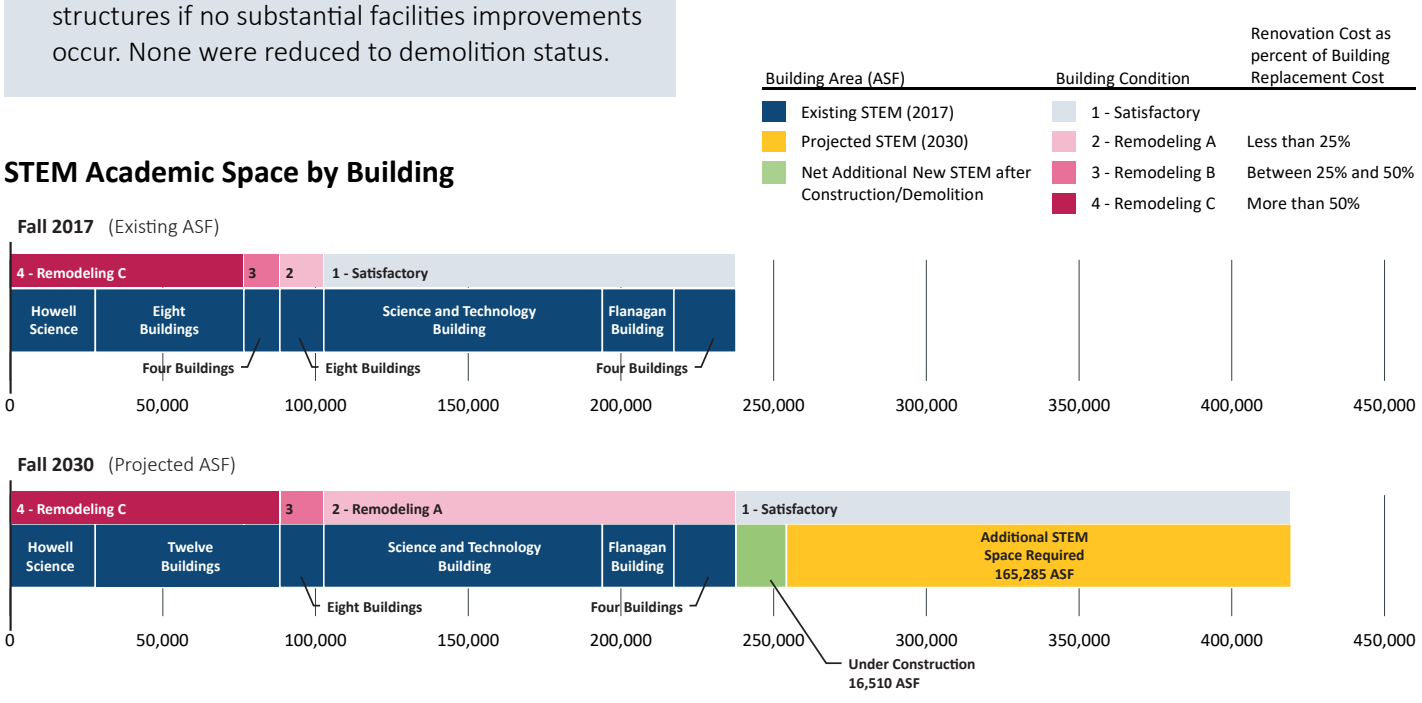
Academic Space by Category



Potential Space Offsets

	2017 Number of Labs		2030 Number of Labs	
	Labs (Inventory)	Labs Not Scheduled	Total Labs Needed	Underutilized Labs
Engineering	18	2	25	9
Hard Science	59	13	81	27
Health Science	7	4	7	3
Math	2		4	1
Technology	3		4	2
Total	89	19	121	42

STEM Academic Space by Building



Space Implications of Enrollment Growth
Graduate

Understanding the Data Set

- Graduate enrollment growth rates in this report were established using historical enrollment patterns and UNC System guidance. Graduate programs were not included in the MGT analysis.
- Without knowledge of specific graduate program curricula, it is assumed that all graduate students use on-campus space every semester.
- Projected 2030 instructional space demand for graduate students was layered on top of undergraduate demand. If the sum of 2030 undergraduate and graduate instruction would cause classrooms or labs to exceed target capacity, a space need for an additional room of the same type was generated.

Graduate Students by Category

Headcount

STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering	104	149	*45*	*3.0%*
Hard Science	137	174	*37*	*2.0%*
Health Science	138	160	*22*	*1.2%*
Math	16	22	*6*	*2.7%*
Technology	298	463	*165*	*3.7%*
Total	**693**	**968**	***275***	***2.8%***

Undergraduate and Graduate Instruction

STEM Category		WSCH 2017	WSCH 2030	*Annual Percent Change*
Engineering	Undergraduate	9,445	16,146	*4.6%*
	Graduate	61	90	*3.3%*
Subtotal		***9,505***	***16,235***	***4.6%***
Hard Science	Undergraduate	49,987	57,678	*1.2%*
	Graduate	1,497	1,931	*2.1%*
Subtotal		***51,484***	***59,609***	***1.2%***
Health Science	Undergraduate	20,379	25,400	*1.9%*
	Graduate	707	827	*1.3%*
Subtotal		***21,085***	***26,227***	***1.8%***
Math	Undergraduate	13,183	16,045	*1.7%*
	Graduate	166	229	*2.7%*
Subtotal		***13,349***	***16,275***	***1.7%***
Technology	Undergraduate	16,112	30,887	*5.6%*
	Graduate	391	630	*4.0%*
Subtotal		***16,503***	***31,516***	***5.5%***
Total STEM		**111,926**	**149,862**	***2.5%***

Space Implications

Classrooms

If graduate enrollment projections are met, an additional 20 seats in classrooms could be needed. It is likely that this need for additional lecture capacity could be met in existing space by extending hourly instructional targets in classrooms or by scheduling conference rooms for graduate lectures.

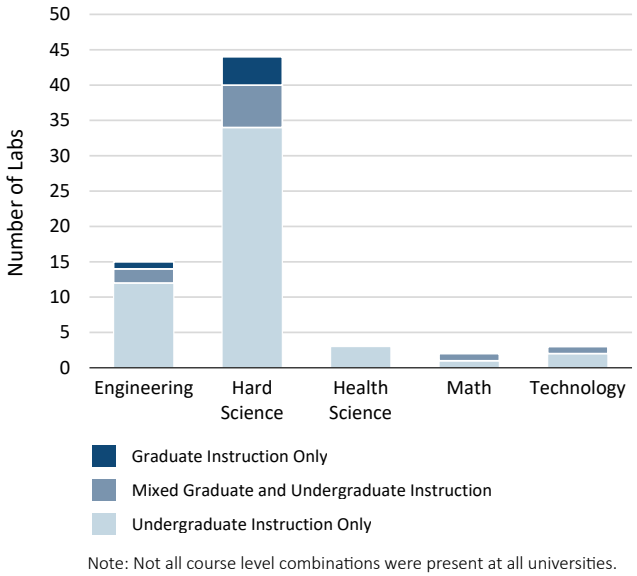
Class Labs

Most labs were used exclusively for undergraduate instruction in fall 2017. Ten labs housed both graduate and undergraduate instruction. Five labs were scheduled for graduate instruction only. The additional lab space to serve future STEM undergraduate enrollment will likely satisfy the space needs of future STEM graduate students as well.

Offices

If enrollment projections are met, 26,125 ASF of additional graduate office space should be allocated to STEM to accommodate 275 new graduate students.

2017 Use of Scheduled Labs by Course Level



Note: Not all course level combinations were present at all universities.

University Summary

Space Utilization Opportunities

Classrooms

- Four classrooms were not scheduled in fall 2017.
  - Flanagan Building 378A
  - IGCC 1
  - Howell Science Building 201C
  - Scott Residence Hall 3
- If enrollment projections are met, the University can meet lecture instruction demand only if classrooms are used at target seat fill and hourly rates.
- There were 95 classrooms with station sizes smaller than 18 square feet. If stations in these rooms were right-sized to 22 square feet or larger, lecture capacity (WSCH) overall would be reduced.
- If enrollment surges, the university could increase seat fill targets to 80 percent in its 36 classrooms with station sizes greater than 22 square feet.

Engineering Labs

- Fifteen of the University's 18 Engineering labs were scheduled in fall 2017.
- Rawl 233 (which had very small station sizes), Science & Technology 134A, and Science & Technology 144B were not scheduled.
- Rivers HESC room 110C reportedly had only one station in 193 SF. It was scheduled for 3 hours.
- Seven additional Engineering labs could be needed if enrollment meets projections.

Hard Science Labs

In fall 2017, 46 Hard Science labs were scheduled. The University had 58 labs in its inventory. Four physics labs in the Howell Science Building were numbered "0" in the space inventory; instruction delivered in these labs could not be accurately allocated to the room in which it occurred.

If enrollment meets targets, an additional 22 labs could be needed. Most additional labs would be Biology class labs, but some Chemistry and Geology labs are also expected to exceed capacity by 2030. The anticipated need can be addressed in multiple ways:

- Repurpose existing unscheduled or underutilized space within Hard Science disciplines or campus-wide. Unscheduled labs could be highly-specialized spaces that are only used for instruction on a limited basis. Of the unscheduled labs, six were labeled "general" in the space inventory. Three general Biology labs in Howell Science and three general Chemistry labs in the Science & Technology building may be available to offset some of the 2030 space need.
- Maximize utilization in existing Hard Science labs. Schedule data shows that 27 labs may not reach recommended utilization targets in 2030. These labs could be candidates to meet future needs through sharing or reassignment of space.
- Construct new labs in an addition or new building if the previous options do not satisfy the full future space need.

Health Science Labs

Four out of seven Health Science labs were scheduled. No scheduling data was provided for the three labs in the Rivers Building. Due to low reported utilization, no additional Health Science labs are projected for 2030.

Math Labs

The University's two Math labs were both well utilized. Calculations indicate that two additional Math labs will be needed by 2030 to accommodate STEM growth.

Technology Labs

All three of the University's Technology labs were scheduled. Austin 209 could exceed capacity by 2030. One additional lab could be needed.

Next Steps

Data Accuracy

Information presented in this report is based, in part, on standard data submitted annually by individual universities to the UNC System. Inaccuracies in reported data could affect these results. Where possible, inconsistencies were identified, confirmed with the System, and corrected. However, room-by-room auditing of space data was beyond the scope of this study.

If the University believes a conclusion was drawn in error, the related data should be corrected by the university before its next submission to the System to ensure the validity of future studies.

University Summary

Maximize Utilization at Pressure Points

Underutilized classrooms provide an opportunity to repurpose space to create additional labs and offices. However, if STEM enrollment projections are met, the University could approach target utilization, on average, within its existing classrooms. This may still allow certain underutilized classrooms to be repurposed, yet may not yield sufficient surplus space to offset future STEM space needs.

As enrollment grows, the University may need additional STEM lab space before funding is available to build or renovate. The University should plan strategically to identify enrollment thresholds that, when met, prompt actions such as scheduling evening lab courses, increasing target seat utilization in labs (within safe limits), and/or sharing lab space among disciplines (where pedagogically feasible).

Supplemental Information from the University

University comments can be found in Appendix C.

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University Analysis

Purpose of this Study

In March 2019 the UNC System commissioned a *Systemwide STEM Program Needs Assessment,* which was prepared by MGT Consulting Group. This report, the *Systemwide STEM Capital Planning Study,* builds upon MGT's work and provides a projection of the physical space required to accommodate future STEM enrollment. The UNC System will use this capital planning study to guide the development of a systemwide STEM capital improvement plan.

By 2030, Elizabeth City State University is projected to gain 88 additional upper division STEM majors. While growth in headcount is comparatively small, Elizabeth City's engineering, hard science, and technology programs are projected to be some of the fastest growing in the state. The analysis on the following pages can help the university fine tune its space utilization and prepare campus facilities to accommodate STEM growth.

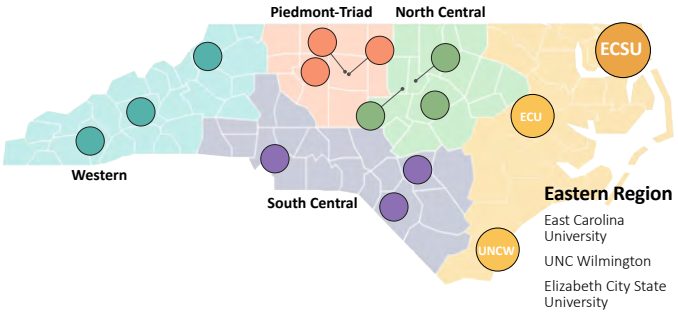
STEM Categories

MGT's study divided STEM majors into five categories: engineering, hard science, health science, math, and technology. In this study, physical space is sorted into the same five categories.

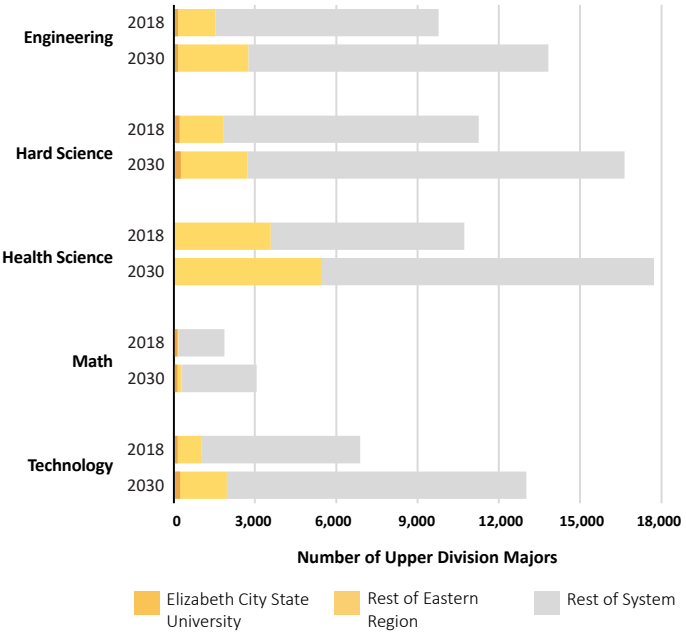
- Engineering space is dedicated to a broad range of engineering subjects, including hands-on technical instruction related to engineering programs.
- Hard science space houses lab-based sciences such as biology, chemistry, physics, geology, and anatomy and physiology. Social sciences are excluded.
- Health science space is dedicated to clinically-oriented, non-research health professions such as nursing and occupational therapy.
- Math space supports all math instruction.
- Technology space accommodates instruction in computer science and data analytics.

Most, but not all, fall 2017 instruction in designated STEM spaces was in STEM subjects. All instruction delivered in STEM spaces counted toward STEM weekly space utilization.

UNC System Regional Map



Elizabeth City State University STEM Majors

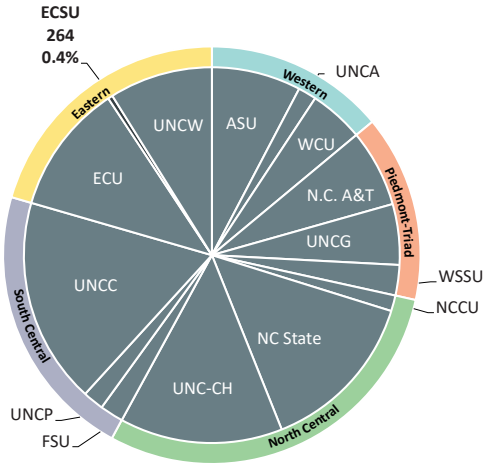


Undergraduate Enrollment

Understanding the Data Set

- MGT's enrollment analyses projected 2018 to 2028 enrollment growth of upper division majors only. JMZ extrapolated to 2030 using the MGT enrollment growth rate for the 2023-2028 period with some minor adjustments from the UNC System.
- While lower division and graduate STEM students were not included in MGT's enrollment projections, space needs associated with STEM growth of these groups are accounted for in this study.

Systemwide 2030 STEM Upper Division Enrollment



Eastern Region STEM Enrollment Outlook

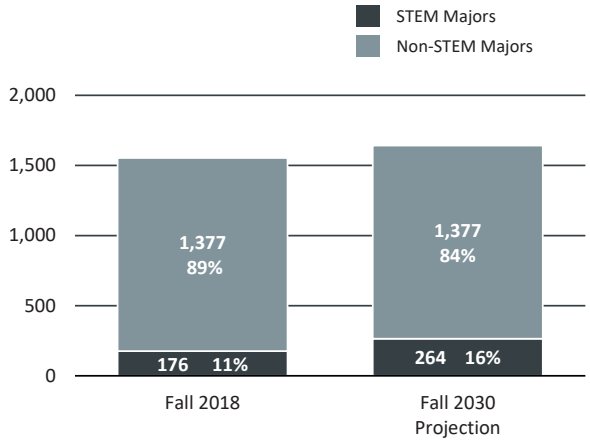
MGT considered industry growth, expected population change, and individual universities' enrollment targets in its enrollment analysis.

Overall population in the Eastern Region is projected to increase by eight percent between 2020 and 2030. The number of the region's traditional college-age residents (age 18 to 24) is expected to grow faster than the population as a whole at eleven percent over the decade.

There is high demand for nurses statewide. The Eastern Region also offers opportunities in other health professions and engineering fields. Engineering programs in the Eastern Region are expected to add over 1,200 majors, more than any other region in the state.

ECSU Upper Division STEM Majors

Headcount



Elizabeth City State University STEM Highlights

(Source: Appendix E of the MGT Report)

- The university's five-year accelerated BS/MS programs in Math and Biology have contributed to enrollment growth.
- A future Unmanned Aircraft program will spur growth in engineering enrollment.
- The university plans to start a Sustainability Studies program.

ECSU Upper Division STEM Majors by Category

Headcount

STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering	20	29	*9*	*3.0%*
Hard Science	95	116	*21*	*1.7%*
Health Science				
Math	10	15	*5*	*3.7%*
Technology	51	104	*53*	*6.1%*
Total	**176**	**264**	***88***	***3.4%***

2017 Space Allocation

Understanding the Data Set

- Space allocation is based on 2017 UNC System data, self-reported by each university.
- Only buildings where space is allocated to STEM programs are included in this study.
- Space prorated for any amount of STEM is captured as 100 percent STEM since it is capable of supporting STEM education.
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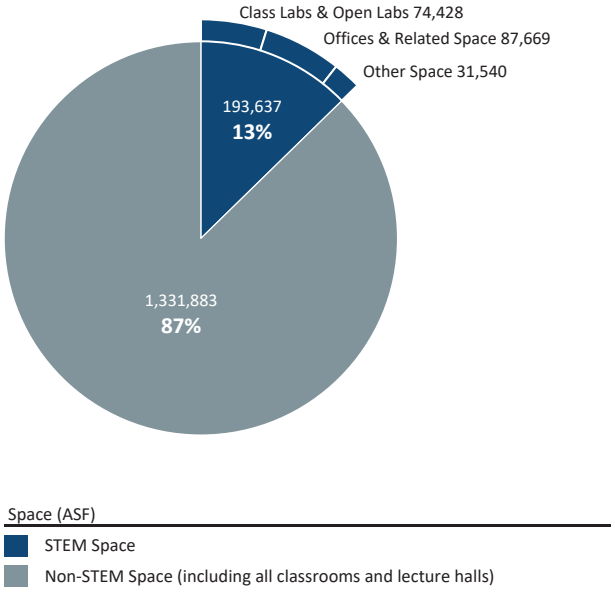
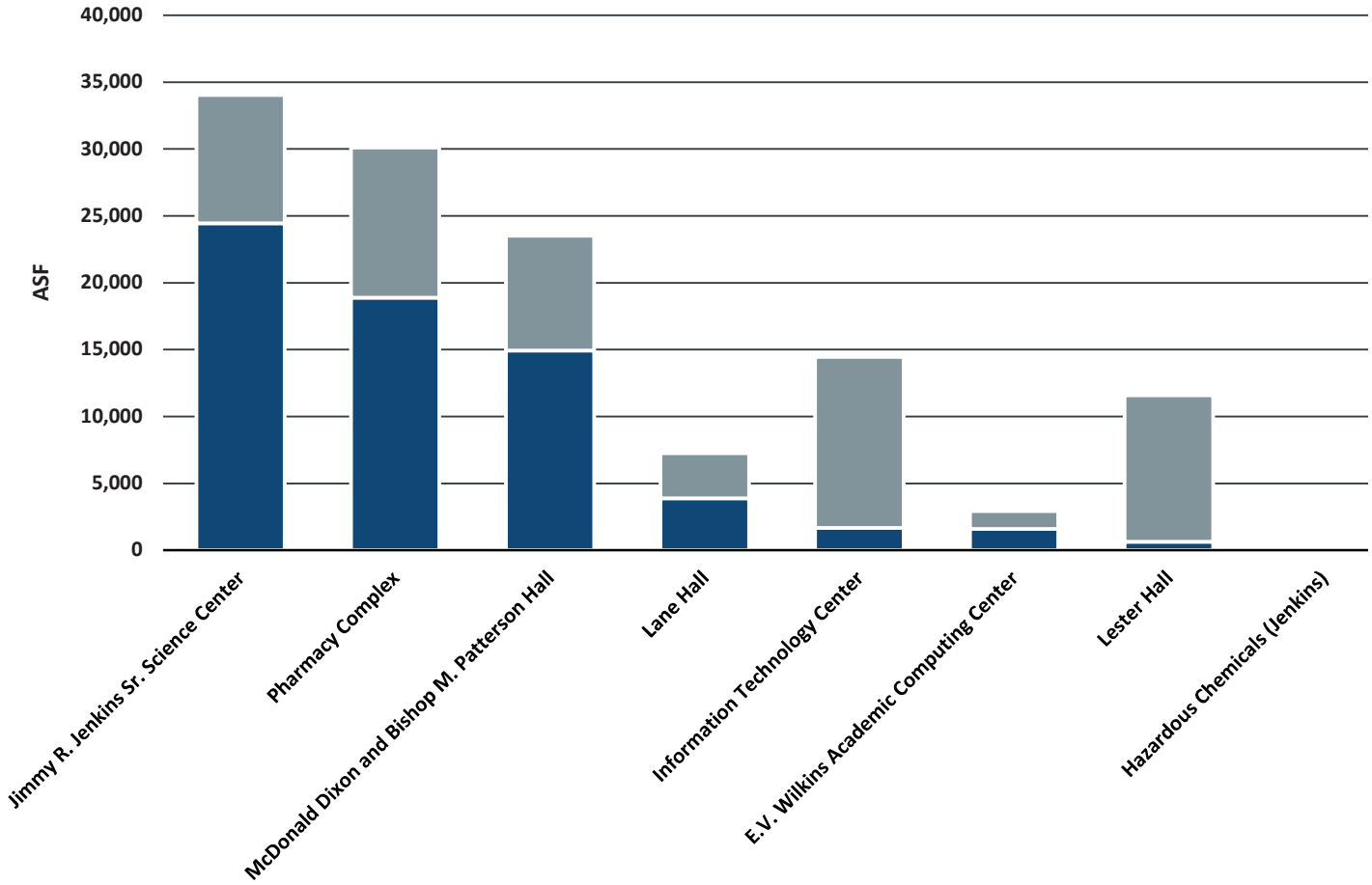
STEM Space Summary



2017 STEM Academic Space by Building



Instructional Space Utilization

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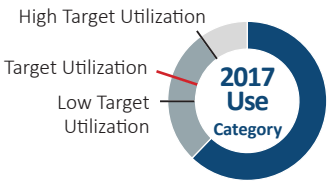
Understanding the Data Set

- Instructional space utilization is based on the fall 2017 course schedule (the most recent, fully vetted course schedule available at the time of this study).
- The study considered daytime room use in a 45-hour week based on the target criteria below from the Association for Learning Environments.
- While the study targets are ideal, a utilization range of five percent below or 10 percent above each target is considered reasonable.
- In a dedicated STEM space, all instruction delivered in that space was counted toward its fall 2017 utilization, including non-STEM courses.

Space Utilization Targets

	Seat Fill			Hours Used		
Space Type	Low	**Target**	High	Low	**Target**	High
Classrooms	62%	**67%**	77%	29	**31**	35
Class Labs	75%	**80%**	90%	19	**21**	26

Understanding the Results



Darkest tone: Fall 2017 space use (hourly or seat fill)

Middle tone: Remaining capacity within target range

Lightest tone: Remaining capacity above target range; use at this level is not expected

Utilization Summary

Classrooms

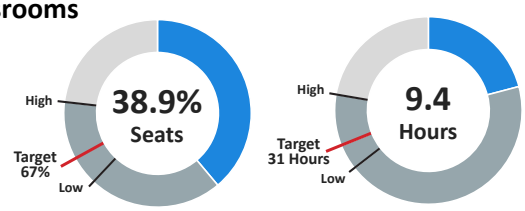
Classrooms did not meet the low (62 percent) seat fill target or the low (29 hours per week) hourly target.

Class Labs

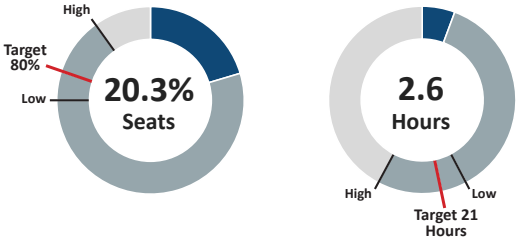
None of ECSU's STEM class labs met the low seat fill target (75 percent) or the low hourly utilization target (19 hours per week).

2017 Weekly Utilization - Seats and Hours

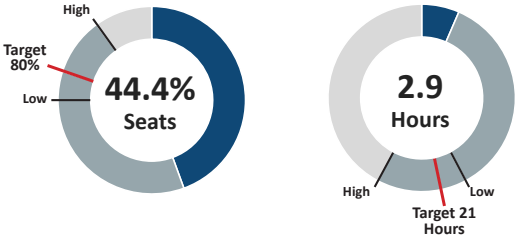
Classrooms



Engineering Labs

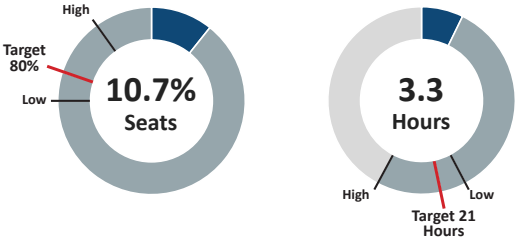


Hard Science Labs

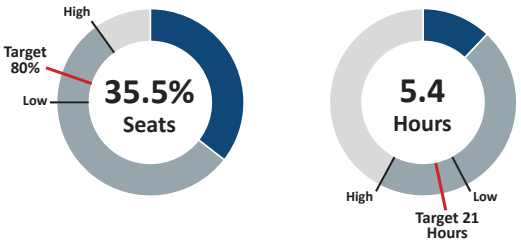


Health Science Labs

Math Labs



Technology Labs



Weekly Instructional Capacity and Projections

ECSU
ELIZABETH CITY STATE UNIVERSITY
FOUNDED 1891

Understanding the Data Set

- An institution's capacity to accommodate future instruction is measured in weekly student clock hours (WSCH). One WSCH equals one student occupying one station for one hour.
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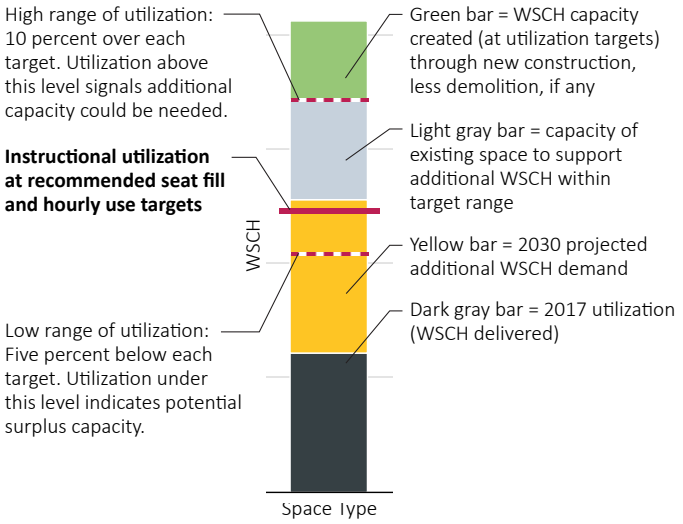
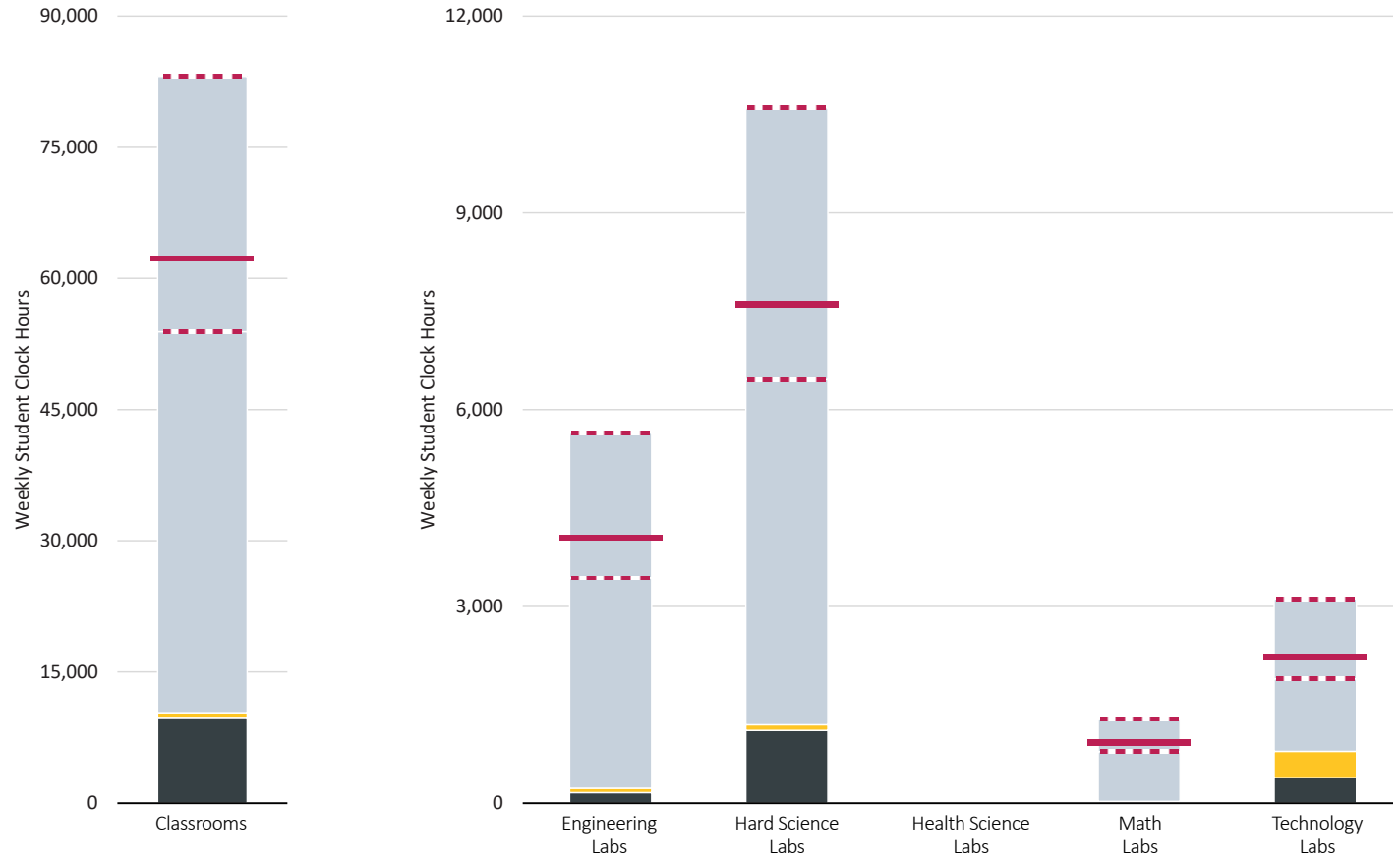
- Graduate programs are evaluated separately. The effect of their growth on instructional demand is included later in this report.
- Future lab demand is based on the assumption that fall 2017 courses were scheduled in the labs best suited to deliver the required instruction.

Understanding the Results



Utilization, Capacity, and Projections



Space Implications of Enrollment Growth
Undergraduate

ECSU
ELIZABETH CITY STATE UNIVERSITY
FOUNDED 1891

Understanding the Data Set

- Projections were made for classrooms, class labs, and office space only. Station sizes conform to UNC System standards.

Instructional Space	Station Size (ASF)
Classrooms	22
Engineering	108
Hard Science	70
Health Science	70
Math	33
Technology	50

Offices	Station Size (ASF)
Faculty	190
Staff (blended size)	140
Graduate Student	95

- If the projected 2030 instructional demand for an individual lab exceeded target capacity, a space need for an additional lab of the same type was generated. If a lab was not scheduled in 2017 or is projected to be underutilized in 2030, it could potentially offset future space demand.
- For each university, the 2018 STEM student:faculty and STEM faculty:staff ratios were maintained within System parameters. Since reliable data for current faculty and staff office space is not available, projections reflect the space needed for additional 2030 STEM faculty and staff only.
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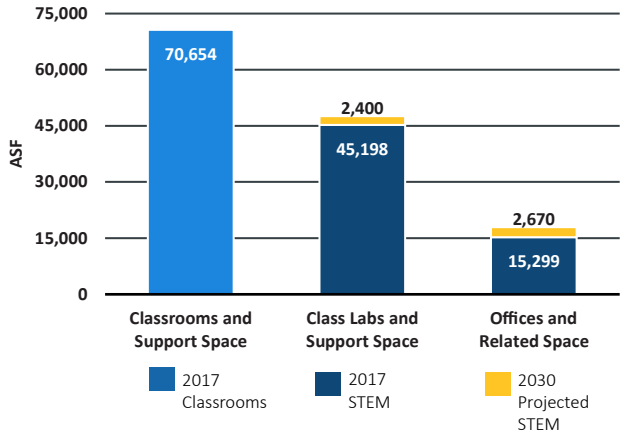
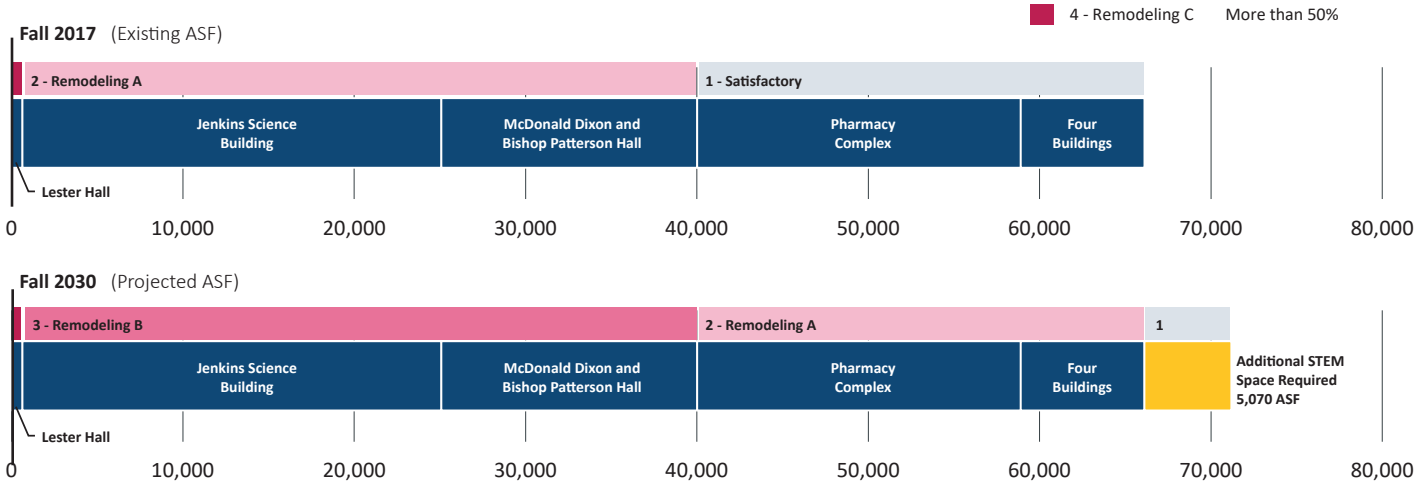
Academic Space by Category



Potential Space Offsets

	2017 Number of Labs		2030 Number of Labs	
	Labs (Inventory)	Labs Not Scheduled	Total Labs Needed	Underutilized Labs
Engineering	11	5	11	6
Hard Science	27	18	27	9
Health Science				
Math	2		2	2
Technology	5	4	6	
Total	45	27	46	17

STEM Academic Space by Building



Space Implications of Enrollment Growth
Graduate

ECSU
ELIZABETH CITY STATE UNIVERSITY
FOUNDED 1891

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- Graduate enrollment growth rates in this report were established using historical enrollment patterns and UNC System guidance. Graduate programs were not included in the MGT analysis.
- Without knowledge of specific graduate program curricula, it is assumed that all graduate students use on-campus space every semester.
- Projected 2030 instructional space demand for graduate students was layered on top of undergraduate demand. If the sum of 2030 undergraduate and graduate instruction would cause classrooms or labs to exceed target capacity, a space need for an additional room of the same type was generated.

Graduate Students by Category

Headcount

STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering				
Hard Science	9	10	*1*	*0.9%*
Health Science				
Math	11	15	*4*	*2.6%*
Technology				
Total	**20**	**25**	***5***	***1.9%***

Instruction by Course Level

STEM Category		WSCH 2017	WSCH 2030	*Annual Percent Change*
Engineering	Undergraduate	757	1,078	*3.0%*
	Graduate			
Subtotal		***757***	***1,078***	***3.0%***
Hard Science	Undergraduate	2,693	2,915	*0.7%*
	Graduate	112	128	*1.1%*
Subtotal		***2,805***	***3,043***	***0.7%***
Health Science	Undergraduate	136	137	
	Graduate			
Subtotal		***136***	***137***	***0.1%***
Math	Undergraduate	1,211	1,368	*1.0%*
	Graduate	40	48	*1.6%*
Subtotal		***1,251***	***1,416***	***1.0%***
Technology	Undergraduate	441	901	*6.1%*
	Graduate			
Subtotal		***441***	***901***	***6.1%***
Total STEM		**5,389**	**6,576**	***1.7%***

Space Implications

Classrooms

No additional classrooms will be required to accommodate projected STEM graduate enrollment growth in 2030.

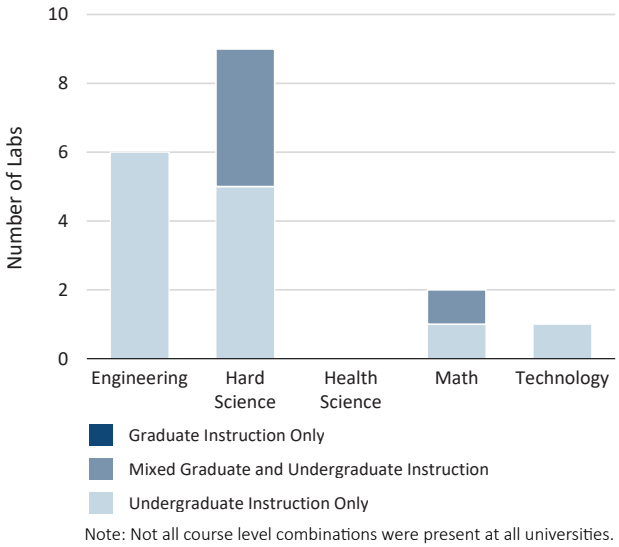
Class Labs

Most labs were used exclusively for undergraduate instruction in fall 2017. Five labs at ECSU were scheduled for both undergraduate and graduate instruction. The additional lab space recommended to accommodate STEM undergraduate enrollment growth will likely satisfy the space needs of future STEM graduate students as well.

Offices

If enrollment projections are met, 475 ASF of additional graduate office space should be allocated to STEM to accommodate five additional graduate students.

2017 Use of Scheduled Labs by Course Level



Note: Not all course level combinations were present at all universities.

University Summary

Space Utilization Opportunities

Classrooms

- Based on schedule data, the University's existing classrooms can accommodate growth through 2030.
- There may be opportunities to repurpose classrooms to meet the projected need for additional STEM space.
- There were 27 classrooms for which no scheduled use was reported:
  - Dixon Hall (one classroom unscheduled)
  - Griffin (1)
  - ITC (4)
  - Jenkins (4)
  - Johnson (2)
  - Lester (2)
  - McLendon (1)
  - Pharmacy (7)
  - Vaughan (3)
  - Williams (2)
- If the unscheduled classrooms were, indeed, in use in fall 2017, the unreported utilization could decrease the University's apparent surplus of classroom capacity.
- There were 28 classrooms with station sizes smaller than 18 ASF per station. If station sizes in these rooms were increased to 22 square feet or larger, lecture capacity (WSCH) overall would be reduced.

Engineering Labs

Five of 11 Engineering labs did not have scheduled use in fall 2017. It is possible that the unscheduled labs are highly-specialized spaces that are infrequently scheduled; or, are used as open or research labs but were coded as class labs. None of the scheduled labs are expected to exceed target utilization in 2030. Two new aviation programs, in the planning stages in 2017, will require program-specific labs.

Hard Science Labs

In Jenkins Science Building and the Pharmacy Complex, 27 labs were coded as Hard Science class labs. Nine class labs were scheduled. Six labs in Jenkins and 12 labs in the Pharmacy Complex had no instruction reported. If the unscheduled labs were in use in fall 2017, the unreported utilization could decrease the University's apparent surplus of Hard Science class lab capacity.

Math and Technology Labs

Wilkins 106 was scheduled for both Math and Computer Science courses. It is expected to exceed target utilization by 2030. An additional lab is recommended.

Two Math labs were coded as instructional labs, but were lightly scheduled in fall 2017. They have sufficient capacity to accommodate projected demand.

Next Steps

Data Accuracy

Information presented in this report is based, in part, on standard data submitted annually by individual universities to the UNC System. Inaccuracies in reported data could affect these results. Where possible, inconsistencies were identified, confirmed with the System, and corrected. However, room-by-room auditing of space data was beyond the scope of this study.

If the University believes a conclusion was drawn in error, the related data should be corrected by the university before its next submission to the System to ensure the validity of future studies.

Maximize Utilization at Pressure Points

Underutilized classrooms provide an opportunity to repurpose space to create additional labs and offices. However, the underutilized classrooms at the University may not be in the right configurations and locations to offset future STEM space needs.

As enrollment grows, the University may need additional lab space before funding is available to build or renovate. The University should plan strategically to identify enrollment thresholds that, when met, prompt actions such as scheduling evening lab courses, increasing target seat utilization in labs (within safe limits), and/or sharing lab space among disciplines (where pedagogically feasible).

Supplemental Information from the University

University comments can be found in Appendix C.

UNIVERSITY of NORTH CAROLINA WILMINGTON

University Analysis

Purpose of this Study

In March 2019 the UNC System commissioned a *Systemwide STEM Program Needs Assessment,* which was prepared by MGT Consulting Group. This report, the *Systemwide STEM Capital Planning Study,* builds upon MGT's work and provides a projection of the physical space required to accommodate future STEM enrollment. The UNC System will use this capital planning study to guide the development of a systemwide STEM capital improvement plan.

By 2030, UNC Wilmington is expected to gain nearly 2,500 additional upper division undergraduate STEM majors. Over half of these additional students will be health science majors; nearly a quarter will be hard science majors. The analysis on the following pages can help the university fine tune its space utilization and prepare campus facilities to accommodate STEM growth.

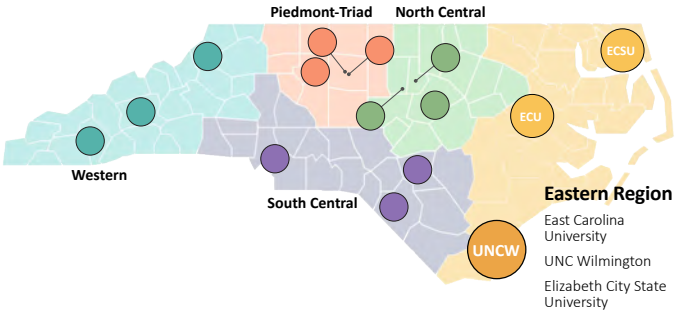
STEM Categories

MGT's study divided STEM majors into five categories: engineering, hard science, health science, math, and technology. In this study, physical space is sorted into the same five categories.

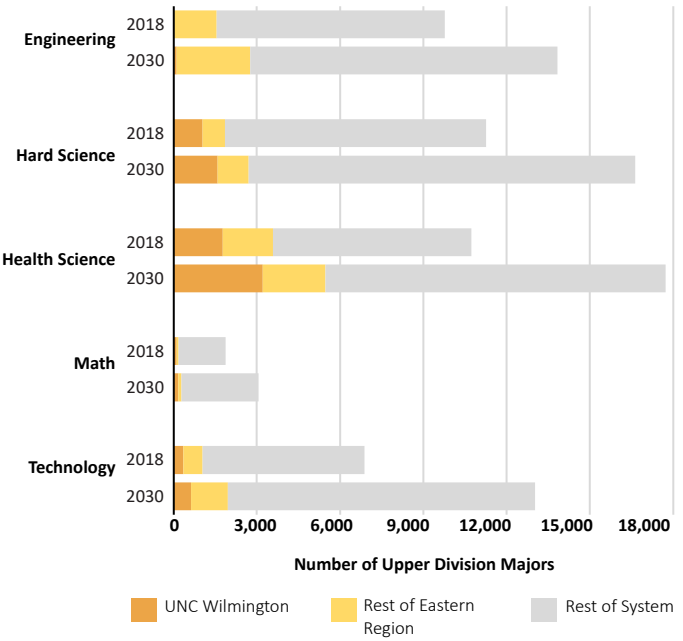
- Engineering space is dedicated to a broad range of engineering subjects, including hands-on technical instruction related to engineering programs.
- Hard science space houses lab-based sciences such as biology, chemistry, physics, geology, and anatomy and physiology. Social sciences are excluded.
- Health science space is dedicated to clinically-oriented, non-research health professions such as nursing and occupational therapy.
- Math space supports all math instruction.
- Technology space accommodates instruction in computer science and data analytics.

Most, but not all, fall 2017 instruction in designated STEM spaces was in STEM subjects. All instruction delivered in STEM spaces counted toward STEM weekly space utilization.

UNC System Regional Map



UNC Wilmington STEM Majors



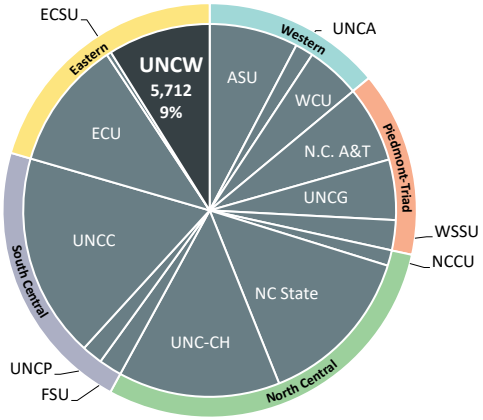
Undergraduate Enrollment

UNIVERSITY of NORTH CAROLINA WILMINGTON

Understanding the Data Set

- MGT's enrollment analyses projected 2018 to 2028 enrollment growth of upper division majors only. JMZ extrapolated to 2030 using the MGT enrollment growth rate for the 2023-2028 period with some minor adjustments from the UNC System.
- While lower division and graduate STEM students were not included in MGT's enrollment projections, space needs associated with STEM growth of these groups are accounted for in this study.

Systemwide 2030 STEM Upper Division Enrollment



Eastern Region STEM Enrollment Outlook

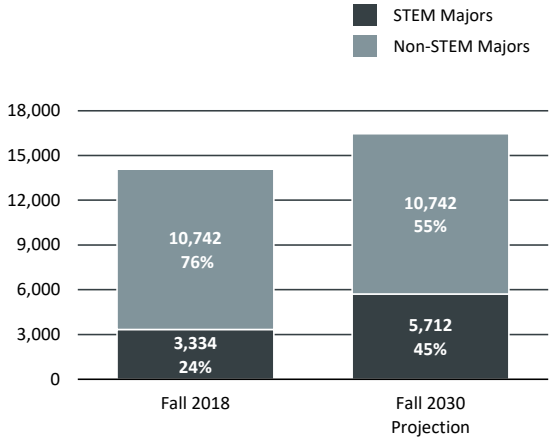
MGT considered industry growth, expected population change, and individual universities' enrollment targets in its enrollment analysis.

Population overall in the Eastern Region is projected to increase by eight percent between 2020 and 2030. The number of the region's traditional college-age residents (age 18 to 24) is expected to grow faster than the population as a whole at eleven percent over the decade.

There is high demand for nurses statewide. The Eastern Region also offers opportunities in other health professions and engineering fields. Engineering programs in the Eastern Region are expected to add over 1,200 majors by 2030, more than any other region in the state.

UNCW Upper Division STEM Majors

Headcount



UNC Wilmington STEM Highlights

(Source: Appendix E of the MGT Report)

- The university is actively advancing its research activities and has earned Doctoral University designation in the Carnegie Classification.
- Veterans Hall is being constructed to house many health sciences programs as well as community health service and outreach programs.

UNCW Upper Division STEM Majors by Category

Headcount

STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering		112	*112*	
Hard Science	1,064	1,584	*520*	*3.4%*
Health Science	1,802	3,215	*1,413*	*4.9%*
Math	111	169	*58*	*3.6%*
Technology	357	632	*275*	*4.9%*
Total	**3,334**	**5,712**	***2,378***	***4.6%***

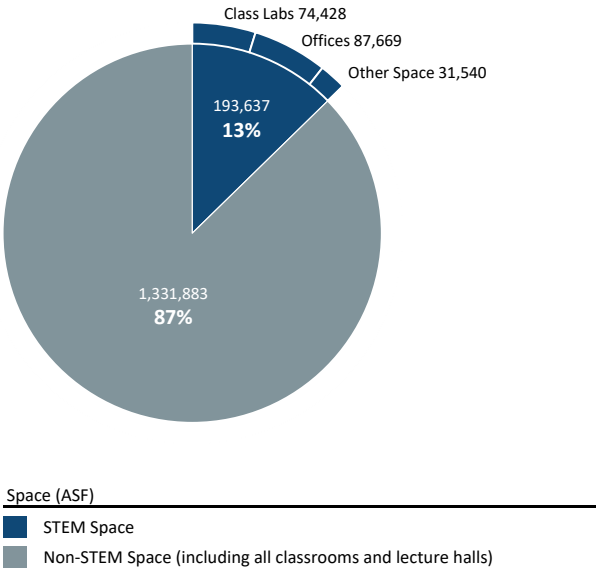
2017 Space Allocation

UNIVERSITY of NORTH CAROLINA WILMINGTON

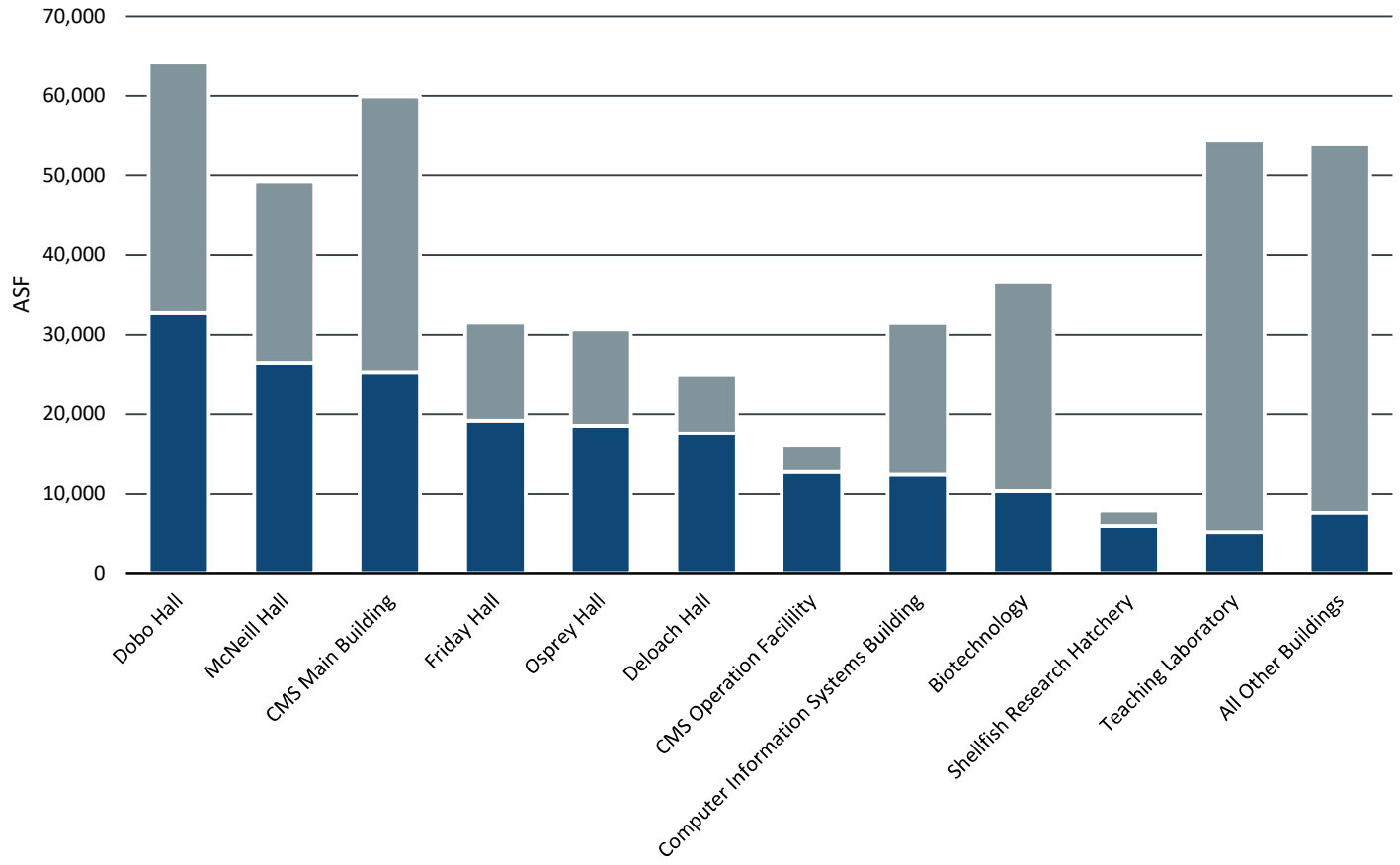
Understanding the Data Set

- Space allocation is based on 2017 UNC System data, self-reported by each university.
- Only buildings where space is allocated to STEM programs are included in this study.
- Space prorated for any amount of STEM is captured as 100 percent STEM since it is capable of supporting STEM education.
- General use classrooms are not counted as STEM-dedicated space. See Appendix B for a list of UNC System category codes considered STEM.
- The study does not include research or related space. However, the instructional spaces in the study may support research activities during unscheduled hours.
- Program space is quantified in assignable square feet (ASF).

STEM Space Summary



2017 STEM Academic Space by Building



Instructional Space Utilization

UNCW
UNIVERSITY of NORTH CAROLINA WILMINGTON

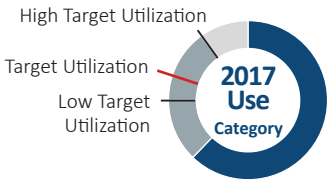
Understanding the Data Set

- Instructional space utilization is based on the fall 2017 course schedule (the most recent, fully vetted course schedule available at the time of this study).
- The study considered daytime room use in a 45-hour week based on the target criteria below from the Association for Learning Environments.
- While the study targets are ideal, a utilization range of five percent below or 10 percent above each target is considered reasonable.
- In a dedicated STEM space, all instruction delivered in that space was counted toward its fall 2017 utilization, including non-STEM courses.

Space Utilization Targets

	Seat Fill			Hours Used		
Space Type	Low	**Target**	High	Low	**Target**	High
Classrooms	62%	**67%**	77%	29	**31**	35
Class Labs	75%	**80%**	90%	19	**21**	26

Understanding the Results



Darkest tone: Fall 2017 space use (hourly or seat fill)

Middle tone: Remaining capacity within target range

Lightest tone: Remaining capacity above target range; use at this level is not expected

Utilization Summary

Classrooms

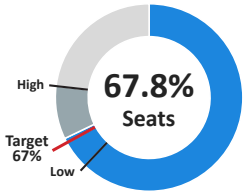
Classrooms met the seat fill target of 67 percent and nearly met the low hourly target of 29 hours per week.

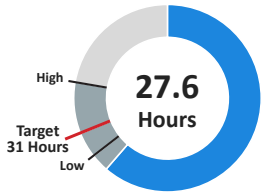
Class Labs

- Hard Science and Math labs reached the seat fill target range. Health Science and Technology labs did not reach the low target seat fill of 75 percent.
- Math labs exceeded the hourly use target range. No other labs met the hourly target range.

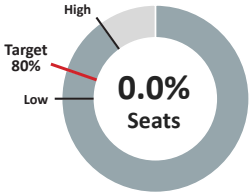
2017 Weekly Utilization - Seats and Hours

Classrooms

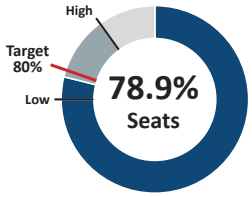




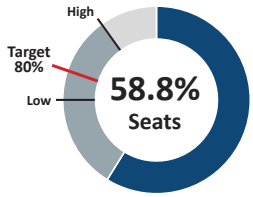
Engineering Labs



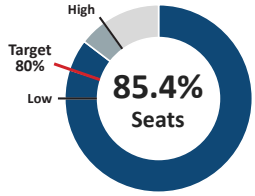
Hard Science Labs



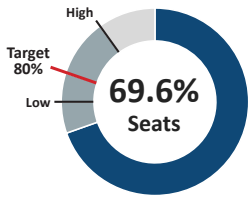
Health Science Labs

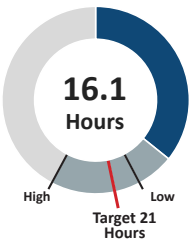


Math Labs



Technology Labs





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UNIVERSITY of NORTH CAROLINA WILMINGTON

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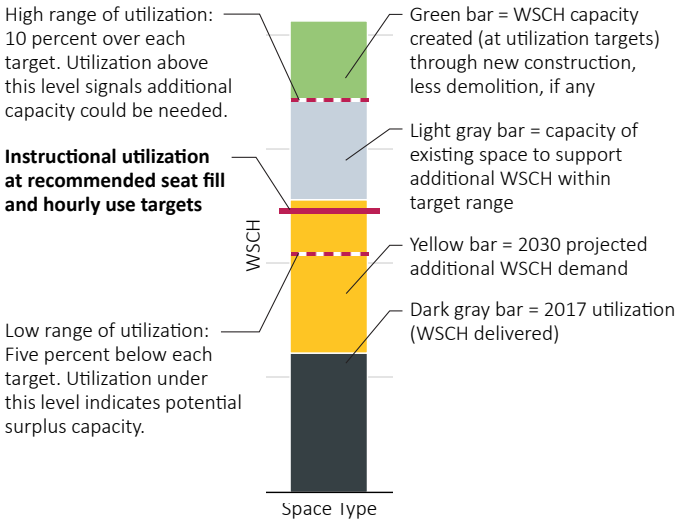
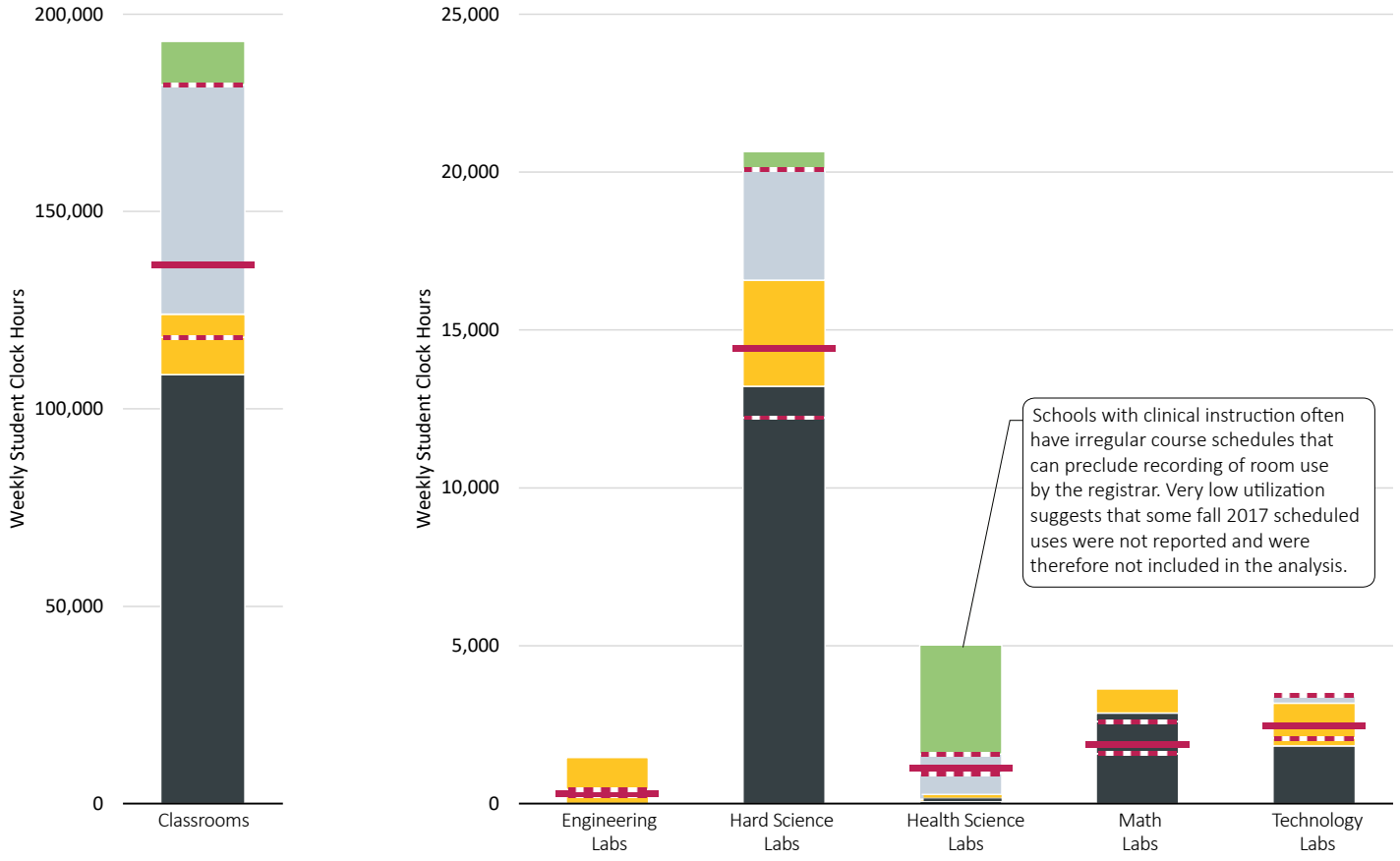


2017 Utilization and 2030 Projections



Space Implications of Enrollment Growth
Undergraduate

UNIVERSITY of NORTH CAROLINA WILMINGTON

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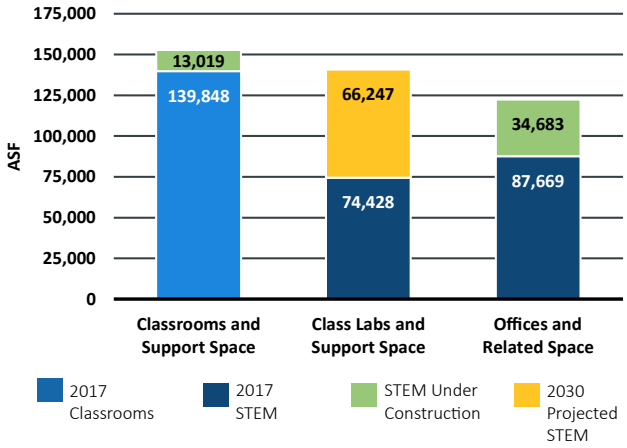
- For each university, the 2018 STEM student:faculty and STEM faculty:staff ratios were maintained within System parameters. Since reliable data for current faculty and staff office space is not available, projections reflect the space needed for additional 2030 STEM faculty and staff only.
- The 2017 building condition codes were self-reported by each university to the UNC System. Building conditions were downgraded by one level in 2030 to reflect the presumed deterioration of structures if no substantial facilities improvements occur. None were reduced to demolition status.

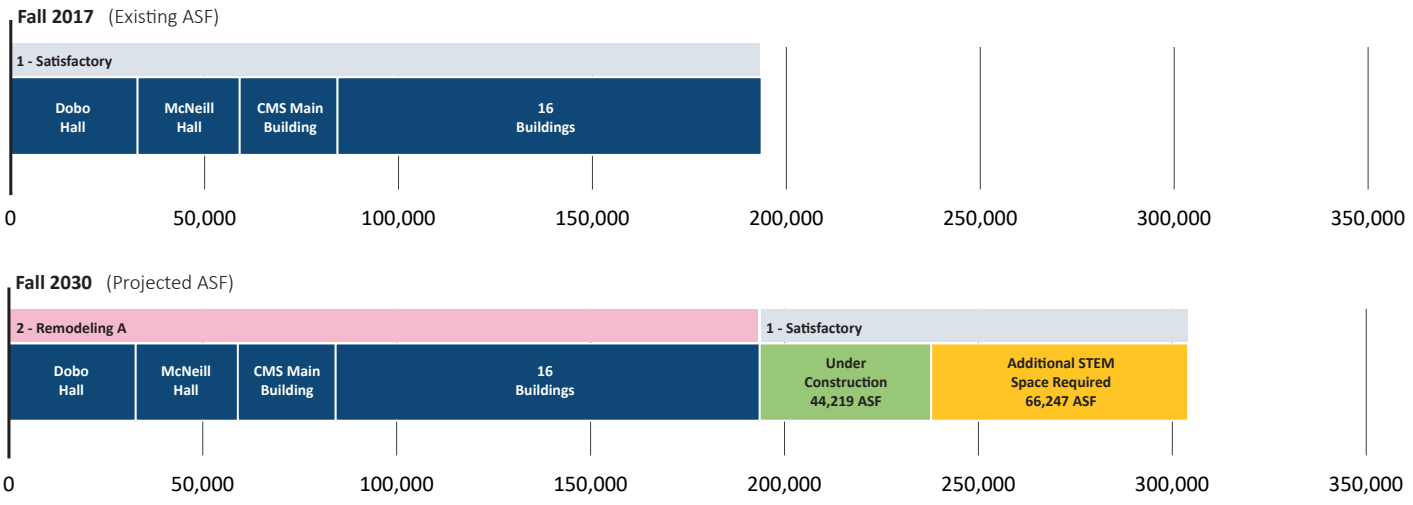
Academic Space by Category



Potential Space Offsets

	2017 Number of Labs		2030 Number of Labs	
	Labs (Inventory)	Labs Not Scheduled	Total Labs Needed	Underutilized Labs
Engineering	1	1	1	
Hard Science	39	4	67	19
Health Science	5	4	5	1
Math	4		10	
Technology	5	2	8	
Total	54	11	91	20

STEM Academic Space by Building



Space Implications of Enrollment Growth
Graduate

UNIVERSITY of NORTH CAROLINA WILMINGTON

Understanding the Data Set

- Graduate enrollment growth rates in this report were established using historical enrollment patterns and UNC System guidance. Graduate programs were not included in the MGT analysis.
- Without knowledge of specific graduate program curricula, it is assumed that all graduate students use on-campus space every semester.
- Projected 2030 instructional space demand for graduate students was layered on top of undergraduate demand. If the sum of 2030 undergraduate and graduate instruction would cause classrooms or labs to exceed target capacity, a space need for an additional room of the same type was generated.

Graduate Students by Category

Headcount

STEM Category	2018	2030 Projection	*Difference*	*Annual Percent Change*
Engineering				
Hard Science	239	316	*77*	*2.4%*
Health Science	512	765	*253*	*3.4%*
Math	23	31	*8*	*2.5%*
Technology	114	169	*55*	*3.3%*
Total	**888**	**1,281**	***393***	***3.1%***

Undergraduate and Graduate Instruction

STEM Category		WSCH 2017	WSCH 2030	*Annual Percent Change*
Engineering	Undergraduate		1,456	
	Graduate			
Subtotal			***1,456***	
Hard Science	Undergraduate	37,260	47,027	*2.0%*
	Graduate	963	1,293	*2.5%*
Subtotal		***38,223***	***48,319***	***2.0%***
Health Science	Undergraduate	8,782	15,915	*5.1%*
	Graduate	15	20	*2.5%*
Subtotal		***8,797***	***15,935***	***5.1%***
Math	Undergraduate	8,838	10,845	*1.7%*
	Graduate	198	271	*2.7%*
Subtotal		***9,036***	***11,116***	***1.7%***
Technology	Undergraduate	7,606	13,656	*5.0%*
	Graduate	477	731	*3.6%*
Subtotal		***8,083***	***14,387***	***4.9%***
Total STEM		**64,138**	**91,213**	***3.0%***

Space Implications

Classrooms

No additional classrooms will be required to accommodate projected STEM graduate enrollment growth in 2030.

Class Labs

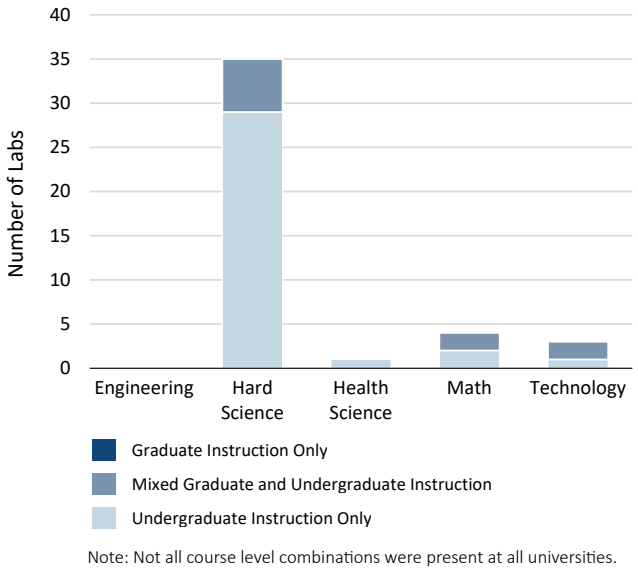
Most labs were used exclusively for undergraduate instruction in fall 2017. Ten labs housed both graduate and undergraduate instruction. The additional lab space recommended to serve future STEM undergraduate enrollment will likely satisfy the space needs of future STEM graduate students as well.

King Hall room 201 was coded as an Engineering lab in the space inventory, yet it was not scheduled.

Offices

If enrollment projections are met, 37,335 ASF of additional graduate office space should be allocated to STEM to accommodate 393 additional graduate students.

2017 Use of Scheduled Labs by Course Level



Note: Not all course level combinations were present at all universities.

University Summary

Space Utilization Opportunities

Classrooms

- Of the University's 146 classrooms, 142 classrooms were scheduled in fall 2017. Education Building 387, King Hall 202, King Hall 203, and McNeill Hall 2058 were not scheduled.
- There were 21 classrooms with station sizes smaller than 18 square feet. If stations in these rooms were right-sized to 22 square feet or larger, lecture capacity (WSCH) overall would be reduced.
- If enrollment surges, UNC Wilmington could increase seat fill targets to 80 percent in its 59 classrooms that have station sizes greater than 22 square feet.

Engineering Labs

One room, King Hall room 201, was coded as an Engineering Lab. It was not scheduled in fall 2017. Instructional demand for the University's planned Coastal Engineering program was recorded in alignment with projected enrollment growth. Instructional space will be required for this program, however, a detailed projection of its space needs was beyond the scope of this project.

Hard Science Labs

In 2017, 35 out of 39 Hard Science class labs were scheduled. In Dobo Hall, three Biology labs (rooms 116, 117, 120) and one Chemistry lab (room 121F) were not scheduled. By 2030, additional instructional capacity equivalent to 28 labs will be required to accommodate Hard Science instruction if enrollment projections are met. The capacity need can be addressed multiple ways:

- Repurpose existing unscheduled or underutilized space within Hard Science disciplines or campus-wide.
- Maximize utilization in existing Hard Science space. Schedule data shows that 19 labs may not reach recommended utilization targets in 2030. These labs could be candidates to meet future needs through sharing or reassignment of space.
- Construct new labs in an addition or new building if the previous options cannot be employed.

Health Science Labs

One of the five Health Science labs in McNeill Hall had reported use in fall 2017. Construction of additional Health Science labs was underway at the time of this analysis. No additional lab space need is projected for 2030.

Math Labs

All of the University's four Math labs were scheduled. Six additional labs are recommended to accommodate STEM growth.

Technology Labs

Four of the University's five Technology labs were scheduled in fall 2017. All four scheduled labs exceeded target instructional capacity in 2017. Six additional Technology labs will be needed by 2030 if enrollment projections are met.

University Summary

Next Steps

Data Accuracy

Information presented in this report is based, in part, on standard data submitted annually by individual universities to the UNC System. Inaccuracies in reported data could affect these results. Where possible, inconsistencies were identified, confirmed with the System, and corrected. However, room-by-room auditing of space data was beyond the scope of this study.

If the University believes a conclusion was drawn in error, the related data should be corrected by the university before its next submission to the System to ensure the validity of future studies.

Maximize Utilization at Pressure Points

Underutilized classrooms provide an opportunity to repurpose space to create additional labs and offices. However, if STEM enrollment projections are met, the University could approach target utilization within many of its existing classrooms. This may allow certain underutilized classrooms to be repurposed, yet may not yield sufficient surplus space to offset future STEM space needs.

As enrollment grows, the University may need additional STEM lab space before funding is available to build or renovate. The University should plan strategically to identify enrollment thresholds that, when met, prompt actions such as scheduling evening lab courses, increasing target seat utilization in labs (within safe limits), and/or sharing lab space among disciplines (where pedagogically feasible).

Supplemental Information from the University

University comments can be found in Appendix C.

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Appendix A

Enrollment Projections by Region, University, and STEM Category

Appendix A - Undergraduate Enrollment Projections by Region, University, and STEM Category

Region	University	STEM Category	Undergraduate Enrollment 2018	Undergraduate Enrollment 2030	*Difference*	*Annual Percent Change*	*12-Year Percent Change*
Western	Appalachian State University	Engineering	144	200	*56*	*2.8%*	*38.9%*
		Hard Science	1,015	1,504	*489*	*3.3%*	*48.2%*
		Health Science	1,234	1,707	*473*	*2.7%*	*38.3%*
		Math	281	527	*246*	*5.4%*	*87.5%*
		Technology	426	1,008	*582*	*7.4%*	*136.6%*
	Appalachian State University Subtotal		**3,100**	**4,946**	***1,846***	***4.0%***	***59.5%***
	UNC Asheville	Engineering	105	272	*167*	*8.3%*	*159.0%*
		Hard Science	368	450	*82*	*1.7%*	*22.3%*
		Health Science	98	122	*24*	*1.8%*	*24.5%*
		Math	51	57	*6*	*0.9%*	*11.8%*
		Technology	90	112	*22*	*1.8%*	*24.4%*
	UNC Asheville Subtotal		**712**	**1,013**	***301***	***3.0%***	***42.3%***
	Western Carolina University	Engineering	435	859	*424*	*5.8%*	*97.5%*
		Hard Science	467	614	*147*	*2.3%*	*31.5%*
		Health Science	872	1,280	*408*	*3.3%*	*46.8%*
		Math	64	97	*33*	*3.5%*	*51.6%*
		Technology	111	166	*55*	*3.4%*	*49.5%*
	Western Carolina University Subtotal		**1,949**	**3,016**	***1,067***	***3.7%***	***54.7%***
	Western Region Subtotal		**5,761**	**8,975**	**3,214**	***3.8%***	***55.8%***
Piedmont-Triad	North Carolina A&T	Engineering	961	1,640	*679*	*4.6%*	*70.7%*
		Hard Science	251	408	*157*	*4.1%*	*62.5%*
		Health Science	462	1,053	*591*	*7.1%*	*127.9%*
		Math	47	82	*35*	*4.7%*	*74.5%*
		Technology	595	1,088	*493*	*5.2%*	*82.9%*
	North Carolina A&T Subtotal		**2,316**	**4,271**	***1,955***	***5.2%***	***84.4%***
	UNC Greensboro	Engineering					
		Hard Science	862	1,385	*523*	*4.0%*	*60.7%*
		Health Science	647	919	*272*	*3.0%*	*42.0%*
		Math	67	81	*14*	*1.6%*	*20.9%*
		Technology	532	975	*443*	*5.2%*	*83.3%*
	UNC Greensboro Subtotal		**2,108**	**3,360**	***1,252***	***4.0%***	***59.4%***
	Winston-Salem State University	Engineering					
		Hard Science	151	269	*118*	*4.9%*	*78.1%*
		Health Science	997	1,278	*281*	*2.1%*	*28.2%*
		Math	5	9	*4*	*5.0%*	*80.0%*
		Technology	87	123	*36*	*2.9%*	*41.4%*
	Winston-Salem State University Subtotal		**1,240**	**1,679**	***439***	***2.6%***	***35.4%***
	Piedmont-Triad Region Subtotal		**5,664**	**9,310**	**3,646**	***4.2%***	***64.4%***
North Central	North Carolina Central University	Engineering					
		Hard Science	278	368	*90*	*2.4%*	*32.2%*
		Health Science	230	297	*67*	*2.2%*	*29.3%*
		Math	15	41	*26*	*8.8%*	*173.7%*
		Technology	56	162	*106*	*9.3%*	*190.0%*
	North Carolina Central University Subtotal		**579**	**869**	***290***	***3.4%***	***50.0%***
	North Carolina State University	Engineering	4,330	5,409	*1,079*	*1.9%*	*24.9%*
		Hard Science	1,862	2,297	*435*	*1.8%*	*23.4%*
		Health Science					
		Math	334	431	*97*	*2.1%*	*29.0%*
		Technology	631	944	*313*	*3.4%*	*49.6%*
	North Carolina State University Subtotal		**7,157**	**9,081**	***1,924***	***2.0%***	***26.9%***
	UNC Chapel Hill	Engineering	174	174		*0.0%*	*0.0%*
		Hard Science	2,238	3,720	*1,482*	*4.3%*	*66.2%*
		Health Science	596	900	*304*	*3.5%*	*51.0%*
		Math	478	882	*404*	*5.2%*	*84.6%*
		Technology	1,668	3,344	*1,676*	*6.0%*	*100.5%*
	UNC Chapel Hill Subtotal		**5,154**	**9,020**	***3,866***	***4.8%***	***75.0%***
	North Central Region Subtotal		**12,890**	**18,970**	**6,080**	***3.3%***	***47.2%***

Note: Rounding may affect totals.

Appendix A - Undergraduate Enrollment Projections by Region, University, and STEM Category

Region	University	STEM Category	Undergraduate Enrollment 2018	Undergraduate Enrollment 2030	*Difference*	*Annual Percent Change*	*12-Year Percent Change*
South Central	Fayetteville State University	Engineering					
		Hard Science	257	325	*68*	*2.0%*	*26.5%*
		Health Science	471	791	*320*	*4.4%*	*67.9%*
		Math	26	34	*8*	*2.3%*	*30.8%*
		Technology	96	143	*47*	*3.4%*	*49.0%*
	Fayetteville State University Subtotal		**850**	**1,293**	***443***	***3.6%***	***52.1%***
	UNC Charlotte	Engineering	2,078	2,512	*434*	*1.6%*	*20.9%*
		Hard Science	1,244	1,812	*568*	*3.2%*	*45.7%*
		Health Science	1,412	3,730	*2,318*	*8.4%*	*164.2%*
		Math	317	509	*192*	*4.0%*	*60.6%*
		Technology	1,454	2,819	*1,365*	*5.7%*	*93.9%*
	UNC Charlotte Subtotal		**6,505**	**11,383**	***4,878***	***4.8%***	***75.0%***
	UNC Pembroke	Engineering					
		Hard Science	416	772	*356*	*5.3%*	*85.6%*
		Health Science	123	183	*60*	*3.4%*	*48.8%*
		Math	9	33	*24*	*11.4%*	*266.7%*
		Technology	93	175	*82*	*5.4%*	*88.2%*
	UNC Pembroke Subtotal		**641**	**1,163**	***522***	***5.1%***	***81.4%***
	South Central Region Subtotal		**7,996**	**13,839**	**5,843**	***4.7%***	***73.1%***
East	East Carolina University	Engineering	1,532	2,619	*1,087*	*4.6%*	*71.0%*
		Hard Science	708	1,012	*304*	*3.0%*	*42.9%*
		Health Science	1,810	2,256	*446*	*1.9%*	*24.6%*
		Math	62	97	*35*	*3.8%*	*56.5%*
		Technology	639	1,225	*586*	*5.6%*	*91.7%*
	East Carolina University Subtotal		**4,751**	**7,209**	***2,458***	***3.5%***	***51.7%***
	Elizabeth City State University	Engineering	20	29	*9*	*3.0%*	*42.5%*
		Hard Science	95	116	*21*	*1.7%*	*21.8%*
		Health Science					
		Math	10	15	*5*	*3.7%*	*54.0%*
		Technology	51	104	*53*	*6.1%*	*104.6%*
	Elizabeth City State University Subtotal		**176**	**264**	***88***	***3.4%***	***50.0%***
	UNC Wilmington	Engineering		112	*112*		
		Hard Science	1,064	1,584	*520*	*3.4%*	*48.9%*
		Health Science	1,802	3,215	*1,413*	*4.9%*	*78.4%*
		Math	111	169	*58*	*3.6%*	*52.3%*
		Technology	357	632	*275*	*4.9%*	*77.0%*
	UNC Wilmington Subtotal		**3,334**	**5,712**	***2,378***	***4.6%***	***71.3%***
	East Region Subtotal		**8,261**	**13,185**	**4,924**	***4.0%***	***59.6%***
System Total	Systemwide STEM Category Total	Engineering	9,779	13,826	*4,047*	*2.9%*	*41.4%*
		Hard Science	11,276	16,636	*5,360*	*3.3%*	*47.5%*
		Health Science	10,754	17,731	*6,977*	*4.3%*	*64.9%*
		Math	1,877	3,065	*1,188*	*4.2%*	*63.3%*
		Technology	6,886	13,021	*6,135*	*5.5%*	*89.1%*
	Systemwide Total		**40,572**	**64,279**	**23,707**	***3.9%***	***58.4%***

Note: Rounding may affect totals.

Appendix A - Graduate Enrollment Projections by Region, University, and STEM Category

Region	University	STEM Category	Graduate Enrollment 2018	Graduate Enrollment 2030	Difference	Annual Percent Change	12-Year Percent Change
Western	Appalachian State University	Engineering	27	34	7	1.9%	25.9%
		Hard Science	77	100	23	2.2%	29.9%
		Health Science	165	205	40	1.8%	24.2%
		Math	15	23	8	3.6%	53.3%
		Technology	70	126	56	5.0%	80.0%
	Appalachian State University Subtotal		**354**	**488**	***134***	***2.7%***	***37.9%***
	UNC Asheville	Engineering	No Graduate Programs				
		Hard Science					
		Health Science					
		Math					
		Technology					
	UNC Asheville Subtotal						
	Western Carolina University	Engineering	75	119	44	3.9%	58.7%
		Hard Science	38	46	8	1.6%	21.1%
		Health Science	397	514	117	2.2%	29.5%
		Math					
		Technology					
	Western Carolina University Subtotal		**510**	**679**	***169***	***2.4%***	***33.1%***
	Western Region Subtotal		**864**	**1,167**	**303**	***2.5%***	***35.1%***
Piedmont-Triad	North Carolina A&T	Engineering	360	515	155	3.0%	43.1%
		Hard Science	97	135	38	2.8%	39.2%
		Health Science	53	93	40	4.8%	75.5%
		Math	15	22	7	3.2%	46.7%
		Technology	68	102	34	3.4%	50.0%
	North Carolina A&T Subtotal		**593**	**867**	***274***	***3.2%***	***46.2%***
	UNC Greensboro	Engineering					
		Hard Science	120	165	45	2.7%	37.5%
		Health Science	413	523	110	2.0%	26.6%
		Math	36	41	5	1.1%	13.9%
		Technology	87	131	44	3.5%	50.6%
	UNC Greensboro Subtotal		**656**	**860**	***204***	***2.3%***	***31.1%***
	Winston-Salem State University	Engineering					
		Hard Science					
		Health Science	367	434	67	1.4%	18.3%
		Math					
		Technology					
	Winston-Salem State University Subtotal		**367**	**434**	***67***	***1.4%***	***18.3%***
	Piedmont-Triad Region Subtotal		**1,616**	**2,161**	**545**	***2.5%***	***33.7%***
North Central	North Carolina Central University	Engineering					
		Hard Science	47	57	10	1.6%	21.3%
		Health Science	236	281	45	1.5%	19.1%
		Math	8	16	8	5.9%	100.0%
		Technology	75	155	80	6.2%	106.7%
	North Carolina Central University Subtotal		**366**	**509**	***143***	***2.8%***	***39.1%***
	North Carolina State University	Engineering	2,791	3,242	451	1.3%	16.2%
		Hard Science	1,005	1,156	151	1.2%	15.0%
		Health Science					
		Math	465	552	87	1.4%	18.7%
		Technology	717	941	224	2.3%	31.2%
	North Carolina State University Subtotal		**4,978**	**5,891**	***913***	***1.4%***	***18.3%***
	UNC Chapel Hill	Engineering	90	104	14	1.2%	15.6%
		Hard Science	976	1,369	393	2.9%	40.3%
		Health Science	316	414	98	2.3%	31.0%
		Math	87	131	44	3.5%	50.6%
		Technology	335	533	198	3.9%	59.1%
	UNC Chapel Hill Subtotal		**1,804**	**2,551**	***747***	***2.9%***	***41.4%***
	North Central Region Subtotal		**7,148**	**8,951**	**1,803**	***1.9%***	***25.2%***

Note: Rounding may affect totals.

Appendix A - Graduate Enrollment Projections by Region, University, and STEM Category

Region	University	STEM Category	Graduate Enrollment 2018	Graduate Enrollment 2030	*Difference*	*Annual Percent Change*	*12-Year Percent Change*
South Central	Fayetteville State University	Engineering					
		Hard Science					
		Health Science					
		Math					
		Technology	11	14	*3*	*2.0%*	*27.3%*
	Fayetteville State University Subtotal		**11**	**14**	***3***	***2.0%***	***27.3%***
	UNC Charlotte	Engineering	544	618	*74*	*1.1%*	*13.6%*
		Hard Science	259	334	*75*	*2.1%*	*29.0%*
		Health Science	509	984	*475*	*5.6%*	*93.3%*
		Math	165	227	*62*	*2.7%*	*37.6%*
		Technology	944	1,477	*533*	*3.8%*	*56.5%*
	UNC Charlotte Subtotal		**2,421**	**3,640**	***1,219***	***3.5%***	***50.4%***
	UNC Pembroke	Engineering					
		Hard Science					
		Health Science	22	26	*4*	*1.4%*	*18.2%*
		Math					
		Technology					
	UNC Pembroke Subtotal		**22**	**26**	***4***	***1.4%***	***18.2%***
	South Central Region Subtotal		**2,454**	**3,680**	**1,226**	***3.4%***	***50.0%***
East	East Carolina University	Engineering	104	149	*45*	*3.0%*	*43.3%*
		Hard Science	137	174	*37*	*2.0%*	*27.0%*
		Health Science	138	160	*22*	*1.2%*	*15.9%*
		Math	16	22	*6*	*2.7%*	*37.5%*
		Technology	298	463	*165*	*3.7%*	*55.4%*
	East Carolina University Subtotal		**693**	**968**	***275***	***2.8%***	***39.7%***
	Elizabeth City State University	Engineering					
		Hard Science	9	10	*1*	*0.9%*	*11.1%*
		Health Science					
		Math	11	15	*4*	*2.6%*	*36.4%*
		Technology					
	Elizabeth City State University Subtotal		**20**	**25**	***5***	***1.9%***	***25.0%***
	UNC Wilmington	Engineering			*0*		
		Hard Science	239	316	*77*	*2.4%*	*32.2%*
		Health Science	512	765	*253*	*3.4%*	*49.4%*
		Math	23	31	*8*	*2.5%*	*34.8%*
		Technology	114	169	*55*	*3.3%*	*48.2%*
	UNC Wilmington Subtotal		**888**	**1,281**	***393***	***3.1%***	***44.3%***
	East Region Subtotal		**1,601**	**2,274**	**673**	***3.0%***	***42.0%***
System Total	Systemwide STEM Category Total	Engineering	3,991	4,781	*790*	*1.5%*	*19.8%*
		Hard Science	3,004	3,862	*858*	*2.1%*	*28.6%*
		Health Science	3,128	4,399	*1,271*	*2.9%*	*40.6%*
		Math	841	1,080	*239*	*2.1%*	*28.4%*
		Technology	2,719	4,111	*1,392*	*3.5%*	*51.2%*
	Systemwide Total		**13,683**	**18,233**	**4,550**	***2.4%***	***33.3%***

Note: Rounding may affect totals.

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Appendix B

Spaces Classified as STEM by UNC Category Code

Instruction Classified as STEM by Subject

Appendix B - Spaces Classified as STEM by UNC Category Code

Source: 2017 Space Inventories (DAVE)

Spaces with these category codes were evaluated as STEM space.
Research space and residential space were excluded.

STEM CATEGORY	UNC SYSTEM CATEGORY CODE	CATEGORY NAME
ENGINEERING	0113	Food Science and Technology
	0116	Agriculture and Forestry Technology
	0198	Agricultural Science
	0588	Industrial & Engineering Management
	0704	Computer Programming
	0839	Industrial Arts, Vocational and Technical Education
	0900	ENGINEERING
	0901	Engineering, General
	0902	Aerospace, Aeronautical, and Astronautical Engineering
	0903	Agricultural Engineering
	0904	Architectural Engineering
	0905	Bioengineering and Biomedical Engineering
	0906	Chemical Engineering (includes Petroleum Refining)
	0907	Petroleum Engineering (excludes Petroleum Refining)
	0908	Civil Construction and Transportation Engineering
	0909	Electrical, Electronics, and Communications Engineering
	0910	Mechanical Engineering
	0911	Geographical Engineering
	0912	Geophysical Engineering
	0913	Industrial and Management Engineering
	0914	Metallurgical Engineering
	0915	Materials Engineering
	0916	Ceramic Engineering
	0917	Textile Engineering
	0918	Mining and Mineral Engineering
	0919	Engineering Physics
	0920	Nuclear Engineering
	0921	Engineering Mechanics
	0922	Environmental and Sanitary Engineering
	0923	Naval Architecture and Marine Engineering
	0924	Ocean Engineering
	0925	Engineering Technologies
	0992	Industrial Technology
	0995	Textile Technology
	0996	Biological and Agricultural Engineering
	0997	Paper Science
	1996	Textile Chemistry
	4904	Engineering and Other Disciplines

Appendix B - Spaces Classified as STEM by UNC Category Code

Source: 2017 Space Inventories (DAVE)

Spaces with these category codes were evaluated as STEM space.
Research space and residential space were excluded.

● Dot indicates the classification was added or has changed since the draft list was issued in February, 2020.

STEM CATEGORY		UNC SYSTEM CATEGORY CODE	CATEGORY NAME
HARD SCIENCE		0103	Soils Science (Management and Conservation
	●	0108	Horticulture (Fruit and Vegetable Production)
		0115	Natural Resources Management
		0400	BIOLOGICAL SCIENCES
		0401	Biology, General
		0402	Botany, General
		0403	Bacteriology
		0404	Plant Pathology
		0405	Plant Pharmacology
		0406	Plant Physiology
		0407	Zoology, General
		0408	Pathology, Human and Animal
		0409	Pharmacology, Human and Animal
		0410	Physiology, Human and Animal
		0411	Microbiology
		0412	Anatomy
		0413	Histology
		0414	Biochemistry
		0415	Biophysics
		0416	Molecular Biology
		0417	Cell Biology (Cytology, Cell Physiology)
		0418	Marine Biology
		0419	Biometrics and Biostatistics
		0420	Ecology
		0421	Entomology
		0422	Genetics
		0423	Radiobiology
		0425	Neurosciences
		0426	Toxicology
		0427	Embryology
		0494	Biotechnology
		0495	Biomathematics
		0497	Parasitology
		0834	Science Education (methodology and theory)
		1211	Pharmacy
	●	1217	Biomedical Communication
		1273	Pharmacy
		1287	Environmental Sciences and Engineering

Appendix B - Spaces Classified as STEM by UNC Category Code

Source: 2017 Space Inventories (DAVE)

Spaces with these category codes were evaluated as STEM space.
Research space and residential space were excluded.

STEM CATEGORY	UNC SYSTEM CATEGORY CODE	CATEGORY NAME
HARD SCIENCE	1900	PHYSICAL SCIENCES
	1901	Physical Science, General
	1902	Physics, General (excludes Biophysics)
	1903	Molecular Physics
	1904	Nuclear Physics
	1905	Chemistry, General (excludes Biochemistry)
	1906	Inorganic Chemistry
	1907	Organic Chemistry
	1908	Physical Chemistry
	1909	Analytical Chemistry
	1910	Pharmaceutical Chemistry
	1911	Astronomy
	1912	Astrophysics
	1913	Atmospheric Sciences and Meteorology
	1914	Geology
	1915	Geochemistry
	1916	Geophysics and Seismology
	1917	Earth Sciences, General
	1918	Paleontology
	1919	Oceanography
	1920	Metallurgy
	1992	Fermentation Sciences
	1993	Forensic Chemistry
	1994	Applied Sciences
	1995	Biological Chemistry
	1997	Fiber and Polymer Science
	1998	Applied Physics
	2006	Psychometrics
	2203	Archeology
	2206	Geography
	2216	Coastal Geography
	4902	Biological and Physical Sciences
	4974	Biomedical Physics
	4986	Nanotechnology
	4987	Biomedical Sciences and Math
	4988	Applied Science Technologies
	4990	Marine Sciences
	4996	Environmental Studies

Appendix B - Spaces Classified as STEM by UNC Category Code

Source: 2017 Space Inventories (DAVE)

Spaces with these category codes were evaluated as STEM space.
Research space and residential space were excluded.

- ● Dot indicates the classification was added or has changed since the draft list was issued in February, 2020.

STEM CATEGORY	UNC SYSTEM CATEGORY CODE	CATEGORY NAME
HEALTH SCIENCE	0424	Nutrition, Scientific (exclude Nutrition in Home Economics and Dietetics)
	0837	Health Education (includes family life education)
	0851	Athletic Training
	0852	Exercise Science
	0884	Therapeutic Recreation
	1200	HEALTH PROFESSIONS
	1201	Health Professions, General
	1202	Hospital and Health Care Administration
	1203	Nursing
	1204	Dentistry
	1205	Dental Specialties
	1207	Medical Specialties
	1208	Occupational Therapy
	1209	Optometry
	1212	Physical Therapy
	1213	Dental Hygiene
	1214	Public Health
	1215	Medical Record Librarianship
●	1218	Veterinary Medicine
	1220	Speech Pathology and Audiology
	1221	Chiropractic
	1223	Medical Laboratory Technologies
	1224	Dental Technologies
	1225	Radiologic Technologies
	1271	Physician Assistant
	1272	Music Therapy
	1285	Health Services Management
	1286	Pre-dental and Pre-medical
	1288	Health Administration
	1289	Health Education
	1290	Public Health Nursing
	1292	Dental Hygiene Education
	1293	Maternal and Child Health
	1295	Epidemiology
	1296	Health Care Management
	1298	Environmental Health
	1306	Foods and Nutrition (includes Dietetics)

Appendix B - Spaces Classified as STEM by UNC Category Code

Source: 2017 Space Inventories (DAVE)

Spaces with these category codes were evaluated as STEM space.
Research space and residential space were excluded.

STEM CATEGORY	UNC SYSTEM CATEGORY CODE	CATEGORY NAME
MATH	0503	Business Statistics
	0512	Insurance
	0597	Insurance and Real Estate
	0833	Mathematics Education (methodology and theory)
	1700	MATHEMATICS
	1701	Mathematic, General
	1702	Statistics, Mathematical and Theoretical
	1703	Applied Mathematics
	1798	Mathematical Science
	2007	Statistics in Psychology
TECHNOLOGY	0586	Management Information Systems
	0606	Mass Multimedia Arts and Sciences
	0701	Computer and Information Sciences, General
	0702	Information Sciences and Systems
	0703	Data Processing
	0705	Systems Analysis
	0706	Modeling, Virtual Environments, Simulation
	0838	Business, Commerce, and Distributive Education

Appendix B - Instruction Classified as STEM by Subject

Source: Fall 2017 Course Schedule

Courses in these subjects were evaluated as STEM instruction.

STEM CATEGORY	DEPARTMENT
ENGINEERING	Aerospace Studies
	Applied Engineering Technology
	Biological and Agricultural Engineering
	Biomedical Engineering
	Built Environment
	Chem, Biological &Bio Engineer
	Chemical Engineering
	Civil and Environmental Engr
	Civil Engineering
	Civl, Arch & Envir Engineering
	College of Engineering
	College of Engineering Deans Office
	Construction Management
	Electr & Computer Engineering
	Electrical and Computer Engineering
	Electrical and Computer Engr
	Energy & Environmental Systems
	Engineering
	Engineering Tech & Const Mgmt
	Fitts Dept Indust & Syst Engr
	Industrial & Systems Engineer
	Kimmel School of Construct Mgt
	Material Science
	Materials Engineering
	Mechanical and Aerospace Engineering
	Mechanical Engineering
	Nuclear Engineering
	School of Engineering and Tech
	Sustainable Development
	Sustainable Tech & Built Envir
	Systems Engr & Engr Management
	Technology and Aviation Sci
	Textile Engineering, Chemistry and Science

Appendix B - Instruction Classified as STEM by Subject

Source: Fall 2017 Course Schedule

Courses in these subjects were evaluated as STEM instruction.

- Dot indicates the classification was added or has changed since the draft list was issued in February, 2020.

STEM CATEGORY	DEPARTMENT	
HARD SCIENCE	● Anatomy and Cell Biology	Genetics
	Applied Ecology	● Genetics and Molecular Biology
	Applied Physical Sciences	Geography
	Astronomy	Geography and Earth Sciences
	Atmospheric Sciences	Geography and Geology
	Biochemistry	Geography and Planning
	● Biochemistry and Biophysics	Geography, Planning and Envir
	● Biochemistry and Molecular Bio	Geological & Environ Sciences
	Bioinformatics	Geological Sciences
	Biological & Biomedical Scienc	Geosciences & Nat Resource
	Biological Sciences	GR Interdisciplinary CRM
	Biology	● Horticultural Science
	Biology & Marine Biology	Interdisciplinary Studies-NEUR
	Biomanufacturing Training and Education Center	Marine Sciences
	● Biostatistics	Marine, Earth and Atmospheric Sciences
	Biotechnology Teaching	Math, Science and Inst Tech Ed-SCIE
	● Carolina Center for Genome Sciences	Mathematics and Physics-ENPH
	Chemistry	Mathematics and Physics-PHYS
	Chemistry & Biochemistry	Microbiology
	Chemistry and Physics	● Microbiology and Immunology
	College of Natural Resources-Cons Bio	Natural Resource & Env Design-INCLUDE
	College of Natural Resources-Fish & Wildlife	Natural Sciences
	Crop & Soil Science	Parks, Recr & Tourism Mgmt-GIS
	Crop and Soil Science	● Pathology and Lab Medicine
	Earth & Ocean Sciences	Pharmaceutical Sciences
	Entomology & Plant Pathology	● Pharmacology and Toxicology
	Environment, Ecology, and Energy	Pharmacy
	Environmental & Geographic Sci	Pharmacy and Hlth Professions
	Environmental and Sustainblty	Physics
	Environmental Sciences	Physics and Astronomy
	Environmental Sciences and Engineering	Physics and Optical Science
	Environmental Studies	Physics/Physical Oceanography
	● Epidemiology	Physiology
	Fermentation Sciences Program	Plant & Microbial Biology
	Food Bioprocessing and Nutrition Sciences-NCSTATE	● Teaching - Molecular Biomedical Sciences
	Forest Biomaterials	Toxicology
	Genetic Counseling	

Appendix B - Instruction Classified as STEM by Subject

Source: Fall 2017 Course Schedule

Courses in these subjects were evaluated as STEM instruction.

● Dot indicates the classification was added or has changed since the draft list was issued in February, 2020.

STEM CATEGORY	DEPARTMENT
HEALTH SCIENCE	Acct, Fin, Hthc Adm & Info Sys-HCM
	Addictions and Rehab Studies
	Allied Health Sciences
	Clinical Laboratory Science
	Clinical Laboratory Sciences
	● College of Veterinary Medicine Dean's Office
	Comm Science and Disord
	Communic Science & Disorders
	Communication Sci & Disorders
	Communication Sciences and Dis
	Community and Therapeutic Rec
	Dean-Health and Human Sciences
	● Dental Medicine
	Exercise and Sports Science
	Exercise Physiology
	Gerontology
	Health and Exercise Science
	Health and Human Performance
	● Health and Physical Education-HEALTH SCI
	Health and Wellness Promotion
	Health Behavior
	Health Education and Promotion
	Health Policy & Management
	Health Sciences
	Health Services
	● Health Services and Info Mgmt
	Healthcare Management
	Human Perf & Leisure Studies-HPED,LSS,SSFM
	Human Sciences-FOOD
	Kinesiology
	Kinesiology, Dept of
	● Maternal and Child Health
	● Medical School
	Nursing
	Nutrition
	Nutrition and Health Care Mana
	Nutrition Science
	Occupational Therapy
	Physical Therapy
	● Physician Assistant
	Public Health
	Public Health Education
	Public Health Sciences
	School Hlth & Appl Human Sci
	School Hlth & Appl Human Sci-ATR
	School Hlth & Appl Human Sci-CHHS
	School Hlth & Appl Human Sci-EXS
	School Hlth & Appl Human Sci-EXSL
	School Hlth & Appl Human Sci-GRN
	School Hlth & Appl Human Sci-HEA
	School Hlth & Appl Human Sci-PBH
	School Hlth & Appl Human Sci-RTH
	School of Nursing
	School of Teaching & Learning-HEAL,HPE
	● Teaching - Department of Clinical Sciences
	● Teaching - Population Health & Pathobiology
	● Teaching - Population Health and Pathobiology

Appendix B - Instruction Classified as STEM by Subject

Source: Fall 2017 Course Schedule

Courses in these subjects were evaluated as STEM instruction.

STEM CATEGORY	DEPARTMENT
MATH	Math and Computer Science-MATA
	Math and Computer Science-MATH
	Math and Computer Science-RS
	Math and Computer Science-STAT
	Math, Science and Inst Tech Ed-MATE
	Mathematical Sciences
	Mathematics
	Mathematics & Computer Science-MATH
	Mathematics & Computer Science-STAT
	Mathematics & Statistics
	Mathematics and Computer Scien-MATH
	Mathematics and Computer Sci-MATH
	Mathematics and Physics-MATH
	Mathematics and Statistics
	Science, Technology, Engineering, & Mathematics Ed-TECH
	Statistics
	Statistics and Operations Research

Appendix B - Instruction Classified as STEM by Subject

Source: Fall 2017 Course Schedule

Courses in these subjects were evaluated as STEM instruction.

STEM CATEGORY	DEPARTMENT
TECHNOLOGY	***InformationSys&OperMgmt***
	Acct, Fin, Hthc Adm & Info Sys-MIS
	Busines-COMP
	Business and Economics-BMIS
	Business-CIS
	Business-DSC
	College of Business-BPHD
	College of Business-DSBA
	Comp Info Sys & Supply Chain
	Computational Science & Eng
	Computer Science
	Computer Systems Technology
	Computing and Informatics
	Data Science
	Graphic Design Technology-GCS
	Info Sys and Supply Chn Mngmt
	Management Information Systems
	Management-MIS
	Marketing, Trans & Supply Chn
	Math and Computer Science-CSC
	Math, Science and Inst Tech Ed-TECH
	Mathematics & Computer Science-CS
	Mathematics & Computer Science-CSC
	Mathematics and Computer Scien-COMP
	Mathematics and Computer Sci-TECH
	Mktg and Supply Chain Mgmt
	New Media
	Operations Research
	Software and Info Systems
	Technology Systems

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Appendix C

Supplemental Information from the Universities

On February 10, 11, and 12, 2020, presentations were conducted with all 15 universities included in this study. Each university received their draft report for review in advance of their presentation. In late February 2020, the System Office sent each university their presentation along with report appendices A and B. Universities were encouraged to schedule follow-up meetings to further clarify and review the methodology used for the study. Seven universities participated in virtual meetings with the System Office and JMZ between April 27, 2020 and May 14, 2020.

By June 2020, all 15 universities had responded to a request from the System Office to submit additional information for the report. Some indicated that the February presentation, additional data, and/or follow-up meetings had sufficiently addressed their concerns. Others offered information that was not captured or was incorrect in their self-reported data, primarily surrounding building condition, space coding, and course scheduling. In some cases, universities provided details about initiatives or planned programs they felt could affect their future space needs.

This appendix summarizes the supplemental information provided by each university, with responses from JMZ where appropriate.

Appalachian State University

The University responded that the Levine Health Sciences Building has been completed and opened since 2017 and that its facilities were sized to accommodate projected growth in Health Science programs.

University of North Carolina at Asheville

The building referred to as Rhoades/Robinson in the study was previously reported to the System Office as one building with one building condition. It is actually three buildings that have different building conditions. The Robinson Hall portion of the building comprises more than half of the gross square footage of the complex and was not part of the recent comprehensive renovation of Rhoades Hall and Rhoades Tower. Robinson Hall houses multiple STEM departments and has significant building condition issues, portions of the building are not accessible, and many areas are no longer functionally suitable.

The University's focus on undergraduate research, lack of graduate student teaching assistants, and the related scheduling challenges for class labs makes achieving standard utilization targets particularly challenging.

Western Carolina University

The University responded that the report needed no further clarification.

North Carolina A&T State University

The University responded with the following concerns:

- The University was concerned about the use of the systemwide STEM study for the identification of additional STEM projects.
- The study drew from 2017 data that has since been identified by the university to have included some incorrect data.
- The study did not provide for data verification at the university level to eliminate inaccurate data.
- The MGT report includes NC A&T in the Piedmont Triad Region but the University considers their demographic and impact to be outside of the assigned region.
- The University was concerned over the CIP codes used in the MGT report to identify STEM majors.

Response: The system-level analysis utilized the same 2017 self-reported data for all universities and individual verification of all the data at each campus was not within the parameters of the systemwide study. A detailed university-specific facilities master plan would provide an opportunity for thorough investigation and data verification at the individual campus level. Information from the MGT report, including regional job growth, enrollment growth projections, and STEM majors, were completed independently of JMZ's report.

University of North Carolina at Greensboro

The University responded that the quantity of their instructional space may be sufficient to accommodate projected instructional demand, but the quality and configuration of that space may not support academic program requirements, safety, and security. Further study should be conducted to determine specific capital project needs.

Winston-Salem State University

WSSU currently shares space with Wake Forest University at Piedmont Triad Community Research Center (PTCRC). The Biomedical Research Infrastructure Center (BRIC) conducts original and innovative biomedical/behavioral research aimed at eliminating health disparities (as they relate to diabetes), HIV/AIDS, hypertension/cardiovascular disease, and sleep deprivation (as it relates to alcoholism and drug addiction). This mutually beneficial relationship affords WSSU access to quality lab space and Wake Forest uses some of WSSU's sophisticated lab equipment. The study was unable to capture Wake Forest's use of these spaces.

WSSU is considering relocating the Health Science Labs at the Enterprise Center to campus to improve them and make access easier for students.

WSSU hopes this report will demonstrate their STEM and research space needs, which align with their current institutional growth vision, but they do not want it to limit their ability to expand functionality or redirect their focus over the next decade.

The Center for Design Innovation (CDI) was established through a joint effort of WSSU, UNCSA, and Forsyth Tech. WSSU's Facilities team maintains the grounds and building, while UNCSA's Finance team maintains the operational budget. Two of the three studios in CDI are operated by WSSU researchers. Institutional leadership is currently developing plans to increase the amount of space used by WSSU.

The University also asked two questions following review of the draft report:

- WSSU: "How were the projections calculated to determine the space needs by 2030? Our three largest undergraduate programs are Biological Sciences, Health Sciences and Computational Science, so a stagnant percentage projected over 12 years from 2018 to 2030 is suspect."

  Response: All STEM categories at WSSU were projected, by MGT, to grow faster than two percent per year over the next decade. Hard Science enrollment is expected to grow nearly five percent per year and Technology enrollment is expected to grow nearly three percent per year. The University had new lab and office space under construction at the time of this analysis; 33,420 ASF of the new lab space offsets a portion of the calculated Hard Science lab needed for 2030.

  Most Technology instruction was delivered in classrooms in fall 2017, which caused the calculated Computational Science lab space demand to be small. However, unscheduled uses of the University's eight Technology labs could prompt a need for additional space by 2030. In addition, the University's existing Technology labs may require modernization if their configuration or condition does not support instruction.

- WSSU: "The projection that the University is only expected to grow by a few hundred students in a decade, mathematically and logically doesn't make sense. How was this determined and to what extent will the University's in-house predictive analytics be allowed to inform this?"

  Response: Appendices A and B detail the process by which MGT's enrollment projections for upper division STEM majors established growth rates that were applied to all STEM instruction and, subsequently, to space projections. Regarding the University's own predictive analysis, a detailed campus-level facilities master plan is recommended prior to any university embarking on a major building project. At that time, enrollment projections, program space needs, and space condition should be verified. Critical factors that were outside the scope of this study, such as specific University initiatives, space configuration, and space location, should be evaluated at that time.

North Carolina Central University

- The University expressed concern that an examination of STEM majors, such as the MGT study, would not reflect the instructional needs of non-STEM majors who take STEM courses.

  Response: JMZ accounted for all instruction in classrooms, STEM class labs, and STEM open labs, regardless of the students' majors or subjects of instruction. Future demand for STEM instruction was calculated as a factor of instruction delivered. All participants in Math instruction, for example, were included in the study regardless of their major. Appendices A and B detail the process by which MGT's enrollment projections for upper division STEM majors established growth rates that were applied to all STEM instruction and subsequently to space projections.

- The University reported that instructional space utilization for STEM courses and STEM spaces typically exceeds non-STEM utilization. Computer labs and IT-enabled classrooms were reportedly utilized near target capacity for every course meeting.

  Response: Because a classroom can be used by any discipline, the aggregate utilization of classroom space (STEM and non-STEM instruction) was evaluated. The fall 2017 classroom utilization and projected 2030 demand suggest there should be sufficient lecture capacity to repurpose some classrooms as computer labs or IT-enabled classrooms if needed. Accomplishing this may require changes to scheduling practices and instruction locations.

North Carolina State University

The University provided updated space use, capacity, and schedule information for 56 labs in 21 buildings. When this data is corrected in future reports, the apparent surplus of STEM class lab space is likely to be reduced.

- Eight labs were incorrectly coded as class labs and actually serve as lab support space.
- The function of 36 class labs has changed, yet the 2017 space inventory did not reflect those changes.
- The course schedule contained errors for five class labs that appeared to be unscheduled but were, in fact, scheduled.
- The area surrounding one class lab was renovated and the lab no longer exists, yet the 2017 space inventory did not reflect this change.
- One class lab was offline due to renovation.
- One class lab was offline due to poor condition.
- Four class labs in the Biomanufacturing Technology Education Center (BTEC) are intended to serve non-academic training courses and are available for NC State use only when not reserved for training. For this reason, these labs may be lightly scheduled by the University or not scheduled at all.

The instructional capacity of a new Engineering building - under construction in 2017 - was considered in the study. The University provided information for three older Engineering buildings that will be renovated when the new Engineering building is occupied. Page, Mann, and Daniels Halls were included in the study but will eventually have less STEM space because they will be re-programmed with a mix of STEM and non-STEM functions. The surplus of STEM space predicted in the study is likely to be reduced when renovation programs for these buildings are finalized.

University of North Carolina at Chapel Hill

The University provided growth projection information for STEM programs that were in the development stages in 2017 and, therefore, did not appear in the study.

- Non-STEM: The new IDEAs in Action undergraduate general education curriculum is scheduled to launch in Fall of 2021. This curriculum focuses, among other things, on experiential education and research experiences. As such, demand for courses with lab components will increase. The Marine Sciences department, which is not included in the System Office study because it only offers MS and PhD programs, is in the process of creating a new lab sequence for undergraduate students to meet this new requirement. The department will require a dedicated lab space to do so.
- Hard Sciences: Neuroscience B.A. / B.S. – The Neuroscience undergraduate major launched in Fall of 2018. At that time, UNC-CH reported 62 majors (upper division only) and estimated 400 majors in five years. As of Fall of 2019, there are 249 upper division majors with another 294 intended. If this trend holds, UNC-CH will surpass the 400 major estimate before the initial 5-year timeframe. This major requires courses in Biology, Computer Science, Mathematics and Statistics & Operations – putting pressure on these disciplines that are already stretched thin. The major also requires specialized lab space, the first lab was developed in Fall 2019 and the first sections were taught in Spring 2020.
- Engineering:
  Biomedical-Bioengineering (BMME) Joint Degree with NC State – Though the degree was in place in Fall of 2017, the specialized lab space at UNC-CH was not operational. Therefore, the System Office study does not capture several lab spaces in Phillips dedicated to BMME majors.

  Applied Physical Sciences (APS) – Though not yet launched, APS plans to launch a minor in Engineering Applications in Fall 2020 and expects to enroll 50 students per year in this STEM-based minor. The department plans to also launch a non-STEM minor simultaneously that will have about 50 students per year. In Fall 2022, APS expects to launch a major in Applied Sciences and Engineering in which they expect to enroll approximately 80 students per year, similar to the Biomedical Engineering program. Both the major and the minor will require specialized lab space.
- Maker Spaces: Be a Maker (BeAM) is a network of maker spaces on UNC-CH's campus that provides opportunities for STEM and non-STEM majors to access emerging technologies and create physical objects to incorporate into coursework, research, and entrepreneurship. This network includes maker spaces located in Science, Art, Housing, and Library facilities. These spaces do not fall under this study's classroom and class lab categories, although both instructional and open lab use are typical with STEM majors. We anticipate a similar growth trajectory with the demand on this specialized space category.
- The University expressed concern that Psychology was not classified as STEM in the MGT report, yet it is considered STEM at the University.

  Response: Classrooms in 27 buildings were used for Psychology instruction in fall 2017. Since all classroom instruction was captured in the analysis regardless of its focus, the use of classrooms for Psychology was reflected in the study. The course schedule shows that Psychology & Neuroscience Department lab courses met in one computer class lab, Davie Hall room 110. The scheduled use of this lab in fall 2017 did not meet target utilization; however, if demand for these courses increases sufficiently, a second computer class lab could be needed by 2030. As new programs develop, additional specialized class labs and other spaces may be required.
- The University expressed concern that an examination of STEM majors in the MGT study would not reflect the instructional needs of non-STEM majors who take STEM courses.

  Response: JMZ accounted for all instruction in classrooms, STEM class labs, and STEM open labs, regardless of the students' majors or subjects of instruction. Future demand for STEM instruction was calculated as a factor of instruction delivered. All participants in Math instruction, for example, were included in the study regardless of their major. Appendices A and B detail the process by which MGT's enrollment projections for upper division STEM majors established growth rates that were applied to all STEM instruction and, subsequently, to space projections.

The University emphasized the report's finding that aging infrastructure and deferred maintenance alone could prompt the need for remodeling. The University pointed out that teaching labs and classrooms that have not had comprehensive renovations result in spaces that do not meet the pedagogical goals of STEM education. For example, the University reports that current emergency renovations of Morehead Chemistry Laboratory Building will replace the HVAC systems and provide necessary air exchanges to support the teaching labs; however, the layout of the labs will not be altered. These labs, designed in the 1970s, do not offer good visibility, making it difficult for instructors to monitor student activity and ensure lab safety protocols are followed. In addition, the existing lab layouts do not meet the pedagogical shift in the curriculum, which calls for course-based small team research and data-driven projects. Furthermore, plans to incorporate new methods of teaching will depend on a mix of dry and wet lab benches within the same teaching lab.

Fayetteville State University

The University reported that they have updated their self-reported building conditions since 2017.

- The University provided supplemental scheduling data for courses offered in fall 2017. The data included information for 21 Nursing courses and one Forensic Microscopy course. The Forensic Microscopy course was scheduled in Science & Technology Building room 327, a class lab, which had been marked as unscheduled in the February 2020 presentation.

  Response: Science & Technology Building room 327 was incorrectly listed as unscheduled in the presentation. In fact, its use was reflected in the report results. The lab will have capacity to accommodate projected instructional demand through 2030. The additional Nursing course data provided by the University included eight lecture courses scheduled in classrooms; these courses were already recorded in the analysis. However, another 12 Nursing clinicals were reported (Adult Health I and Adult Health II) but, for ten of them, no specific room assignment was given. These clinical meetings contribute to space need in the SE NC Nursing Education Building, or NERC, though their timing and duration varies from semester to semester. Additional study at the campus level would help determine future space needs for Nursing and other irregularly scheduled Health Science programs.

- Users of the SE NC Nursing Education Building questioned that the report shows two class labs in the building.

  Response: The inventory shows that room 109 and room 330 were coded as class labs. Room 330 was scheduled for instruction in fall 2017 and room 109 was not.

University of North Carolina at Charlotte

The University provided additional information on building condition, evening courses, and a need for additional student project space. Their comments are paraphrased below.

- The McEniry, Burson, Cameron, Smith, Friday and McMillan greenhouse buildings are 35-54 years old, need significant renovation, and should have been reported by the University as building condition 4 (requires major remodeling).
- At most institutions, daytime use dictates instructional space need. However, the University offers a robust schedule of evening courses (291 weekly room hours after 5:00 pm in 2017). If these courses had been included in the analysis, the University feels it would result in a more complete picture of their STEM instructional space use because room hour use and seat fill would have been higher.
- Space for project-based collaboration is needed to support STEM instruction. In 2019, Engineering had 564 students working on senior design projects in teams, which translates to over 28,000 square feet of space needed (using the UNC System guidelines for moderately intensive lab use).

University of North Carolina at Pembroke

The University reported two potential coding inaccuracies that should be corrected in future reports.

- Health Sciences Building room 204 is a meeting room that was scheduled for Nursing instruction.

  Response: If it had been analyzed as a classroom, Health Sciences Building room 204 would have sufficient capacity to accommodate instruction through 2030 based on reported data.

- Oxendine room 1202 was coded as an open lab. It held two computer science courses during fall 2017.

  Response: Scheduled instruction in open labs was added to the aggregate class lab demand (by STEM category) so that open lab instructional use could be accounted for in 2030 space need. The two courses in Oxendine 1202 occupied the room for five hours per week in fall 2017, leaving sufficient time for out-of-class uses. If the lab is scheduled more intensely in the future, additional lab space may be required.

East Carolina University

The University was composing its response to the February 2020 presentation and the subsequent April 2020 meeting when the COVID-19 pandemic interrupted the effort. The University sent an abbreviated response that described their process of reviewing underperforming academic spaces and improving utilization. The University provided a table of class labs that have been changed to other uses since 2017.

- Nine biology class labs were re-classified as research labs.
- Two geology labs were changed to office and office support.
- Four labs (two biology labs, a physics lab, and a geology lab) were flagged as being underutilized and the University advised the departments to schedule all courses through the registrar to accurately reflect utilization.
- One classroom was converted to a Coastal Studies class lab.
- Three non-STEM labs were created in Brewster Hall.

Elizabeth City State University

The University provided information on the growth of its Aviation and Unmanned Aerials Systems programs.

- The Aviation Degree Program has experienced an increase in enrollment of over 40 percent in the last two years. The University is projecting an increase of 300 percent by 2024-25. Flight simulators, specialized aviation equipment, and other aviation labs will be required to support this projected growth. The University has had to convert one of its largest classrooms to support flight simulator labs, which removes it as an option to support other academic programs. A large facility that can accommodate the flight simulators and has the required electrical and cooling capacity will be required to meet five-year enrollment growth projections.
- In fall of 2019, the University launched its first Unmanned Aerials Systems degree program, which focuses on the use of drones to support everyday activities and workplace demands. Several external partnerships with law enforcement and the Department of Transportation are expected to result in significant program enrollment growth. An outdoor drone lab or other enclosed structure will be needed to operate drones within FAA guidelines. In addition, specialized lab spaces to build, store, and maintain the various specialized drones are necessary to support the projected enrollment growth of the program.

University of North Carolina at Wilmington

The University provided comments that clarify room use and suggest additional labs that should be considered as STEM.

The University showed concern that an analysis of STEM majors would exclude demand for STEM courses taken by non-majors. Appendices A and B detail the process by which MGT's enrollment projections for upper division STEM majors established growth rates that were applied to all STEM instruction.

New degree programs have come online since 2017 or are in the queue, which may affect space projections. Coastal Engineering, Business Analytics, Data Science, Respiratory Therapy, and expansion of some nursing programs were mentioned.

- The University noted that STEM instruction took place in physical education spaces which were not included in the study.

  Response: Because gyms often house instruction in multiple disciplines, athletics practices, University events, and recreational use, their utilization cannot be assessed from data alone. A campus-level study that includes interviews with all gymnasium users is needed to determine whether additional gymnasiums are needed.

  Twelve Exercise Science courses were taught in two Trask Coliseum class labs, rooms 115 and 117. Because Physical Education was not considered STEM, the instruction in these labs did not appear in the body of this report. If enrollment projections are met, in 2030 Trask 115 and 117 will approach - but not exceed - target utilization. Unscheduled uses, such as student skills practice, could prompt a need for additional lab space that was not captured in this analysis.

- Most Health Science courses are scheduled outside the Student Data Mart system. The University reports that Health Science labs are booked on a rotating schedule to support multiple courses for teaching and simulation.
- Labs within the Watson College of Education were not coded to reflect math and science instruction.

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Appendix D

STEM Evaluation Tables

Appendix D - STEM Evaluation Tables

Building Condition Code

1	Satisfactory Condition (No renovation needed)
2	Remodeling A (Renovation cost less than 25% of building replacement cost)
3	Remodeling B (Renovation cost between 25% and 50% of building replacement cost)
4	Remodeling C (Renovation cost more than 50% of building replacement cost)

ENG = Engineering
HARD SCI = Hard Science
HLTH SCI = Health Science
MATH = Mathematics
TECH = Technology

Notes

Numerical entries in blue indicate net new construction is included in the figure.
* Rounding caused variation in the enrollment projections limited to +/- one student per STEM category systemwide.
** When calculated net space need was negative, zero was entered.

			2017 Building Condition and STEM Space, New Construction Underway, Planned Demolition									2030 Additional Enrollment and STEM Space			
Region/ University	STEM Category	Condition	Labs	Offices	Study	Special Use	General Use	Service and Support	Clinic	Total	Percent in Condition Code	Enrollment Growth*	Labs (ASF)	Offices (ASF)	Total Space (ASF)
Western Region															
ASU	**ENG**	1		2,200				1,565		3,765	9.2%				
		2								0	0.0%				
		3								0	0.0%				
		4	29,900	6,572			789	90		37,351	90.8%				
	Subtotal		**29,900**	**8,772**	**0**	**0**	**789**	**1,655**	**0**	**41,116**		**56**	**19,699**	**3,080**	**22,779**
	HARD SCI	1	12,751	9,446		1,915	1,050	2,400		27,562	25.9%				
		2	41,828	20,138	1,118		1,759	2,206		67,049	63.1%				
		3	4,154	1,787			89	1,644		7,674	7.2%				
		4	1,940	2,004						3,944	3.7%				
	Subtotal		**60,673**	**33,375**	**1,118**	**1,915**	**2,898**	**6,250**	**0**	**106,229**		**489**	**42,504**	**8,510**	**51,014**
	HLTH SCI	1	973	1,529						2,502	1.6%				
		2			408		1,366			1,774	1.2%				
		3	5,182	3,484		561	226			9,453	6.1%				
		4	22,585	26,533		89,377	1,916			140,411	91.1%				
	Subtotal		**28,740**	**31,546**	**408**	**89,938**	**3,508**	**0**	**0**	**154,140**		**473**	**25,368**	**5,430**	**30,798**
	MATH	1								0	0.0%				
		2	3,288	6,130						9,418	100.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**3,288**	**6,130**	**0**	**0**	**0**	**0**	**0**	**9,418**		**246**	**4,871**	**4,350**	**9,221**
	TECH	1								0	0.0%				
		2	8,328	10,872				152		19,352	100.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**8,328**	**10,872**	**0**	**0**	**0**	**152**	**0**	**19,352**		**582**	**9,120**	**8,510**	**17,630**
ASU			**130,929**	**90,695**	**1,526**	**91,853**	**7,195**	**8,057**	**0**	**330,255**		**1,846**	**101,562**	**29,880**	**131,442**
UNCA	**ENG**	1								0	0.0%				
		2	4,051	1,663						5,714	100.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**4,051**	**1,663**	**0**	**0**	**0**	**0**	**0**	**5,714**		**167**	**5,832**	**3,400**	**9,232**
	HARD SCI	1								0	0.0%				
		2	33,827	11,412						45,239	99.8%				
		3								0	0.0%				
		4		71						71	0.2%				
	Subtotal		**33,827**	**11,483**	**0**	**0**	**0**	**0**	**0**	**45,310**		**82**	**8,568**	**2,160**	**10,728**
	HLTH SCI	1	2,695	4,513	3,022	4,284				14,514	100.0%				
		2								0	0.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**2,695**	**4,513**	**3,022**	**4,284**	**0**	**0**	**0**	**14,514**		**24**	**0**	**540**	**540**
	MATH	1								0	0.0%				
		2	988	2,794			122			3,904	100.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**988**	**2,794**	**0**	**0**	**122**	**0**	**0**	**3,904**		**6**	**2,534**	**350**	**2,884**
	TECH	1								0	0.0%				
		2	4,831	2,933			715			8,479	100.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**4,831**	**2,933**	**0**	**0**	**715**	**0**	**0**	**8,479**		**22**	**3,360**	**890**	**4,250**
UNCA			**46,392**	**23,386**	**3,022**	**4,284**	**837**	**0**	**0**	**77,921**		**301**	**20,294**	**7,340**	**27,634**

Appendix D - STEM Evaluation Tables

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Notes

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* Rounding caused variation in the enrollment projections limited to +/- one student per STEM category systemwide.
** When calculated net space need was negative, zero was entered.

			2017 Building Condition and STEM Space, New Construction Underway, Planned Demolition									2030 Additional Enrollment and STEM Space			
Region/ University	STEM Category	Condition	Labs	Offices	Study	Special Use	General Use	Service and Support	Clinic	Total	Percent in Condition Code	Enrollment Growth*	Labs (ASF)	Offices (ASF)	Total Space (ASF)
Western Region															
WCU	**ENG**	1	4,717	650						5,367	15.6%				
		2	22,378	6,183	424					28,985	84.4%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**27,095**	**6,833**	**424**	**0**	**0**	**0**	**0**	**34,352**		**424**	**37,584**	**5,110**	**42,694**
	HARD SCI	1	50,159	15,761	1,266	1,617		8,140		76,943	91.5%				
		2	5,389	340	819	355	258			7,161	8.5%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**55,548**	**16,101**	**2,085**	**1,972**	**258**	**8,140**	**0**	**84,104**		**147**	**10,248**	**757**	**11,005**
	HLTH SCI	1	29,305	21,091		8,795	812			60,003	98.5%				
		2								0	0.0%				
		3	897							897	1.5%				
		4								0	0.0%				
	Subtotal		**30,202**	**21,091**	**0**	**8,795**	**812**	**0**	**0**	**60,900**		**408**	**10,752**	**6,410**	**17,162**
	MATH	1	467	4,107						4,574	50.3%				
		2		4,515						4,515	49.7%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**467**	**8,622**	**0**	**0**	**0**	**0**	**0**	**9,089**		**33**	**0**	**920**	**920**
	TECH	1	877	443						1,320	75.6%				
		2		426						426	24.4%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**877**	**869**	**0**	**0**	**0**	**0**	**0**	**1,746**		**55**	**0**	**540**	**540**
WCU			**114,189**	**53,516**	**2,509**	**10,767**	**1,070**	**8,140**	**0**	**190,191**		**1,067**	**58,584**	**13,737**	**72,321**
Western Total															
	ENG	1	4,717	2,850				1,565		9,132	11.2%				
		2	26,429	7,846	424					34,699	42.7%				
		3								0	0.0%				
		4	29,900	6,572			789	90		37,351	46.0%				
	Subtotal		**61,046**	**17,268**	**424**	**0**	**789**	**1,655**	**0**	**81,182**		**647**	**63,115**	**11,590**	**74,705**
	HARD SCI	1	62,910	25,207	1,266	3,532	1,050	10,540		104,505	44.3%				
		2	81,044	31,890	1,937	355	2,017	2,206		119,449	50.7%				
		3	4,154	1,787			89	1,644		7,674	3.3%				
		4	1,940	2,075						4,015	1.7%				
	Subtotal		**150,048**	**60,959**	**3,203**	**3,887**	**3,156**	**14,390**	**0**	**235,643**		**718**	**61,320**	**11,427**	**72,747**
	HLTH SCI	1	32,973	27,133	3,022	13,079	812			77,019	33.6%				
		2			408		1,366			1,774	0.8%				
		3	6,079	3,484		561	226			10,350	4.5%				
		4	22,585	26,533		89,377	1,916			140,411	61.2%				
	Subtotal		**61,637**	**57,150**	**3,430**	**103,017**	**4,320**	**0**	**0**	**229,554**		**905**	**36,120**	**12,380**	**48,500**
	MATH	1	467	4,107						4,574	20.4%				
		2	4,276	13,439			122			17,837	79.6%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**4,743**	**17,546**	**0**	**0**	**122**	**0**	**0**	**22,411**		**285**	**7,405**	**5,620**	**13,025**
	TECH	1	877	443						1,320	4.5%				
		2	13,159	14,231			715	152		28,257	95.5%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**14,036**	**14,674**	**0**	**0**	**715**	**152**	**0**	**29,577**		**659**	**12,480**	**9,940**	**22,420**
Western Region			**291,510**	**167,597**	**7,057**	**106,904**	**9,102**	**16,197**	**0**	**598,367**		**3,214**	**180,440**	**50,957**	**231,397**

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Notes

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** When calculated net space need was negative, zero was entered.

			2017 Building Condition and STEM Space, New Construction Underway, Planned Demolition									2030 Additional Enrollment and STEM Space			
Region/ University	STEM Category	Condition	Labs	Offices	Study	Special Use	General Use	Service and Support	Clinic	Total	Percent in Condition Code	Enrollment Growth*	Labs (ASF)	Offices (ASF)	Total Space (ASF)
Piedmont-Triad Region															
A&T	**ENG**	1	53,135	30,931	1,775		4,029	1,110		90,980	48.0%				
		2	11,769	24,509	248		4,924	1,363		42,813	22.6%				
		3	1,897	3,353				262		5,512	2.9%				
		4	30,711	18,318	736		543	106		50,414	26.6%				
	Subtotal		**97,512**	**77,111**	**2,759**	**0**	**9,496**	**2,841**	**0**	**189,719**		**679**	**19,700**	**2,119**	**21,819**
	HARD SCI	1	22,597	11,130	862	845	2,732	1,076		39,242	49.1%				
		2								0	0.0%				
		3	9,498	7,678	2,031		428			19,635	24.5%				
		4	12,056	7,474	1,115		473			21,118	26.4%				
	Subtotal		**44,151**	**26,282**	**4,008**	**845**	**3,633**	**1,076**	**0**	**79,995**		**157**	**21,260**	**6,570**	**27,830**
	HLTH SCI	1	9,786	2,206						11,992	51.2%				
		2								0	0.0%				
		3	1,963	551						2,514	10.7%				
		4	2,300	6,303			320			8,923	38.1%				
	Subtotal		**14,049**	**9,060**	**0**	**0**	**320**	**0**	**0**	**23,429**		**591**	**0**	**10,030**	**10,030**
	MATH	1								0	0.0%				
		2								0	0.0%				
		3	3,509	5,455						8,964	100.0%				
		4								0	0.0%				
	Subtotal		**3,509**	**5,455**	**0**	**0**	**0**	**0**	**0**	**8,964**		**35**	**2,060**	**5,300**	**7,360**
	TECH	1								0	0.0%				
		2								0	0.0%				
		3			400					400	21.6%				
		4	915	539						1,454	78.4%				
	Subtotal		**915**	**539**	**400**	**0**	**0**	**0**	**0**	**1,854**		**493**	**0**	**6,380**	**6,380**
A&T			**160,136**	**118,447**	**7,167**	**845**	**13,449**	**3,917**	**0**	**303,961**		**1,955**	**43,020**	**30,399**	**73,419**
UNCG	**ENG**	1								0					
		2								0					
		3								0					
		4								0					
	Subtotal		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**			**0**	**0**	**0**
	HARD SCI	1	83,457	21,643	1,557	4,847	3,230	1,553		116,287	84.7%				
		2	164	987				62		1,213	0.9%				
		3	3,642	4,375	99		221			8,337	6.1%				
		4	4,395	6,653				373		11,421	8.3%				
	Subtotal		**91,658**	**33,658**	**1,656**	**4,847**	**3,451**	**1,988**	**0**	**137,258**		**523**	**0**	**9,477**	**9,477**
	HLTH SCI	1	33,961	22,500		63	1,981			58,505	47.6%				
		2	6,818	28,892		3,305	578	998		40,591	33.0%				
		3	4,963	1,214		16,702	180			23,059	18.7%				
		4	0	0			838			838	0.7%				
	Subtotal		**45,742**	**52,606**	**0**	**20,070**	**3,577**	**998**	**0**	**122,993**		**272**	**7,161**	**33,105**	**40,266**
	MATH	1	1,406	6,346	118		545			8,415	80.0%				
		2								0	0.0%				
		3	2,106							2,106	20.0%				
		4								0	0.0%				
	Subtotal		**3,512**	**6,346**	**118**	**0**	**545**	**0**	**0**	**10,521**		**14**	**0**	**510**	**510**
	TECH	1		2,599	124					2,723	100.0%				
		2								0	0.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**0**	**2,599**	**124**	**0**	**0**	**0**	**0**	**2,723**		**443**	**0**	**7,130**	**7,130**
UNCG			**140,912**	**95,209**	**1,898**	**24,917**	**7,573**	**2,986**	**0**	**273,495**		**1,252**	**7,161**	**50,222**	**57,383**

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** When calculated net space need was negative, zero was entered.

			2017 Building Condition and STEM Space, New Construction Underway, Planned Demolition									2030 Additional Enrollment and STEM Space			
Region/ University	STEM Category	Condition	Labs	Offices	Study	Special Use	General Use	Service and Support	Clinic	Total	Percent in Condition Code	Enrollment Growth*	Labs (ASF)	Offices (ASF)	Total Space (ASF)
Piedmont-Triad Region															
WSSU	**ENG**	1	1,095							1,095	100.0%				
		2								0	0.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**1,095**	**0**	**0**	**0**	**0**	**0**	**0**	**1,095**			**0**	**0**	**0**
	HARD SCI	1	47,444	11,085						58,529	92.1%				
		2								0	0.0%				
		3		2,156		2,747				4,903	7.7%				
		4			91					91	0.1%				
	Subtotal		**47,444**	**13,241**	**91**	**2,747**	**0**	**0**	**0**	**63,523**		**118**	**0**	**(2,670)**	**(2,670)**
	HLTH SCI	1	14,586	13,702	731		500			29,519	88.7%				
		2		222						222	0.7%				
		3	207	3,315						3,522	10.6%				
		4								0	0.0%				
	Subtotal		**14,793**	**17,239**	**731**	**0**	**500**	**0**	**0**	**33,263**		**281**	**4,368**	**2,160**	**6,528**
	MATH	1								0	0.0%				
		2								0	0.0%				
		3								0	0.0%				
		4	2,212	5,705	356			505		8,778	100.0%				
	Subtotal		**2,212**	**5,705**	**356**	**0**	**0**	**505**	**0**	**8,778**		**4**	**0**	**1,620**	**1,620**
	TECH	1	10,663	10,046	1,308		535			22,552	100.0%				
		2								0	0.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**10,663**	**10,046**	**1,308**	**0**	**535**	**0**	**0**	**22,552**		**36**	**0**	**190**	**190**
WSSU			**76,207**	**46,231**	**2,486**	**2,747**	**1,035**	**505**	**0**	**129,211**		**439**	**4,368**	**1,300**	**5,668**
Piedmont-Triad Total															
	ENG	1	54,230	30,931	1,775		4,029	1,110		92,075	48.3%				
		2	11,769	24,509	248		4,924	1,363		42,813	22.4%				
		3	1,897	3,353				262		5,512	2.9%				
		4	30,711	18,318	736		543	106		50,414	26.4%				
	Subtotal		**98,607**	**77,111**	**2,759**	**0**	**9,496**	**2,841**	**0**	**190,814**		**679**	**19,700**	**2,119**	**21,819**
	HARD SCI	1	153,498	43,858	2,419	5,692	5,962	2,629		214,058	76.2%				
		2	164	987				62		1,213	0.4%				
		3	13,140	14,209	2,130	2,747	649			32,875	11.7%				
		4	16,451	14,127	1,206		473	373		32,630	11.6%				
	Subtotal		**183,253**	**73,181**	**5,755**	**8,439**	**7,084**	**3,064**	**0**	**280,776**		**798**	**21,260**	**13,377**	**34,637**
	HLTH SCI	1	58,333	38,408	731	63	2,481			100,016	55.7%				
		2	6,818	29,114		3,305	578	998		40,813	22.7%				
		3	7,133	5,080		16,702	180			29,095	16.2%				
		4	2,300	6,303			1,158			9,761	5.4%				
	Subtotal		**74,584**	**78,905**	**731**	**20,070**	**4,397**	**998**	**0**	**179,685**		**1,144**	**11,529**	**45,295**	**56,824**
	MATH	1	1,406	6,346	118		545			8,415	29.8%				
		2								0	0.0%				
		3	5,615	5,455						11,070	39.2%				
		4	2,212	5,705	356			505		8,778	31.1%				
	Subtotal		**9,233**	**17,506**	**474**	**0**	**545**	**505**	**0**	**28,263**		**53**	**2,060**	**7,430**	**9,490**
	TECH	1	10,663	12,645	1,432		535			25,275	93.2%				
		2								0	0.0%				
		3			400					400	1.5%				
		4	915	539						1,454	5.4%				
	Subtotal		**11,578**	**13,184**	**1,832**	**0**	**535**	**0**	**0**	**27,129**		**972**	**0**	**13,700**	**13,700**
Piedmont-Triad			**377,255**	**259,887**	**11,551**	**28,509**	**22,057**	**7,408**	**0**	**706,667**		**3,646**	**54,549**	**81,921**	**136,470**

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* Rounding caused variation in the enrollment projections limited to +/- one student per STEM category systemwide.
** When calculated net space need was negative, zero was entered.

			2017 Building Condition and STEM Space, New Construction Underway, Planned Demolition									2030 Additional Enrollment and STEM Space			
Region/ University	STEM Category	Condition	Labs	Offices	Study	Special Use	General Use	Service and Support	Clinic	Total	Percent in Condition Code	Enrollment Growth*	Labs (ASF)	Offices (ASF)	Total Space (ASF)
North Central Region															
NCCU	**ENG**	1		4,535		1,749	1,128			7,412	100.0%				
		2								0	0.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**0**	**4,535**	**0**	**1,749**	**1,128**	**0**	**0**	**7,412**		**0**	**0**	**0**	**0**
	HARD SCI	1	39,986	23,476				280		63,742	88.4%				
		2								0	0.0%				
		3	3,945	4,000		440				8,385	11.6%				
		4								0	0.0%				
	Subtotal		**43,931**	**27,476**	**0**	**440**	**0**	**280**	**0**	**72,127**		**91**	**7,140**	**1,080**	**8,220**
	HLTH SCI	1	8,258	14,608	1,466	910	5,895	149	795	32,081	100.0%				
		2								0	0.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**8,258**	**14,608**	**1,466**	**910**	**5,895**	**149**	**795**	**32,081**		**67**	**2,184**	**4,830**	**7,014**
	MATH	1	6,314	6,366						12,680	100.0%				
		2								0	0.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**6,314**	**6,366**	**0**	**0**	**0**	**0**	**0**	**12,680**		**26**	**8,672**	**1,430**	**10,102**
	TECH	1								0					
		2								0					
		3								0					
		4								0					
	Subtotal		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**		**106**	**0**	**2,510**	**2,510**
NCCU			**58,503**	**52,985**	**1,466**	**3,099**	**7,023**	**429**	**795**	**124,300**		**290**	**17,996**	**9,850**	**27,846**
NC State	**ENG**	1	52,279	152,821	2,472	3,808	6,518	15,781		233,679	34.8%				
		2	27,511	67,189	1,480		1,060	2,077		99,317	14.8%				
		3	67,597	133,174	6,573	248	22,351	7,097		237,040	35.3%				
		4	26,977	52,098		18,846	1,777	2,086		101,784	15.2%				
	Subtotal		**174,364**	**405,282**	**10,525**	**22,902**	**31,706**	**27,041**	**0**	**671,820**		**1,079**	**12,847**	**(23,205)**	**(10,358)**
	HARD SCI	1	38,967	27,983		149	4,634	343		72,076	12.6%				
		2	79,835	137,973	5,945	60,379	4,800	1,993		290,925	50.9%				
		3	26,224	38,375		526	525	2,270		67,920	11.9%				
		4	20,169	59,674	5,149	53,557	578	1,575		140,702	24.6%				
	Subtotal		**165,195**	**264,005**	**11,094**	**114,611**	**10,537**	**6,181**	**0**	**571,623**		**435**	**79,716**	**21,940**	**101,656**
	HLTH SCI	1								0					
		2								0					
		3								0					
		4								0					
	Subtotal		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**					**0**
	MATH	1	5,253	49,996	5,706		10,680			71,635	65.3%				
		2								0	0.0%				
		3	7,711	26,536	161	880	2,522	264		38,074	34.7%				
		4								0	0.0%				
	Subtotal		**12,964**	**76,532**	**5,867**	**880**	**13,202**	**264**	**0**	**109,709**		**97**	**2,297**	**13,310**	**15,607**
	TECH	1	3,789	24,289			1,759			29,837	65.6%				
		2	2,795	3,870						6,665	14.7%				
		3	4,528	3,063						7,591	16.7%				
		4		1,393						1,393	3.1%				
	Subtotal		**11,112**	**32,615**	**0**	**0**	**1,759**	**0**	**0**	**45,486**		**313**	**3,960**	**9,330**	**13,290**
NC State			**363,635**	**778,434**	**27,486**	**138,393**	**57,204**	**33,486**	**0**	**1,398,638**		**1,924**	**98,820**	**21,375**	**120,195**

Appendix D - STEM Evaluation Tables

Building Condition Code

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ENG = Engineering
HARD SCI = Hard Science
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TECH = Technology

Notes

Numerical entries in blue indicate net new construction is included in the figure.
* Rounding caused variation in the enrollment projections limited to +/- one student per STEM category systemwide.
** When calculated net space need was negative, zero was entered.

			2017 Building Condition and STEM Space, New Construction Underway, Planned Demolition									2030 Additional Enrollment and STEM Space			
Region/ University	STEM Category	Condition	Labs	Offices	Study	Special Use	General Use	Service and Support	Clinic	Total	Percent in Condition Code	Enrollment Growth*	Labs (ASF)	Offices (ASF)	Total Space (ASF)
North Central Region															
UNC-CH	**ENG**	1								0					
		2								0					
		3								0					
		4								0					
	Subtotal		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**			**0**	**0**	**0**
	HARD SCI	1	2,794	80,333	6,029	14,723	19,157	4,257		127,293	38.9%				
		2	12,996	13,006		1,273	1,479	153		28,907	8.8%				
		3	63,991	68,541	4,272	687	2,384	8,791		148,666	45.5%				
		4	3,284	9,274	1,105	1,336	3,570	3,556		22,125	6.8%				
	Subtotal		**83,065**	**171,154**	**11,406**	**18,019**	**26,590**	**16,757**	**0**	**326,991**		**1,482**	**22,428**	**0**	**22,428**
	HLTH SCI	1		25,421			523			25,944	89.3%				
		2		300						300	1.0%				
		3								0	0.0%				
		4		70		2,738				2,808	9.7%				
	Subtotal		**0**	**25,791**	**0**	**2,738**	**523**	**0**	**0**	**29,052**		**304**	**0**	**0**	**0**
	MATH	1	680	14,683	178		865			16,406	47.6%				
		2								0	0.0%				
		3	457	16,106	333		993	141		18,030	52.4%				
		4								0	0.0%				
	Subtotal		**1,137**	**30,789**	**511**	**0**	**1,858**	**141**	**0**	**34,436**		**404**	**0**	**0**	**0**
	TECH	1								0	0.0%				
		2								0	0.0%				
		3	816	35,356			1,193	876		38,241	100.0%				
		4								0	0.0%				
	Subtotal		**816**	**35,356**	**0**	**0**	**1,193**	**876**	**0**	**38,241**		**1,676**	**0**	**0**	**0**
UNC-CH			**85,018**	**263,090**	**11,917**	**20,757**	**30,164**	**17,774**	**0**	**428,720**		**3,866**	**22,428**	**0**	**22,428**
North Central Total															
	ENG	1	52,279	157,356	2,472	5,557	7,646	15,781		241,091	35.5%				
		2	27,511	67,189	1,480		1,060	2,077		99,317	14.6%				
		3	67,597	133,174	6,573	248	22,351	7,097		237,040	34.9%				
		4	26,977	52,098		18,846	1,777	2,086		101,784	15.0%				
	Subtotal		**174,364**	**409,817**	**10,525**	**24,651**	**32,834**	**27,041**	**0**	**679,232**		**1,079**	**12,847**	**(23,205)**	**(10,358)**
	HARD SCI	1	81,747	131,792	6,029	14,872	23,791	4,880		263,111	27.1%				
		2	92,831	150,979	5,945	61,652	6,279	2,146		319,832	32.9%				
		3	94,160	110,916	4,272	1,653	2,909	11,061		224,971	23.2%				
		4	23,453	68,948	6,254	54,893	4,148	5,131		162,827	16.8%				
	Subtotal		**292,191**	**462,635**	**22,500**	**133,070**	**37,127**	**23,218**	**0**	**970,741**		**2,008**	**109,284**	**23,020**	**132,304**
	HLTH SCI	1	8,258	40,029	1,466	910	6,418	149	795	58,025	94.9%				
		2		300						300	0.5%				
		3								0	0.0%				
		4		70		2,738				2,808	4.6%				
	Subtotal		**8,258**	**40,399**	**1,466**	**3,648**	**6,418**	**149**	**795**	**61,133**		**371**	**2,184**	**4,830**	**7,014**
	MATH	1	12,247	71,045	5,884		11,545			100,721	64.2%				
		2								0	0.0%				
		3	8,168	42,642	494	880	3,515	405		56,104	35.8%				
		4								0	0.0%				
	Subtotal		**20,415**	**113,687**	**6,378**	**880**	**15,060**	**405**	**0**	**156,825**		**527**	**10,969**	**14,740**	**25,709**
	TECH	1	3,789	24,289			1,759			29,837	35.6%				
		2	2,795	3,870						6,665	8.0%				
		3	5,344	38,419			1,193	876		45,832	54.7%				
		4		1,393						1,393	1.7%				
	Subtotal		**11,928**	**67,971**	**0**	**0**	**2,952**	**876**	**0**	**83,727**		**2,095**	**3,960**	**11,840**	**15,800**
North Central			**507,156**	**1,094,509**	**40,869**	**162,249**	**94,391**	**51,689**	**795**	**1,951,658**		**6,080**	**139,244**	**31,225**	**170,469**

Appendix D - STEM Evaluation Tables

Building Condition Code

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2	Remodeling A (Renovation cost less than 25% of building replacement cost)
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4	Remodeling C (Renovation cost more than 50% of building replacement cost)

ENG = Engineering
HARD SCI = Hard Science
HLTH SCI = Health Science
MATH = Mathematics
TECH = Technology

Notes

Numerical entries in blue indicate net new construction is included in the figure.
* Rounding caused variation in the enrollment projections limited to +/- one student per STEM category systemwide.
** When calculated net space need was negative, zero was entered.

			2017 Building Condition and STEM Space, New Construction Underway, Planned Demolition									2030 Additional Enrollment and STEM Space			
Region/ University	STEM Category	Condition	Labs	Offices	Study	Special Use	General Use	Service and Support	Clinic	Total	Percent in Condition Code	Enrollment Growth*	Labs (ASF)	Offices (ASF)	Total Space (ASF)
South Central Region															
FSU	**ENG**	1								0					
		2								0					
		3								0					
		4								0					
	Subtotal		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**		**0**	**0**	**0**	**0**
	HARD SCI	1	40,445	12,757	828	854	4,330			59,214	100.0%				
		2								0	0.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**40,445**	**12,757**	**828**	**854**	**4,330**	**0**	**0**	**59,214**		**68**	**4,116**	**1,080**	**5,196**
	HLTH SCI	1	3,164	1,589						4,753	100.0%				
		2								0	0.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**3,164**	**1,589**	**0**	**0**	**0**	**0**	**0**	**4,753**		**320**	**4,032**	**2,320**	**6,352**
	MATH	1	4,075	9,100				415		13,590	100.0%				
		2								0	0.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**4,075**	**9,100**	**0**	**0**	**0**	**415**	**0**	**13,590**		**8**	**4,118**	**540**	**4,658**
	TECH	1		1,058			222			1,280	100.0%				
		2								0	0.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**0**	**1,058**	**0**	**0**	**222**	**0**	**0**	**1,280**		**47**	**0**	**1,080**	**1,080**
FSU			**47,684**	**24,504**	**828**	**854**	**4,552**	**415**	**0**	**78,837**		**443**	**12,266**	**5,020**	**17,286**
UNCC	**ENG**	1	46,784	61,827	1,830		1,556	2,326		114,323	72.9%				
		2	23,591	18,109	231			513		42,444	27.1%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**70,375**	**79,936**	**2,061**	**0**	**1,556**	**2,839**	**0**	**156,767**		**434**	**20,218**	**5,850**	**26,068**
	HARD SCI	1	83,795	59,330	1,575	6,108		88		150,896	95.3%				
		2	905	472		6,124				7,501	4.7%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**84,700**	**59,802**	**1,575**	**12,232**	**0**	**88**	**0**	**158,397**		**568**	**28,401**	**2,503**	**30,904**
	HLTH SCI	1	12,627	27,030						39,657	97.5%				
		2								0	0.0%				
		3	122	408		501				1,031	2.5%				
		4								0	0.0%				
	Subtotal		**12,749**	**27,438**	**0**	**501**	**0**	**0**	**0**	**40,688**		**2,319**	**14,700**	**22,670**	**37,370**
	MATH	1	5,071	13,613	235					18,919	98.0%				
		2		221						221	1.1%				
		3		172						172	0.9%				
		4								0	0.0%				
	Subtotal		**5,071**	**14,006**	**235**	**0**	**0**	**0**	**0**	**19,312**		**192**	**1,188**	**7,440**	**8,628**
	TECH	1	4,547	23,916	196					28,659	86.7%				
		2	1,733	2,658						4,391	13.3%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**6,280**	**26,574**	**196**	**0**	**0**	**0**	**0**	**33,050**		**1,365**	**20,640**	**13,450**	**34,090**
UNCC			**179,175**	**207,756**	**4,067**	**12,733**	**1,556**	**2,927**	**0**	**408,214**		**4,878**	**85,147**	**51,913**	**137,060**

Appendix D - STEM Evaluation Tables

Building Condition Code

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ENG = Engineering
HARD SCI = Hard Science
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MATH = Mathematics
TECH = Technology

Notes

Numerical entries in blue indicate net new construction is included in the figure.
* Rounding caused variation in the enrollment projections limited to +/- one student per STEM category systemwide.
** When calculated net space need was negative, zero was entered.

			2017 Building Condition and STEM Space, New Construction Underway, Planned Demolition									2030 Additional Enrollment and STEM Space			
Region/ University	STEM Category	Condition	Labs	Offices	Study	Special Use	General Use	Service and Support	Clinic	Total	Percent in Condition Code	Enrollment Growth*	Labs (ASF)	Offices (ASF)	Total Space (ASF)
South Central Region															
UNCP	**ENG**	1								0					
		2								0					
		3								0					
		4								0					
	Subtotal		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**		**0**	**0**	**0**	**0**
	HARD SCI	1	24,809	8,657						33,466	100.0%				
		2								0	0.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**24,809**	**8,657**	**0**	**0**	**0**	**0**	**0**	**33,466**		**356**	**6,048**	**4,230**	**10,278**
	HLTH SCI	1	10,165	12,210			232			22,607	100.0%				
		2								0	0.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**10,165**	**12,210**	**0**	**0**	**232**	**0**	**0**	**22,607**		**60**	**0**	**3,690**	**3,690**
	MATH	1		1,839						1,839	100.0%				
		2								0	0.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**0**	**1,839**	**0**	**0**	**0**	**0**	**0**	**1,839**		**24**	**0**	**3,180**	**3,180**
	TECH	1	3,386	798						4,184	100.0%				
		2								0	0.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**3,386**	**798**	**0**	**0**	**0**	**0**	**0**	**4,184**		**82**	**6,960**	**700**	**7,660**
UNCP			**38,360**	**23,504**	**0**	**0**	**232**	**0**	**0**	**62,096**		**522**	**13,008**	**11,800**	**24,808**
South Central Total															
	ENG	1	46,784	61,827	1,830		1,556	2,326		114,323	72.9%				
		2	23,591	18,109	231			513		42,444	27.1%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**70,375**	**79,936**	**2,061**	**0**	**1,556**	**2,839**	**0**	**156,767**		**434**	**20,218**	**5,850**	**26,068**
	HARD SCI	1	149,049	80,744	2,403	6,962	4,330	88		243,576	97.0%				
		2	905	472		6,124				7,501	3.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**149,954**	**81,216**	**2,403**	**13,086**	**4,330**	**88**	**0**	**251,077**		**992**	**38,565**	**7,813**	**46,378**
	HLTH SCI	1	25,956	40,829			232			67,017	98.5%				
		2								0	0.0%				
		3	122	408		501				1,031	1.5%				
		4								0	0.0%				
	Subtotal		**26,078**	**41,237**	**0**	**501**	**232**	**0**	**0**	**68,048**		**2,699**	**18,732**	**28,680**	**47,412**
	MATH	1	9,146	24,552	235			415		34,348	98.9%				
		2		221						221	0.6%				
		3		172						172	0.5%				
		4								0	0.0%				
	Subtotal		**9,146**	**24,945**	**235**	**0**	**0**	**415**	**0**	**34,741**		**224**	**5,306**	**11,160**	**16,466**
	TECH	1	7,933	25,772	196		222			34,123	88.6%				
		2	1,733	2,658						4,391	11.4%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**9,666**	**28,430**	**196**	**0**	**222**	**0**	**0**	**38,514**		**1,494**	**27,600**	**15,230**	**42,830**
South Central			**265,219**	**255,764**	**4,895**	**13,587**	**6,340**	**3,342**	**0**	**549,147**		**5,843**	**110,421**	**68,733**	**179,154**

Appendix D - STEM Evaluation Tables

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Notes

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** When calculated net space need was negative, zero was entered.

			2017 Building Condition and STEM Space, New Construction Underway, Planned Demolition									2030 Additional Enrollment and STEM Space			
Region/ University	STEM Category	Condition	Labs	Offices	Study	Special Use	General Use	Service and Support	Clinic	Total	Percent in Condition Code	Enrollment Growth*	Labs (ASF)	Offices (ASF)	Total Space (ASF)
Eastern Region															
ECU	**ENG**	1	26,266	10,939		441		220		37,866	77.3%				
		2		170						170	0.3%				
		3		4,210						4,210	8.6%				
		4	767	5,988						6,755	13.8%				
	Subtotal		**27,033**	**21,307**	**0**	**441**	**0**	**220**	**0**	**49,001**		**1,087**	**27,216**	**13,270**	**40,486**
	HARD SCI	1	52,466	34,387				6,083		92,936	62.4%				
		2		747						747	0.5%				
		3						3,600		3,600	2.4%				
		4	25,482	22,631	640	1,600	156	1,135		51,644	34.7%				
	Subtotal		**77,948**	**57,765**	**640**	**1,600**	**156**	**10,818**	**0**	**148,927**		**304**	**67,738**	**6,815**	**74,553**
	HLTH SCI	1		45		265				310	1.6%				
		2	5,819	4,831						10,650	54.6%				
		3	847	2,916		124	119			4,006	20.6%				
		4	2,899	1,623						4,522	23.2%				
	Subtotal		**9,565**	**9,415**	**0**	**389**	**119**	**0**	**0**	**19,488**		**446**	**0**	**9,960**	**9,960**
	MATH	1	1,480	765						2,245	19.5%				
		2		128						128	1.1%				
		3								0	0.0%				
		4	851	7,709	600					9,160	79.4%				
	Subtotal		**2,331**	**8,602**	**600**	**0**	**0**	**0**	**0**	**11,533**		**35**	**2,376**	**5,760**	**8,136**
	TECH	1	1,455	178						1,633	18.7%				
		2	825	1,816						2,641	30.3%				
		3								0	0.0%				
		4	4,453							4,453	51.0%				
	Subtotal		**6,733**	**1,994**	**0**	**0**	**0**	**0**	**0**	**8,727**		**586**	**3,000**	**29,150**	**32,150**
ECU			**123,610**	**99,083**	**1,240**	**2,430**	**275**	**11,038**	**0**	**237,676**		**2,458**	**100,330**	**64,955**	**165,285**
ECSU	**ENG**	1								0	0.0%				
		2	11,982	2,857						14,839	100.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**11,982**	**2,857**	**0**	**0**	**0**	**0**	**0**	**14,839**		**9**	**0**	**540**	**540**
	HARD SCI	1	8,986	5,072	556	1,332	1,516	1,496		18,958	43.8%				
		2	18,775	4,794		734				24,303	56.2%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**27,761**	**9,866**	**556**	**2,066**	**1,516**	**1,496**	**0**	**43,261**		**21**	**0**	**540**	**540**
	HLTH SCI	1								0	#DIV/0!				
		2								0	#DIV/0!				
		3								0	#DIV/0!				
		4								0	#DIV/0!				
	Subtotal		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**		**0**	**0**	**350**	**350**
	MATH	1	1,172	1,075						2,247	77.9%				
		2								0	0.0%				
		3								0	0.0%				
		4	639							639	22.1%				
	Subtotal		**1,811**	**1,075**	**0**	**0**	**0**	**0**	**0**	**2,886**		**5**	**0**	**350**	**350**
	TECH	1	3,644	1,266						4,910	95.4%				
		2		235						235	4.6%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**3,644**	**1,501**	**0**	**0**	**0**	**0**	**0**	**5,145**		**53**	**2,400**	**890**	**3,290**
ECSU			**45,198**	**15,299**	**556**	**2,066**	**1,516**	**1,496**	**0**	**66,131**		**88**	**2,400**	**2,670**	**5,070**

Appendix D - STEM Evaluation Tables

Building Condition Code

1	Satisfactory Condition (No renovation needed)
2	Remodeling A (Renovation cost less than 25% of building replacement cost)
3	Remodeling B (Renovation cost between 25% and 50% of building replacement cost)
4	Remodeling C (Renovation cost more than 50% of building replacement cost)

ENG = Engineering
HARD SCI = Hard Science
HLTH SCI = Health Science
MATH = Mathematics
TECH = Technology

Notes

Numerical entries in blue indicate net new construction is included in the figure.
* Rounding caused variation in the enrollment projections limited to +/- one student per STEM category systemwide.
** When calculated net space need was negative, zero was entered.

			2017 Building Condition and STEM Space, New Construction Underway, Planned Demolition									2030 Additional Enrollment and STEM Space			
Region/ University	STEM Category	Condition	Labs	Offices	Study	Special Use	General Use	Service and Support	Clinic	Total	Percent in Condition Code	Enrollment Growth*	Labs (ASF)	Offices (ASF)	Total Space (ASF)
Eastern Region															
UNCW	**ENG**	1	672	316						988	100.0%				
		2								0	0.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**672**	**316**	**0**	**0**	**0**	**0**	**0**	**988**		**112**	**0**	**1,620**	**1,620**
	HARD SCI	1	53,735	60,335		12,778	5,510	8,369		140,727	100.0%				
		2								0	0.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**53,735**	**60,335**	**0**	**12,778**	**5,510**	**8,369**	**0**	**140,727**		**520**	**49,812**	**11,690**	**61,502**
	HLTH SCI	1	10,313	46,485	125		4,117			61,040	100.0%				
		2								0	0.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**10,313**	**46,485**	**125**	**0**	**4,117**	**0**	**0**	**61,040**		**1,413**	**0**	**(26,043)**	**(26,043)**
	MATH	1	4,867	7,241						12,108	100.0%				
		2								0	0.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**4,867**	**7,241**	**0**	**0**	**0**	**0**	**0**	**12,108**		**58**	**6,415**	**2,350**	**8,765**
	TECH	1	4,841	7,975	154		487			13,457	100.0%				
		2								0	0.0%				
		3								0	0.0%				
		4								0	0.0%				
	Subtotal		**4,841**	**7,975**	**154**	**0**	**487**	**0**	**0**	**13,457**		**275**	**10,020**	**7,210**	**17,230**
UNCW			**74,428**	**122,352**	**279**	**12,778**	**10,114**	**8,369**	**0**	**228,320**		**2,378**	**66,247**	**0****	**66,247**
Eastern Total															
	ENG	1	26,938	11,255		441		220		38,854	59.9%				
		2	11,982	3,027						15,009	23.2%				
		3		4,210						4,210	6.5%				
		4	767	5,988						6,755	10.4%				
	Subtotal		**39,687**	**24,480**	**0**	**441**	**0**	**220**	**0**	**64,828**		**1,208**	**27,216**	**15,430**	**42,646**
	HARD SCI	1	115,187	99,794	556	14,110	7,026	15,948		252,621	75.9%				
		2	18,775	5,541		734				25,050	7.5%				
		3						3,600		3,600	1.1%				
		4	25,482	22,631	640	1,600	156	1,135		51,644	15.5%				
	Subtotal		**159,444**	**127,966**	**1,196**	**16,444**	**7,182**	**20,683**	**0**	**332,915**		**845**	**117,550**	**19,045**	**136,595**
	HLTH SCI	1	10,313	46,530	125	265	4,117			61,350	76.2%				
		2	5,819	4,831						10,650	13.2%				
		3	847	2,916		124	119			4,006	5.0%				
		4	2,899	1,623						4,522	5.6%				
	Subtotal		**19,878**	**55,900**	**125**	**389**	**4,236**	**0**	**0**	**80,528**		**1,859**	**0**	**(15,733)**	**(15,733)**
	MATH	1	7,519	9,081						16,600	62.6%				
		2		128						128	0.5%				
		3								0	0.0%				
		4	1,490	7,709	600					9,799	36.9%				
	Subtotal		**9,009**	**16,918**	**600**	**0**	**0**	**0**	**0**	**26,527**		**98**	**8,791**	**8,460**	**17,251**
	TECH	1	9,940	9,419	154		487			20,000	73.2%				
		2	825	2,051						2,876	10.5%				
		3								0	0.0%				
		4	4,453							4,453	16.3%				
	Subtotal		**15,218**	**11,470**	**154**	**0**	**487**	**0**	**0**	**27,329**		**914**	**15,420**	**37,250**	**52,670**
Eastern			**243,236**	**236,734**	**2,075**	**17,274**	**11,905**	**20,903**	**0**	**532,127**		**4,924**	**168,977**	**67,625**	**236,602**

Appendix D - STEM Evaluation Tables

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Notes

Numerical entries in blue indicate net new construction is included in the figure.
* Rounding caused variation in the enrollment projections limited to +/- one student per STEM category systemwide.
** When calculated net space need was negative, zero was entered.

			2017 Building Condition and STEM Space, New Construction Underway, Planned Demolition									2030 Additional Enrollment and STEM Space			
Region/ University	STEM Category	Condition	Labs	Offices	Study	Special Use	General Use	Service and Support	Clinic	Total	Percent in Condition Code	Enrollment Growth*	Labs (ASF)	Offices (ASF)	Total Space (ASF)
Systemwide Total															
	ENG	1	184,948	264,219	6,077	5,998	13,231	21,002		495,475	42.2%				
		2	101,282	120,680	2,383		5,984	3,953		234,282	20.0%				
		3	69,494	140,737	6,573	248	22,351	7,359		246,762	21.0%				
		4	88,355	82,976	736	18,846	3,109	2,282		196,304	16.7%				
	Subtotal		**444,079**	**608,612**	**15,769**	**25,092**	**44,675**	**34,596**	**0**	**1,172,823**		**4,047**	**143,096**	**11,784**	**154,880**
	HARD SCI	1	562,391	381,395	12,673	45,168	42,159	34,085		1,077,871	52.0%				
		2	193,719	189,869	7,882	68,865	8,296	4,414		473,045	22.8%				
		3	111,454	126,912	6,402	4,400	3,647	16,305		269,120	13.0%				
		4	67,326	107,781	8,100	56,493	4,777	6,639		251,116	12.1%				
	Subtotal		**934,890**	**805,957**	**35,057**	**174,926**	**58,879**	**61,443**	**0**	**2,071,152**		**5,361**	**347,979**	**74,682**	**422,661**
	HLTH SCI	1	135,833	192,929	5,344	14,317	14,060	149	795	363,427	58.7%				
		2	12,637	34,245	408	3,305	1,944	998		53,537	8.6%				
		3	14,181	11,888		17,888	525			44,482	7.2%				
		4	27,784	34,529		92,115	3,074			157,502	25.4%				
	Subtotal		**190,435**	**273,591**	**5,752**	**127,625**	**19,603**	**1,147**	**795**	**618,948**		**6,978**	**68,565**	**75,452**	**144,017**
	MATH	1	30,785	115,131	6,237		12,090	415		164,658	61.3%				
		2	4,276	13,788			122			18,186	6.8%				
		3	13,783	48,269	494	880	3,515	405		67,346	25.1%				
		4	3,702	13,414	956			505		18,577	6.9%				
	Subtotal		**52,546**	**190,602**	**7,687**	**880**	**15,727**	**1,325**	**0**	**268,767**		**1,187**	**34,531**	**47,410**	**81,941**
	TECH	1	33,202	72,568	1,782		3,003			110,555	53.6%				
		2	18,512	22,810			715	152		42,189	20.5%				
		3	5,344	38,419	400		1,193	876		46,232	22.4%				
		4	5,368	1,932						7,300	3.5%				
	Subtotal		**62,426**	**135,729**	**2,182**	**0**	**4,911**	**1,028**	**0**	**206,276**		**6,134**	**59,460**	**87,960**	**147,420**
Systemwide STEM			**1,684,376**	**2,014,491**	**66,447**	**328,523**	**143,795**	**99,539**	**795**	**4,337,966**		**23,707**	**653,631**	**300,461**	**954,092**
	2017 Existing STEM Space									4,045,013					
	Planned Net New STEM Construction 2017-2030									292,953					
Additional Classrooms required to meet 2030 STEM lecture demand															13,568
Systemwide Total															**967,660**

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