College of Natural and Applied Sciences Master Plan

Missouri State University

Final Report
September 1st 2020

CHRISTNER

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MASTER PLAN
INTRODUCTION

Master Plan Committee

CNAS Executive Committee

Tammy Jahnke, Dean

Kyoungtae Kim, Associate Dean, BIO

Xiaomin Qiu, Associate Dean, GGP

Jorge Rebaza, Associate Dean, MTH

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Missouri State University

Laura Derrick, Project Manager

Christner Architects:

Jeff Ryan, Design Principal

Stacey Wehe, Project Manager & Educational Planner

Jonathan Murphy, Project Designer

Natasha Dunwoody, Planner

IMEG Consulting Engineers provided additional structural and MEPFP consulting on the master plan.

While not members of the Core Committee, regular progress meetings were held with University Administration including:

Mark Wheeler, University Architect & Director of Planning, Design, and Construction

Frank Einhellig, Provost

Stephen Foucart, Chief Financial Officer

Jeff Coiner, Chief Information Officer

Matthew Morris, Vice President for Administrative Services

Jen Cox, Undergraduate Provost

Brad Kielhofner, University Engineer & Director of Facilities Management

A final presentation was made to Clifton Smart, University President, and this group on July 8th, 2020. While funding remains a question, the recommendations of this master plan were well-received during that meeting.

Process & Schedule

CNAS understood that their master plan would eventually be a reflection of the voices who contributed to creating it. To obtain diverse perspectives and build broad support, a highly inclusive process was embarked on beginning in the summer of 2019. Regular meetings were held with the CNAS Executive Committee and key strategic conversations occurred early in the process with CNAS staff including one on one conversations with each department head to review their goals and needs in detail. Two major series of engagement sessions were held; the first during the Discovery and Analysis Phase (August and September 2019) and the second during Options Development (November 2019). Engagement sessions were day-long events with open invitations issued to all department staff and faculty and student leaders.

Comprehensive analysis was performed on the existing buildings and site and a prioritized space program was developed in collaboration with the committee. Iterative design options were prepared in tandem with a live cost model until a preferred direction was unanimously selected. The final master plan recommendations were made to the Executive Committee in April, followed by a recommendation to University Administration and a final presentation to the University President in July 2020.

Master Plan Scope

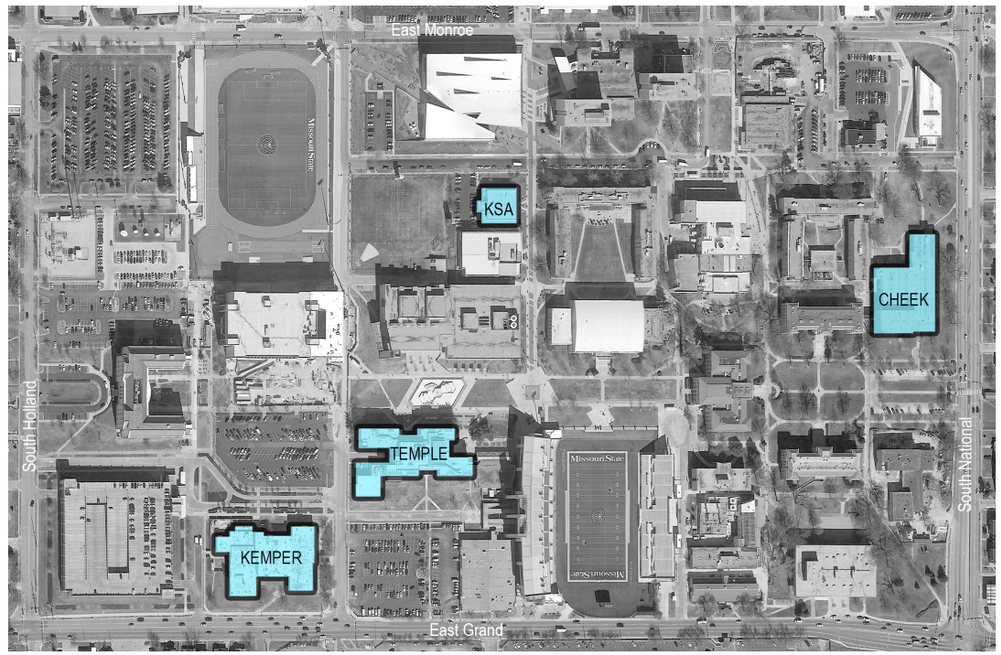
The College of Natural and Applied Sciences includes seven departments and one cooperative program in conjunction with University of Missouri Science and Technology. These departments are housed in several buildings across campus and utilize spaces in several more. This master plan will focus only on the following:

Departments:

1. Physics, Astronomy and Materials Science (PAMS)
2. Chemistry (CHM)
3. Biology (BIO)
4. Geography, Geology and Planning (GGP)
5. Mathematics (MTH)
6. Computer Science (CSC)

Buildings:

1. **Temple Hall;** originally constructed in 1971 is the largest CNAS building and main hub for CNAS. The building includes lab, academic, and office space for the biology, chemistry, and GGP departments and recent additions to the building include a state-of-the-art vivarium and new greenhouses.
2. **Cheek Hall;** originally constructed in 1955 as the University's Library was repurposed in the 1980's to house the mathematics and computer science departments. The building also includes the University's Computer Services department and some of the campus's main IT infrastructure.
3. **Kemper Hall;** constructed in 1975, is home to the physics, astronomy and materials science department. PAMS shares the building with MSU's construction management program and houses several high-bay and specialty lab spaces.
4. **Kings Street Annex** was constructed in 1982 as a book storage building for the library. Today it is home to the recreation, sport and park administration program. As CNAS needs have expanded beyond their available space, a portion of offices and labs, primarily for biology, were moved to this building.



It should be noted that the master plan will not address the Hospitality Leadership and Cooperative Engineering programs. Additionally, it will not address facilities that are not located on MSU's main campus including leased space downtown and the University's observatory.

SWOT Analysis

The SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis below was prepared by CNAS leadership as part of their recent Strategic Plan. The SWOT analysis formed the foundation of initial conversations with CNAS about their priorities, vision, and goals for the master plan.

Strength

- **Research**
- **Excellence in Teaching**
- Eternal Funding
- Instrumentation and Facilities
- **Outstanding Students**

Weakness

- **Dated Math & Science Teaching Facilities**
- **Lack of Research Space in the Sciences**
- **Recruitment is Challenging (with dated facilities)**

Opportunity

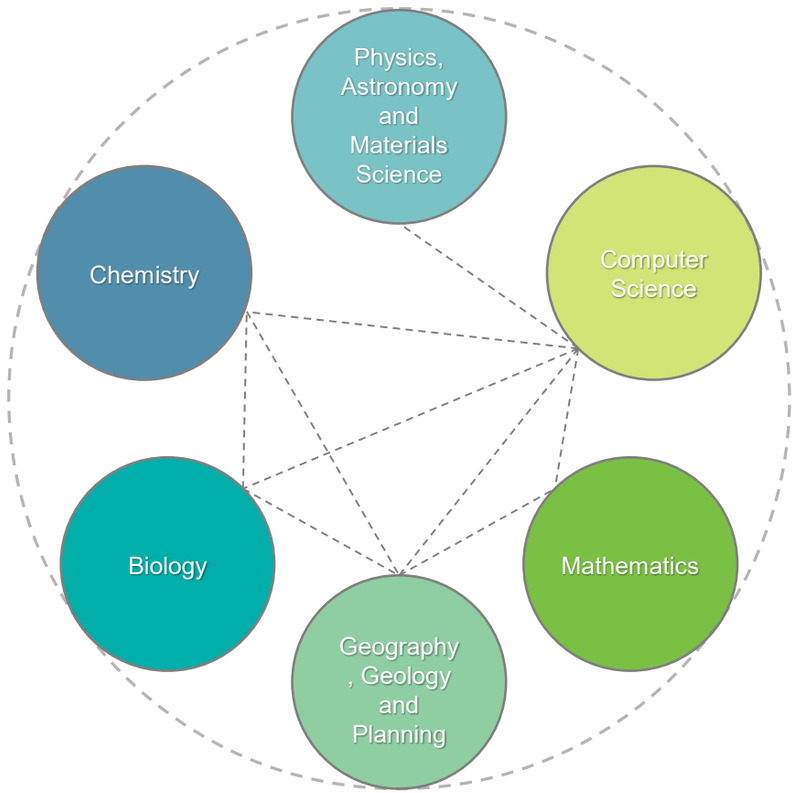
- Interest at Federal and State Level in increasing STEM graduates
- External Funding Opportunities in the Sciences
- PSM Program
- Strategic Uses of Online Education
- **Potential for Growth in Graduate Programs**

Threat

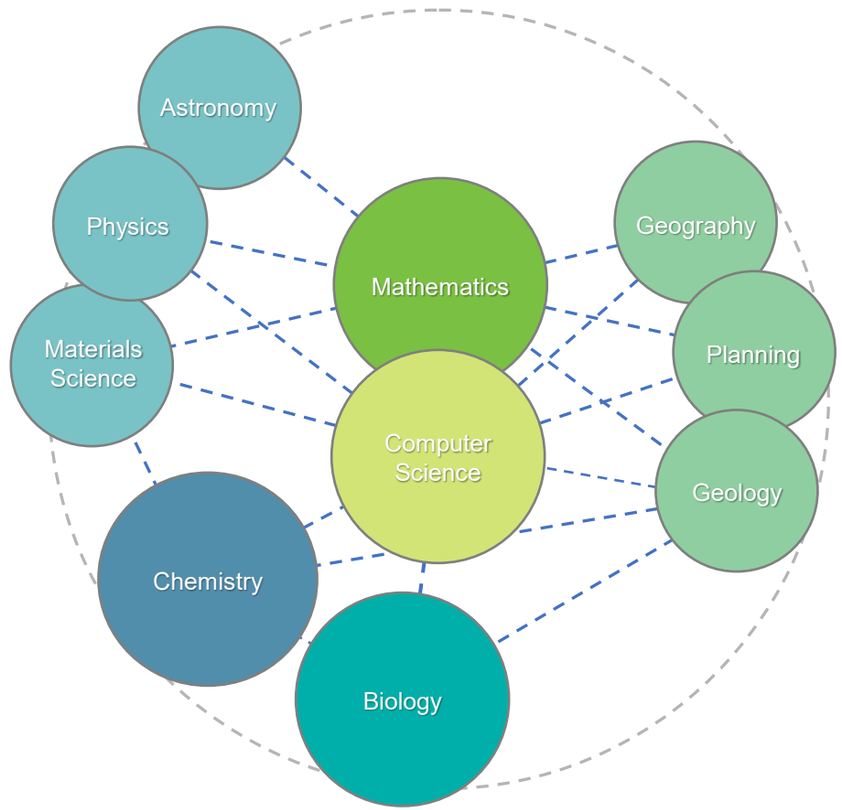
- **Lack of Space for Growth**
- Lack of Recurring Funding
- Decrease in Federal Grants
- **Lack of Outstanding STEM facilities impedes recruitment**
- Impact of Declining Enrollments on Tenure-Track Faculty

Collaboration Model

While CNAS aspires to encourage interdisciplinary collaboration across departments, its current facilities do not promote and enable collaboration. Departments are at times housed in several different buildings, and some CNAS buildings, such as Cheek, are physically more distant from the primary hub of CNAS, Temple Hall.



Current Model



Aspirational Model

Master Plan Goals

The following master plan goals were identified in collaboration with the CNAS Executive Committee with input and validation from the College's staff, students, and faculty. These goals formed the basis of the master plan and informed the prioritization of plan components and recommendations.

Provide for the Future of CNAS

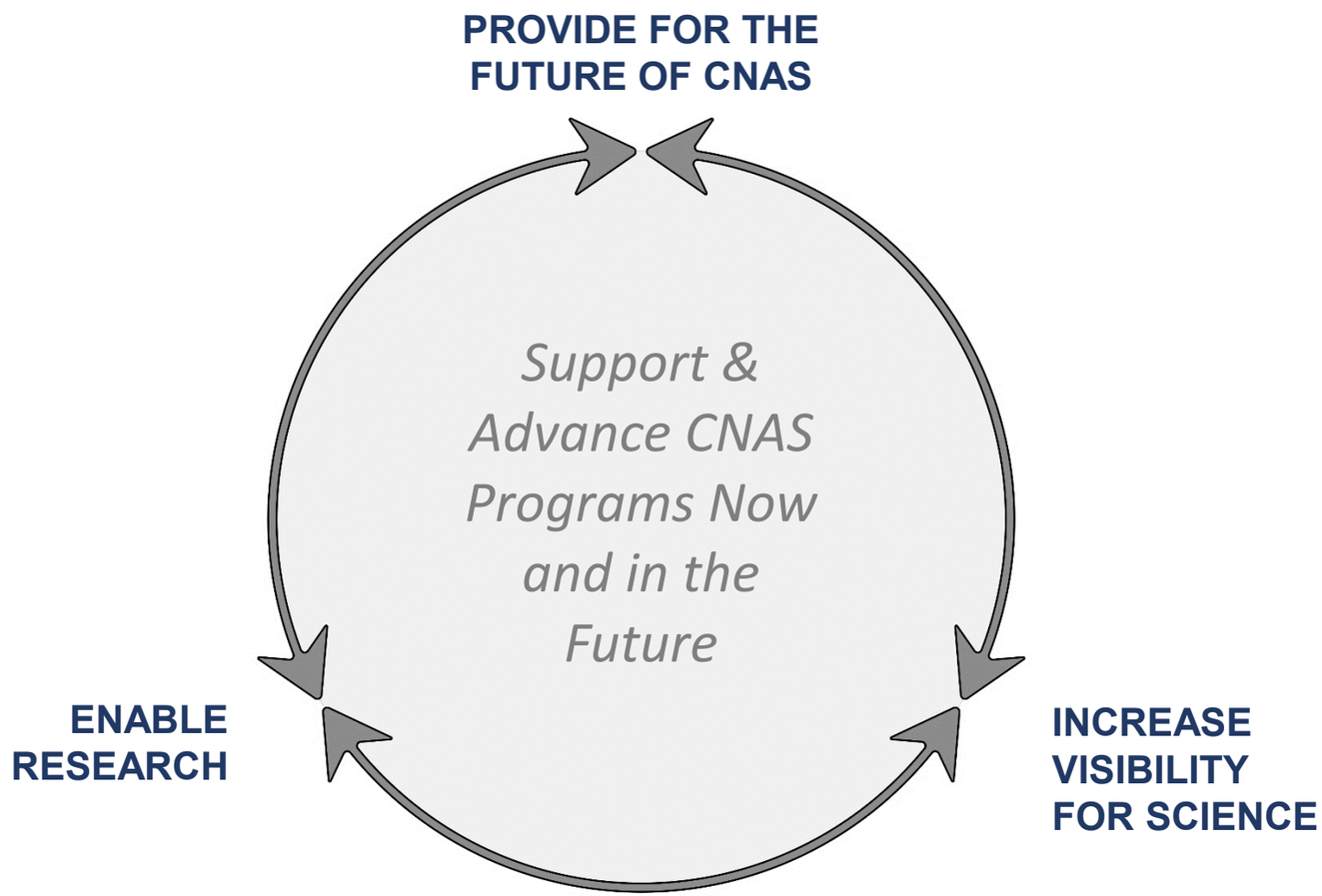
- Create a phaseable master plan that can be implemented over time.
- Increase current and future flexibility of classroom spaces.
- Right-size all spaces
- Create student-centered spaces
- Address deferred maintenance

Enable Research

- Create state-of-the-art, flexible research space
- Co-locate departments
- Empower and promote interdisciplinary connections

Increase Visibility for Science

- Communicate the activities occurring within buildings
- Showcase research and collections
- Inspire and engage campus in the CNAS experience.
- Enable accessibility and equity across all facilities

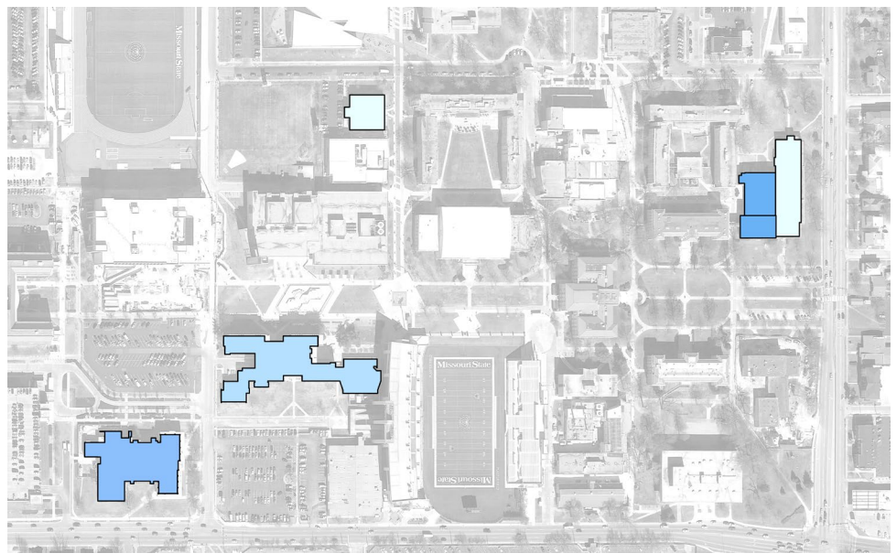


FACILITY ASSESSMENT

Facility Condition Assessment Summary

Extensive facility condition assessments were performed as part of the master plan. A high-level summary of findings are contained below and on the following pages with detailed reports included in the appendix of this report.

	Enclosure	Building Systems	Floor Plan	Spatial Quality	**Total Score** out of 100
Cheek Hall-Classroom Wing	10	13	16	14	**53**
Cheek Hall-Office Wing	5	8	2	2	**17**
Temple Hall	5	9	14	10	**38**
Kemper Hall	12	10	11	10	**43**
King Street Annex	9	8	2	2	**21**
	Out of 30	Out of 30	Out of 20	Out of 20	

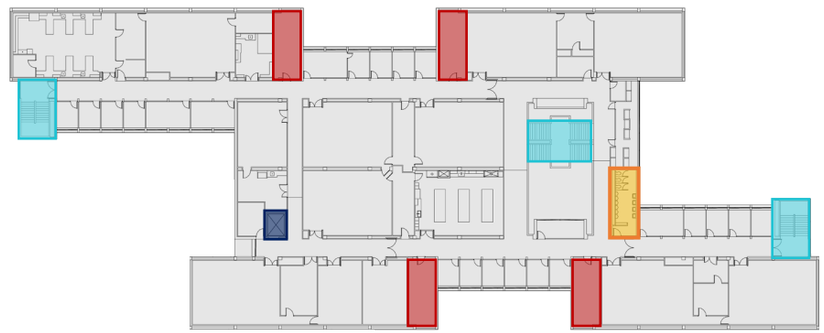


Enclosure refers to condition of walls and roof assemblies
Building systems refers to mechanical, electrical, and plumbing systems
Floor Plan refers to the efficiency and flexibility of the buildings' organization
Spatial Quality refers to interior conditions including access to natural light, aesthetics of finishes, and

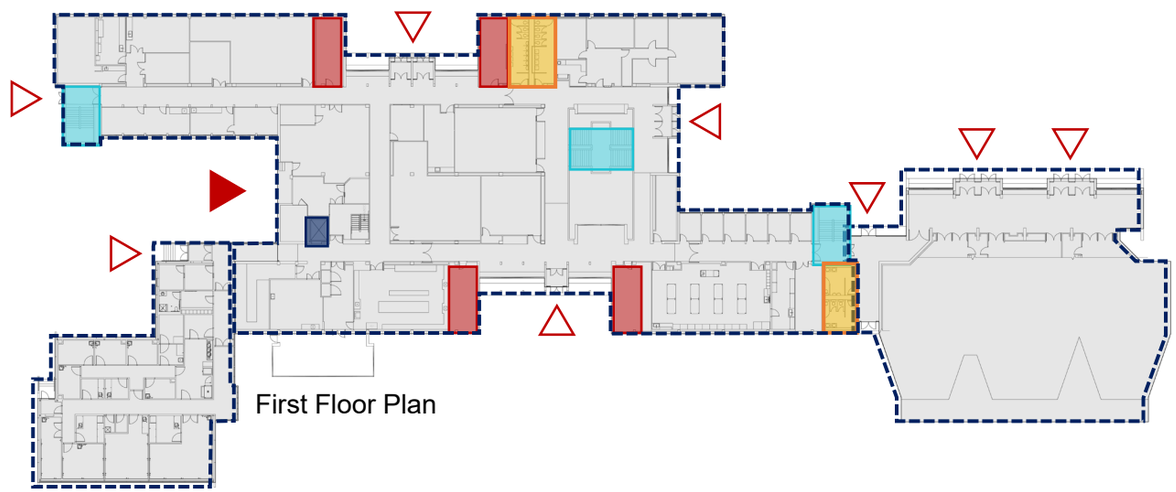
Facility Condition Assessment: Temple Hall

Temple Hall occupies a central location on campus, with frontage on the main academic quad. The building itself is brutalist in style, a somewhat polarizing architectural style that features a robust structure but somewhat unwelcoming façade. The building was designed with a highly efficient, but overly specialized floor plan that has inhibited long-term flexibility. The building's enclosure is performing poorly, and mechanical systems are maxxed out with no capacity for additional fume hoods or laboratory expansions.

- The building features a central communicating stair and two rated stairs.
- A single elevator serves the entire building. The elevator is used as both a service elevator and to provide ADA access to upper floors and the basement level. It is a limiting factor in serving the building and provides insufficient capacity for this size of building.
- Two banks of restrooms are provided on the ground floor but upper floors provide reduced fixture quantities and alternate by gender per floor. Equitable access and distribution is not provided on upper floors.
- Four mechanical rooms are provided on each floor. This provides efficient distribution to each wing of Temple Hall, but the mechanical rooms and undersized and flanked by labs providing limited opportunities for expansion.
- Loading dock
- Building Entry. Over 8 entry points are provided on the ground floor of Temple Hall. While this provides easy access from all directions, it presents security and access control challenges.



Typical Floor Plan



First Floor Plan

A recent addition, this 1-story wing features a state-of-the-art vivarium.

The central research building includes 4 stories plus a basement of classroom spaces, teaching and research labs, and offices.

The 1-story Classroom Wing features 3 large auditoriums.

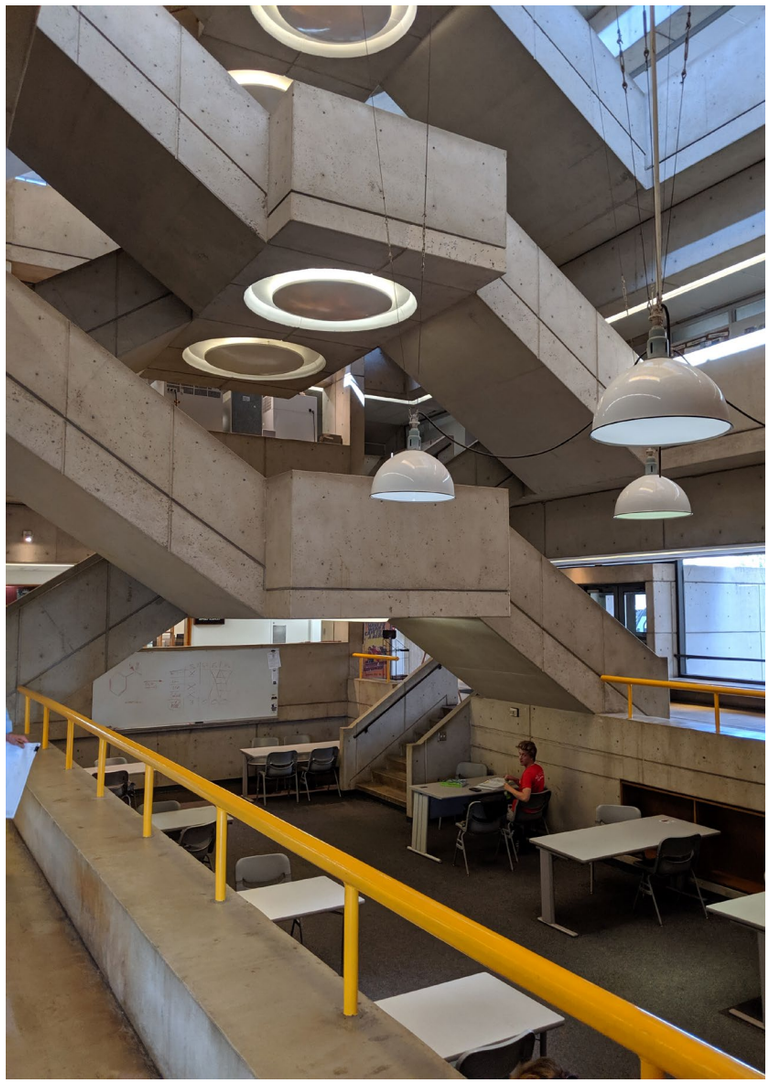
Temple Hall

North elevation of Temple Hall along the main academic quad (left and far left).

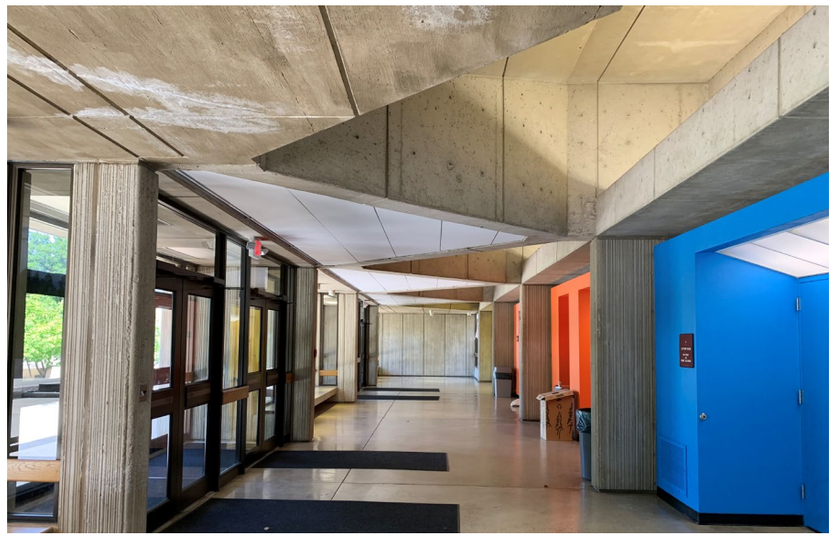
Existing northeast entry to Temple (below left and below far left).

New vivarium addition at the southwest corner of Temple Hall (below).

Temple Hall



Main communicating stair and student lounge.



Typical corridor and typical auditorium classroom.

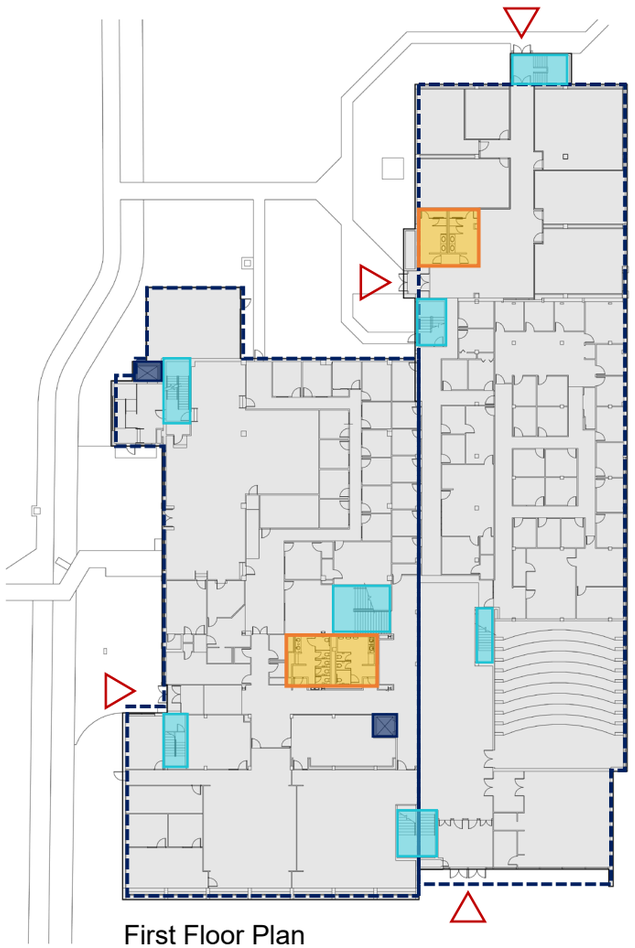
Typical teaching laboratory and research laboratory.

Facility Condition Assessment: Cheek Hall

Cheek Hall is on the periphery of the historic quad, adjacent to National Avenue. While this location is prominent along a major arterial road and central to some academic buildings, it is remote from other CNAS buildings which inhibits collaboration and casual socialization.

Originally constructed as a library, the building has significant wayfinding challenges that are compounded by floor levels not aligning across the two bars of the building. The mezzanine is particularly challenging with its low floor to floor heights and life safety and accessibility challenges. Overall, the deep floor plates result in limited access to daylight and the ad hoc approach to building system upgrades over the years has resulted in a patchwork of systems that are generally beyond their useful life.

- The building includes over seven stairs, four within rated enclosures and three open communicating stairs connecting varying levels of the building. The abundance of vertical circulation contributes to wayfinding challenges within the building.
- Two elevators serve the building. While the central elevator is easily identifiable, the northwest elevator is hidden and not easily accessible.
- Two banks of restrooms are provided in convenient, central locations.
- Mechanical spaces are primarily located in the basement and supplemented with rooftop mechanical equipment.
- Cheek Hall does not have a loading dock.
- Four main building entries are provided. These tie closely to primary circulation patterns around the building and are intuitively located.



First Floor Plan

The 3-story western bar of the building holds classrooms, offices, and the University's Computer Services department.

The main podium bar includes a large mezzanine and holds a large auditorium, several classrooms, and offices.

Cheek Hall

South elevation of Cheek Hall (above and above right).

West elevation (near right).

Northwest corner of Cheek (far right). While the south elevation has plentiful windows, the remaining elevations have little to no windows, creating an imposing, inhumane impression to nearby pedestrians and interior spaces.

Cheek Hall

Main lobby / entry space (above). Existing social space (above right). The building is punctuated by recent renovations such as the computer lab (above) and classroom (above right), which modernize spaces but fall short of holistic upgrades to the building and systems.

Main lobby / entry space (above) with a view to the mezzanine stairs (above center).

Facility Condition Assessment: Kemper Hall

Kemper Hall, another brutalist building has similar challenges to Temple. The robust structure is well-suited to the laboratories within this building, but the overall appearance of the building is not welcoming. The "robustness" of the building translates to interior spaces as well, creating cold and uncomfortable student-centered and social areas. The deep floor plate of the building limits access to daylight in several areas. The building itself is very well-suited to its current spaces, but the irregular floor plan limits flexibility and repurposing of spaces.

The building includes four main stairs (two central communicating stairs and two rated stair enclosures). The office suite mezzanine and several high bay labs necessitate several other short-run stairs. Since these additional flights are all contained within enclosed spaces, they do not confuse general circulation patterns.

One central elevator serves the building with an additional lift utilized in the office mezzanine to serve both levels.

A central bank of restrooms is provided on each level.

Mechanical spaces are primarily located in the basement and supplemented with rooftop mechanical equipment.

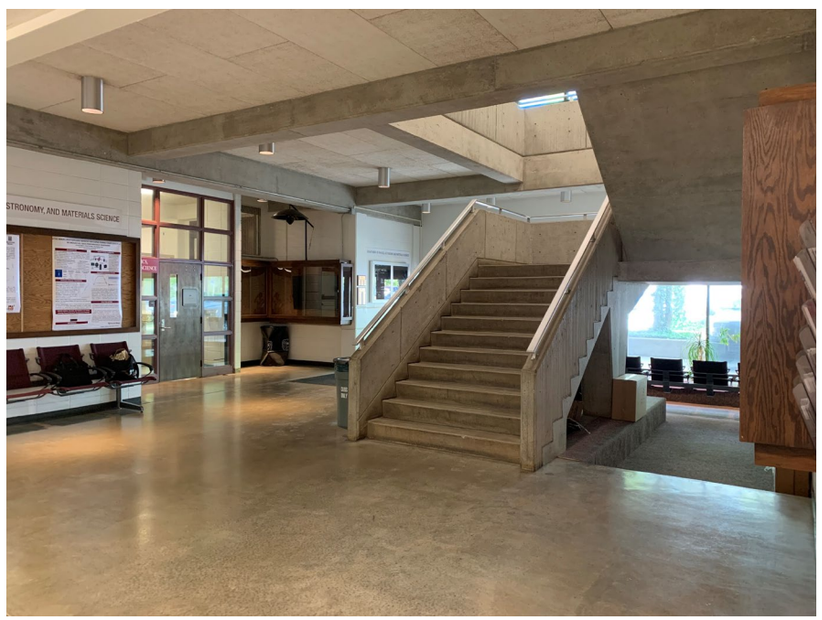
A generous loading dock and service yard is located at the rear of the building and serves several labs.

Two main building entries are provided. These tie closely to primary circulation patterns around the building and are intuitively located.

First Floor Plan

Kemper Hall is primarily a 2-story building with several high-bay labs located along the western section of the building.

Kemper Hall

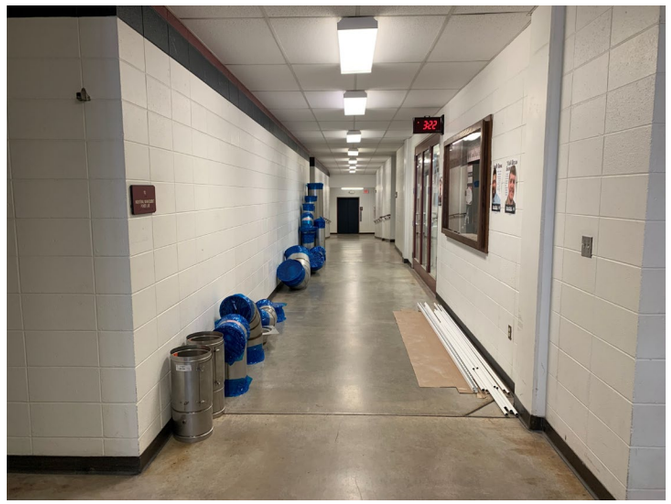


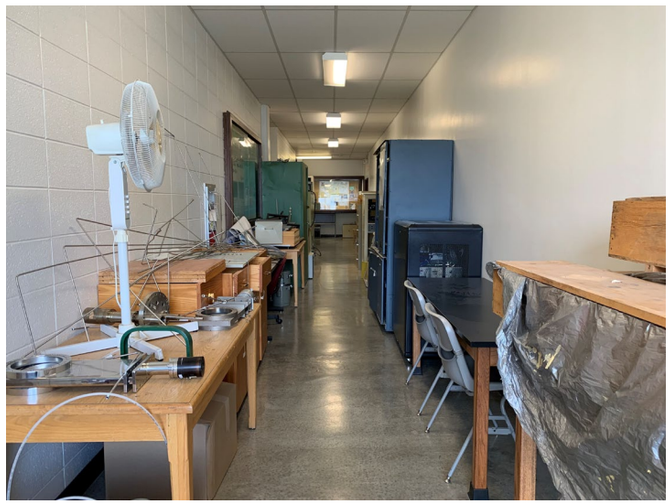
Main elevation of Kemper Hall (above).

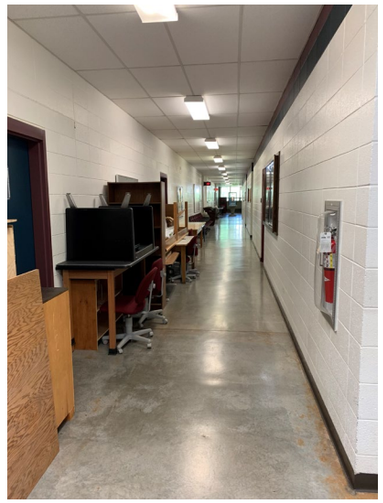
West elevation (above right).

Main entry / social space (right).

Kemper Hall

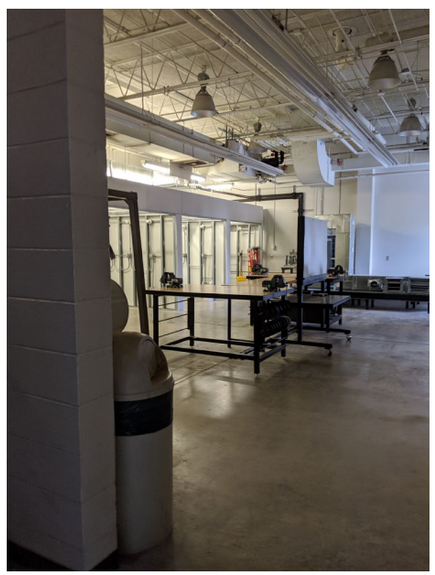


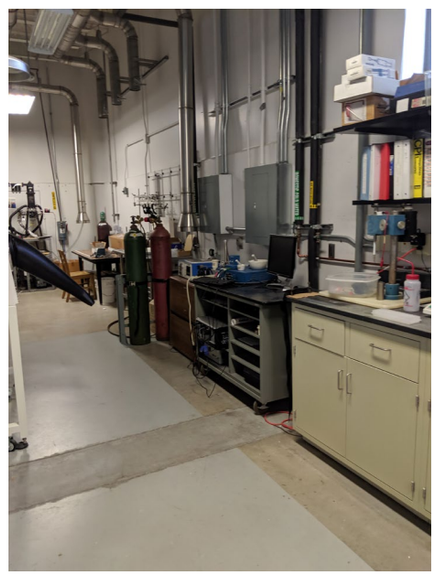




Typical corridor spaces (left) are utilitarian and lined with storage due to a building-wide shortage of laboratory support spaces.

Typical high bay teaching and research labs and a typical classroom (below).





Facility Condition Assessment: Kings Street Annex

Originally constructed as a storage building for books, Kings Street Annex has no exterior windows and an aesthetic that falls below the expectations set elsewhere on campus. The intuitiveness of the racetrack circulation corridor is made confusing by the split-level nature of the building and inherent disorientation resulting from the lack of windows and connection to the exterior. The tight and compartmentalized floor plan is efficient but has limited flexibility and has been adapted to serve CNAS needs out of necessity.

The remote location of the building, poor spatial quality, and limited flexibility make this an undesirable building. Overall, Kings Street Annex has significant deficiencies and limited potential for future use by CNAS.

The building includes three main stairwells, one of which is a communicating stair that only connects two floors.

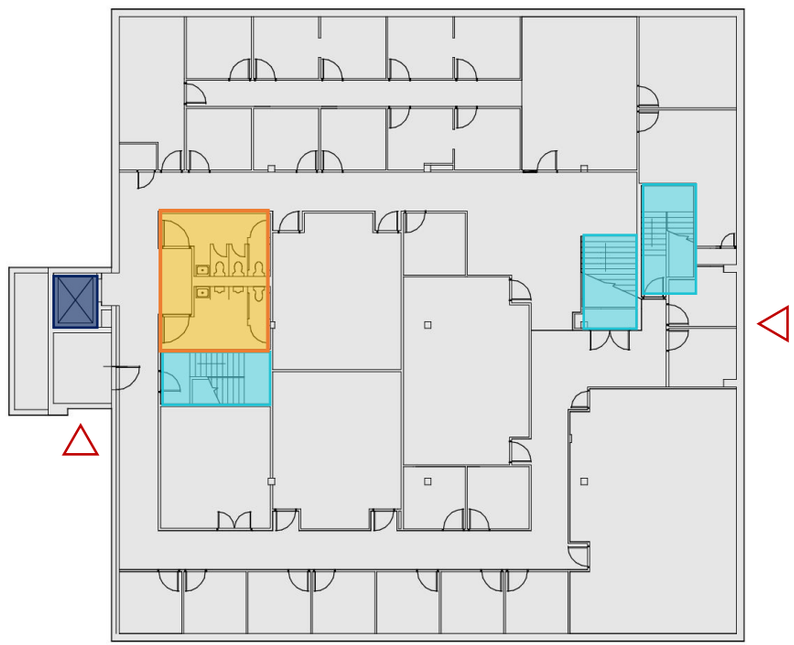
One elevator serves the building. With the split-level condition, this creates only one accessible entry to the building.

A central bank of restrooms is provided on each level.

Mechanical spaces are primarily located in the basement and supplemented with rooftop mechanical equipment.

Kings Street Annex does not have a loading dock.

Two main building entries are provided.



Lower Level Floor Plan

Kings Street Annex is a 3-story building with a split-level entry. It holds a wide variety of spaces including classrooms, teaching labs, and research labs.

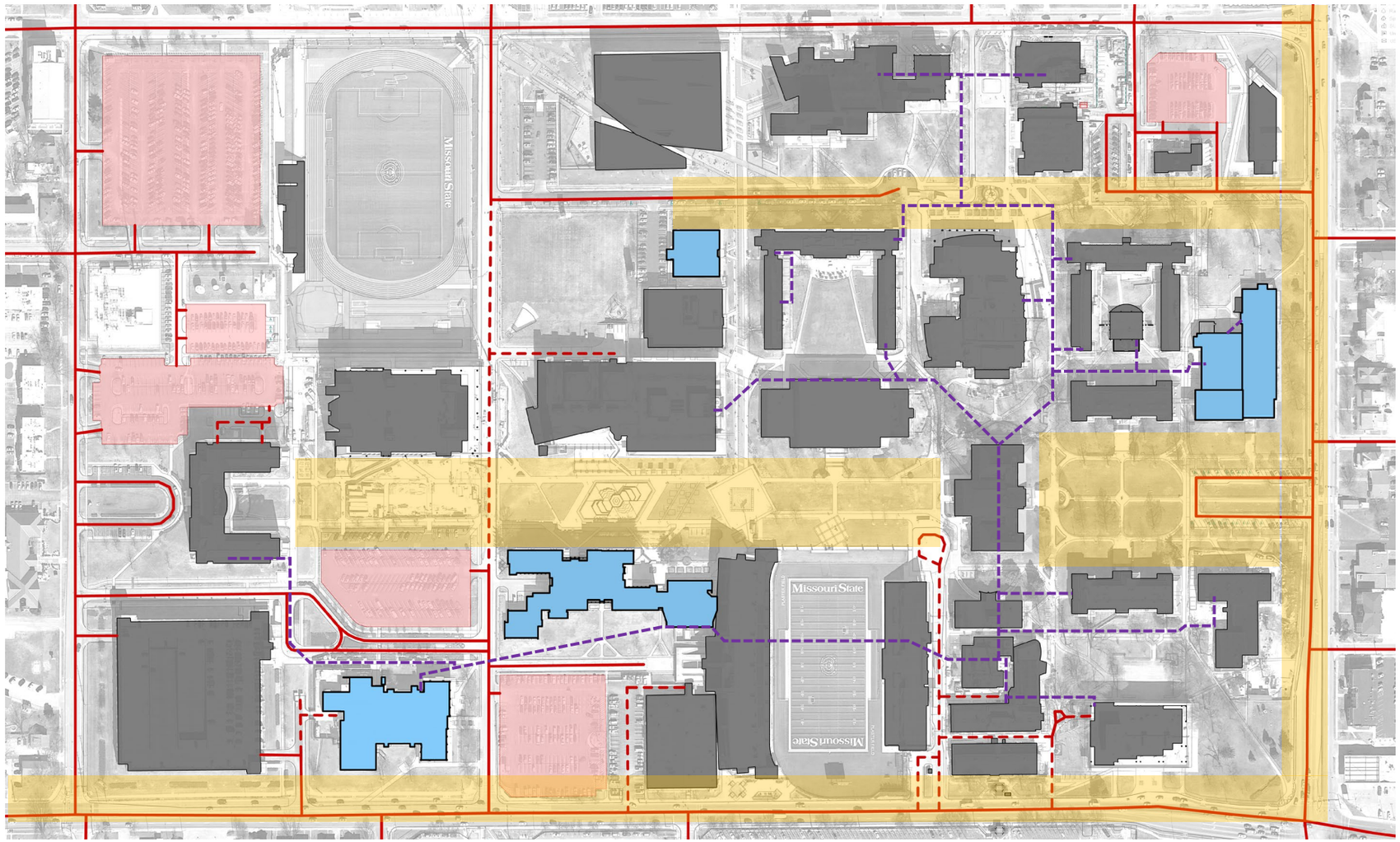
Kings Street Annex

Main exterior elevation and front door to Kings Street Annex (above).

Typical classroom space and a typical corridor (above).

Site Assessment

- General Vehicular Access. Over time campus has gradually decommissioned several vehicular circulation paths internal to campus. The roads and bus drop-off between Temple and Kemper present an impediment to enhanced connectivity between those buildings.
- Shuttle / Campus Vehicular Access
- Parking Lot
- Preserved Space. Campus features several large preserved greenspace quads that are punctuated with smaller scale quads. Any construction should preserve the established setbacks of these areas.
- Campus Utility Tunnel. While underground utilities exist throughout campus, the main campus utility tunnel has been identified as it will be exponentially more expensive to re-route it.



SPACE ASSESSMENT & RECOMMENDATIONS

Space Inventory Overview

The design team collected a detail inventory of spaces to understand space allocations and space uses. The inventory was captured through walk-throughs and visual observations of buildings, the CNAS phone list and online directories of spaces, input from facilities personnel, and individual departmental discussions to understand use. Inventory plans were created by department and by use with all data forming the foundation of space assessments and recommendations.

Full inventory plans have been provided in the Appendix.

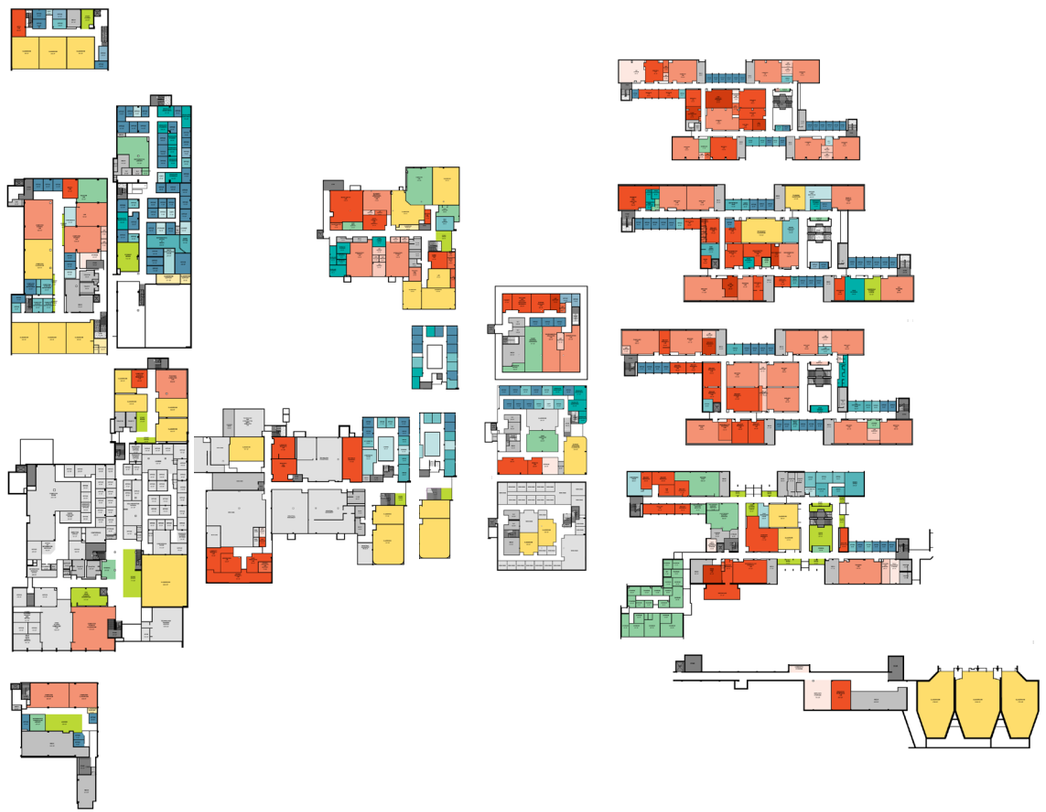
Plans by Department Legend

- Biology
- Chemistry
- Computer Science
- GGP
- Mathematics
- PAMS
- Core (Shared)
- Academic (Shared)
- General CNAS
- Student Space
- Building Services
- Vertical Circulation
- Non-CNAS Space

Plans by Use Legend

- Classroom
- Research Lab
- Teaching Lab
- Lab Support
- Office
- Conference Room
- Resource
- Student Space
- Building Services
- Vertical Circulation

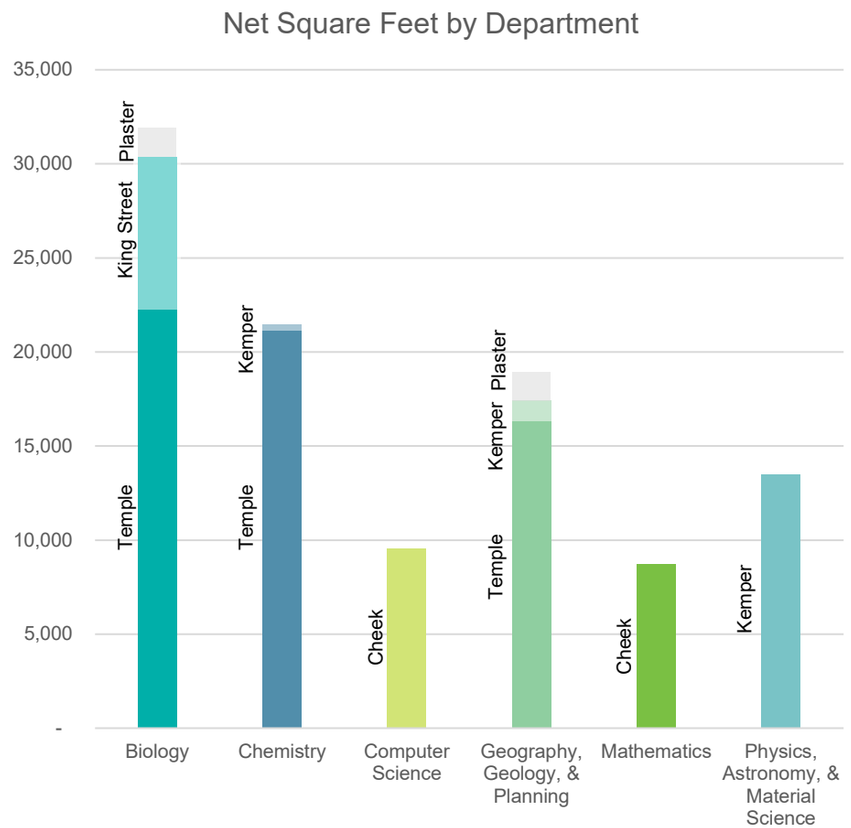
Plans by Department

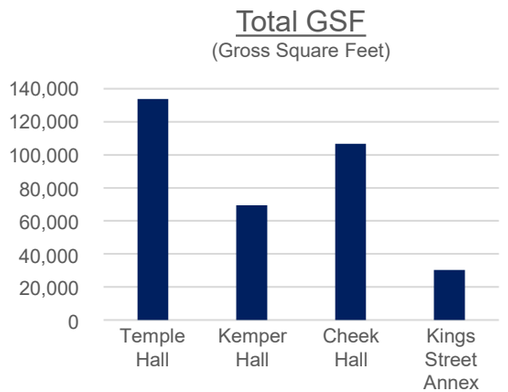


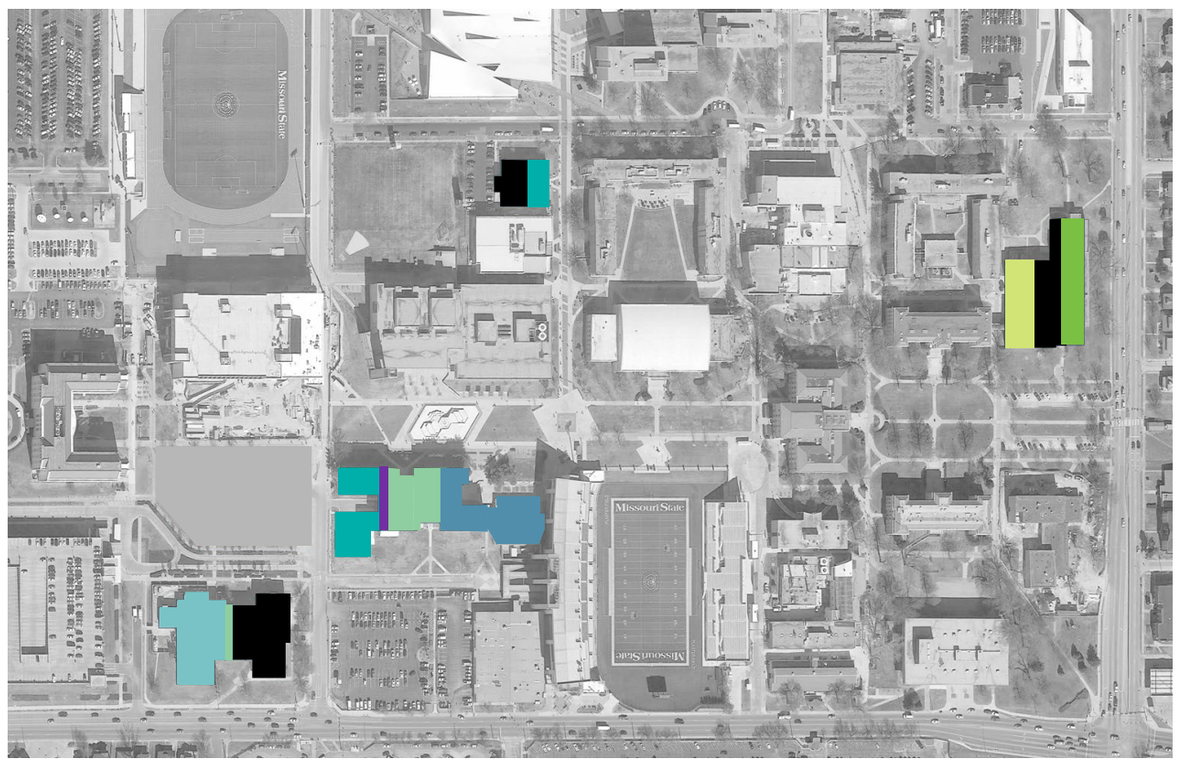
Plans by Use

Space Inventory Overview

While some departments are co-located within the same building, others (specifically biology) are distributed across several buildings and require additional facilities outside of the core CNAS buildings, such as Plaster Stadium. Additionally, while some buildings (specifically Temple) house only CNAS departments, other buildings house departments from multiple colleges.







Total Existing CNAS Net Square Feet = 155,197

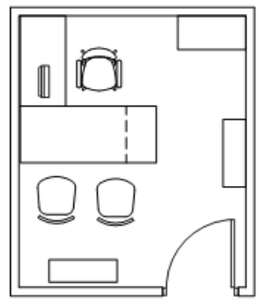
Note: Hospitality and Engineering programs have been excluded from this analysis. Additionally, CNAS utilizes several classrooms across campus. These classrooms are shared with other Colleges and not included in this inventory.

Office Assessment

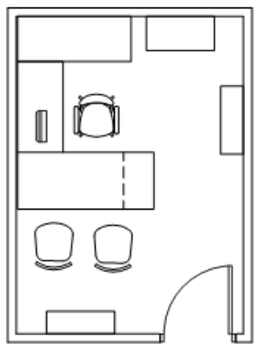
CNAS buildings include a range of faculty and graduate student office sizes. On average, faculty offices fall below the University's standard space allocations. While the University has set standard office sizes for faculty, there is no campus standard for graduate students. Regardless, there is significant disparity across departments at allocations for graduate student offices.

Department	Faculty Count	Total Faculty Office Net Square Feet	Average Square Foot / Faculty Office
Biology	28	2,691	96
Chemistry	18	1,789	99
Computer Science	9	1,128	125
Geography, Geology, & Planning	22	2,011	91
Mathematics	40	4,291	107
Physics, Astronomy, & Material Science	12	1,496	125
Total	**129**	**13,406**	**104**

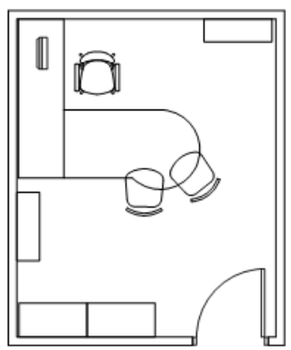
Department	Graduate Student Count	Total Graduate Student Office Net Square Feet	Average Square Foot / Graduate Student Office
Biology	45	1,419	32
Chemistry	20	136	7
Computer Science	10	429	43
Geography, Geology, & Planning	30	754	25
Mathematics	6	793	132
Physics, Astronomy, & Material Science	20	1,239	62
Total	**131**	**4,770**	**36**



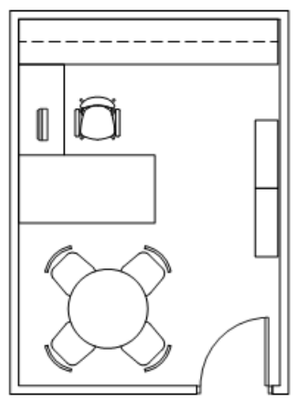
Typical Faculty Office
120 NSF



Typical Faculty Office
140 NSF



Typical Department Head Office
160 NSF



Typical Director Office
185 NSF

Student Space Assessment

The student spaces analyzed include general lounge space, dedicated student lounges, student meeting rooms, café spaces and vending. Student offices are not included in this assessment.

On average, approximately 3% of CNAS net square feet is allocated to students. This allocation falls just below the minimum range for student-centered spaces. Appropriate allocations for student-centered spaces encourage student collaboration and mentoring, improve socialization, and assist in attracting and retaining students.

Building	Net Square Feet of Student Space	% of Building Net Square Feet
Temple	2,328	2%
Kemper	593	1%
Cheek	3,427	6%
Kings Street Annex	0	0%

Existing net square feet / Enrolled Student = 3.9
Recommended net square feet / Undergraduate Student = 5*
Recommended net square feet / Graduate Student = 8**

Existing net square feet Student Space = 6,348
Recommended net square feet of Student Space = 6,870-11,370
(Low end assumes 3 net square feet/undergraduate and 5 net square feet/graduate,
High end assumes 5 net square feet/undergraduate and 15 net square feet/graduate)

*Industry benchmark ranges for a Midwestern public university are 1 – 5 net square feet / undergraduate student
**Industry benchmark ranges for a Midwestern public university are 5 – 15 net square feet / graduate student

Laboratory Observations

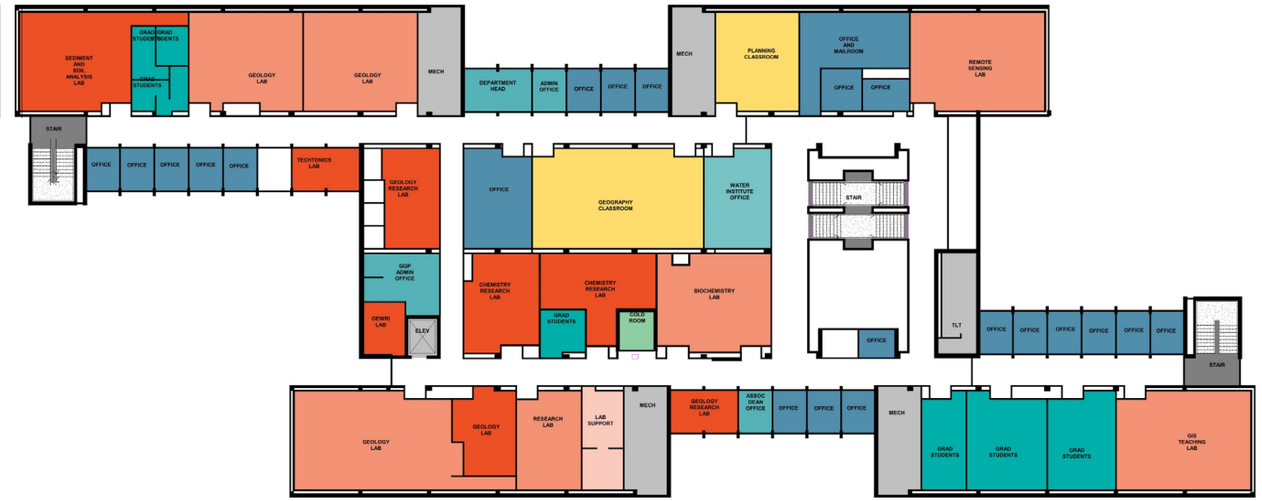
In walking CNAS buildings and analyzing floor plans, the following observations were made regarding laboratory spaces.

PROS

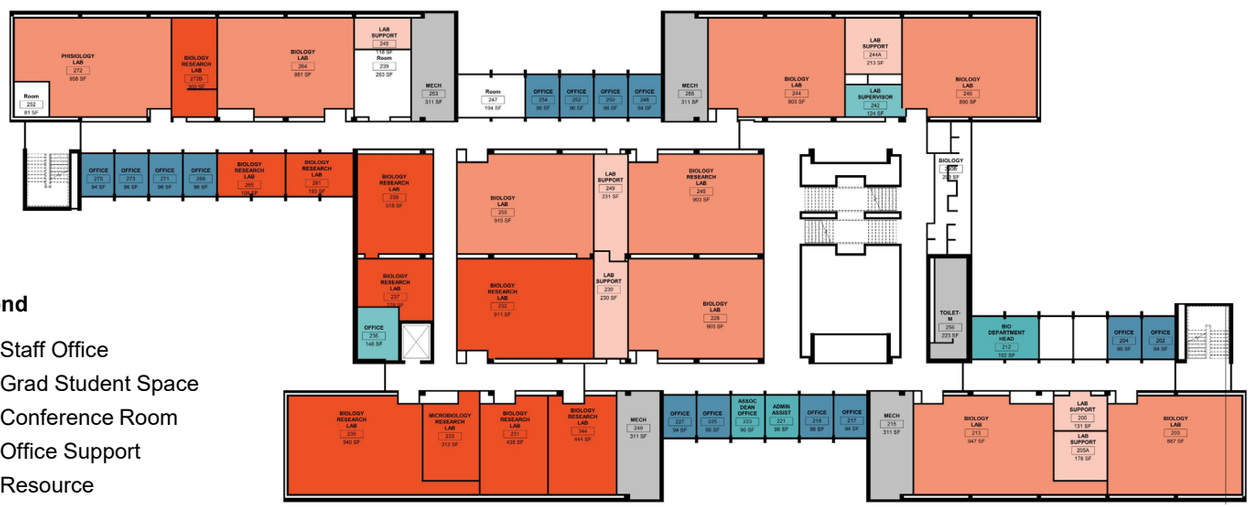
- Laboratory support areas have generally good locations and relationships to lab locations
- Corridor accessibility to labs and support areas is beneficial
- Layout of labs on floor plate always allows for 2 means of egress
- Office spaces are near labs

CONS

- Lab support / core support areas appear significantly undersized. Lab storage was frequently observed in public corridors.
- Soft spaces, meeting areas, and collaboration areas do not exist
- Research spaces are taking over office area, perhaps from a lack of support space.



Temple Hall 3rd Floor
Chemistry / Biology



Temple Hall 2nd Floor
Physiology / Biology

Room Type Legend

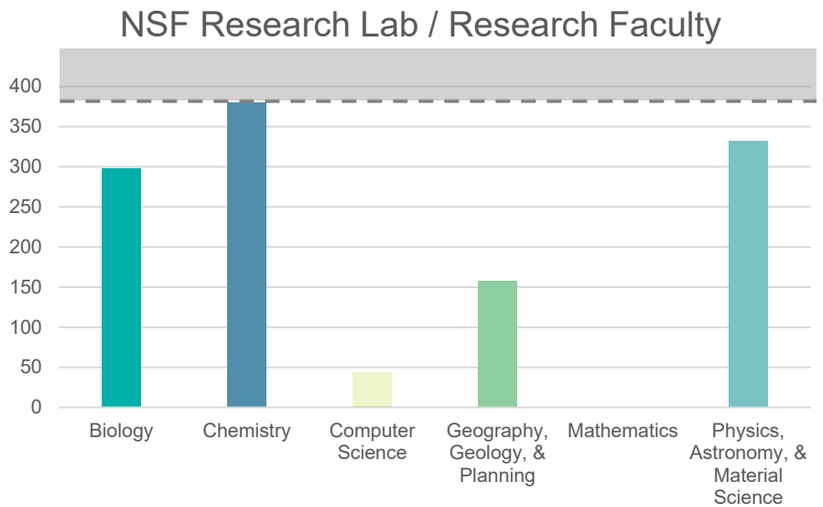
- Classroom
- Classroom Support
- Research Lab
- Teaching Lab
- Lab Support
- Faculty Office
- Admin Office
- Office
- Staff Office
- Grad Student Space
- Conference Room
- Office Support
- Resource
- Student Space
- Building Services
- Vertical Circulation

Laboratory Assessment: Research Labs

In collaboration with department heads, quantities of faculty and student researchers were compiled and analyzed. It was immediately apparent that the annual fluctuations in quantities of both faculty and student researchers demand a highly flexible solution for research labs.

Additionally, when comparing square foot recommendations for academic research labs, most labs fell below minimum recommendations.

Department	Research Lab NSF	Research Lab Count	Research Lab size range (SF)	Faculty Count (Research)	Avg NSF Research Lab/Faculty
Biology	8,334	21	193-940	28	298
Chemistry	6,852	12	296-1,117	18	381
Computer Science	396	1	309	9	44
Geography, Geology, & Planning	3,471	11	36-970	22	158
Mathematics	-	0	-	40	0
Physics, Astronomy, & Material Science	3,985	6	396-1,104	12	332



Research Lab Size Recommendation (Bio, Chem, Geo, PAMS):
380 - 580 net square feet / research faculty

The quantity of faculty members doing research varies from year to year; requiring a flexible solution to research labs.

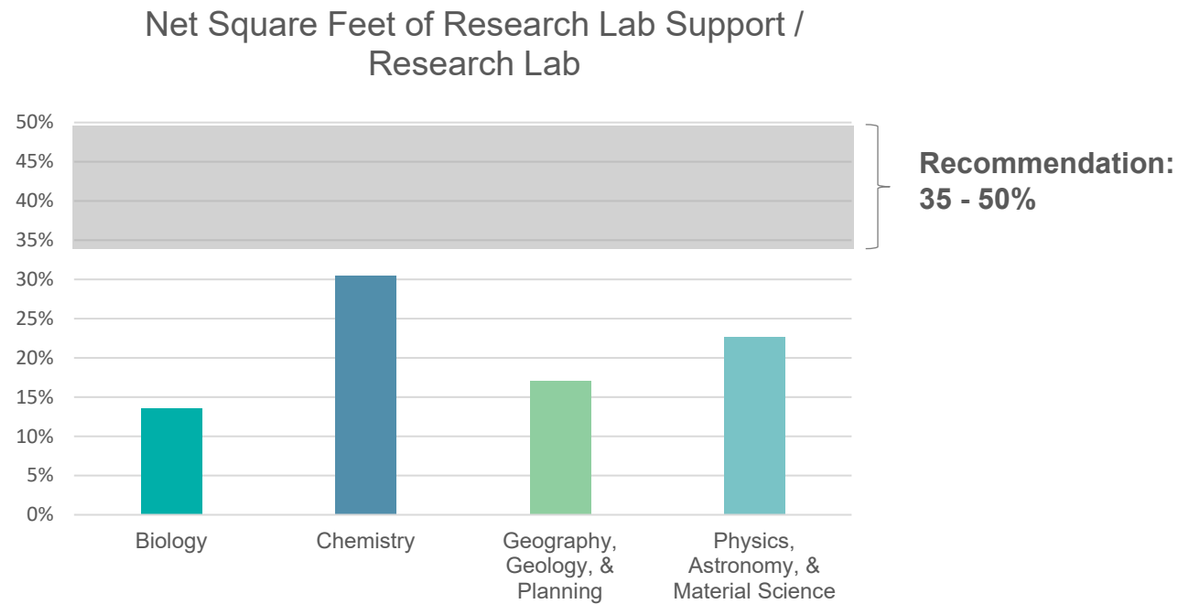
Undergraduate and graduate students doing research vary significantly from year to year and can experience significant swings in the quantity of students in specific labs. Additionally, especially with undergraduate research, there may be several undergraduate students doing research within a lab but no more than one or two students in the lab at a time.

Research Students		
Department	**Undergrad**	**Graduate**
Biology	32	45
Chemistry	25	20
Computer Science	20	10
Geography, Geology, & Planning	25	30
Mathematics	5	6
Physics, Astronomy, & Material Science	12	20

Laboratory Assessment: Research Lab Support

Laboratory support areas include storage and shared instrumentation spaces were inventoried for CNAS. Overall, there is a significant deficit of support areas which significantly impedes the usability of spaces as alternatives must be found for storage including personal offices, corridor spaces, and labs themselves which creates unsafe conditions in several areas.

	Net Square Feet of Research Lab	Net Square Feet of Research Support	Net Square Feet of Research Support / Lab
Biology	8,334	1,133	14%
Chemistry	6,852	2,091	31%
Geography, Geology, & Planning	3,471	595	17%
Physics, Astronomy, & Material Science	3,985	905	23%



Research lab to lab support ratios are typically 1:1 (100%) for research institutions and can be as low as 1:3 (33%) when support is shared in academic institutions as there are efficiencies in storage and shared instrumentation.

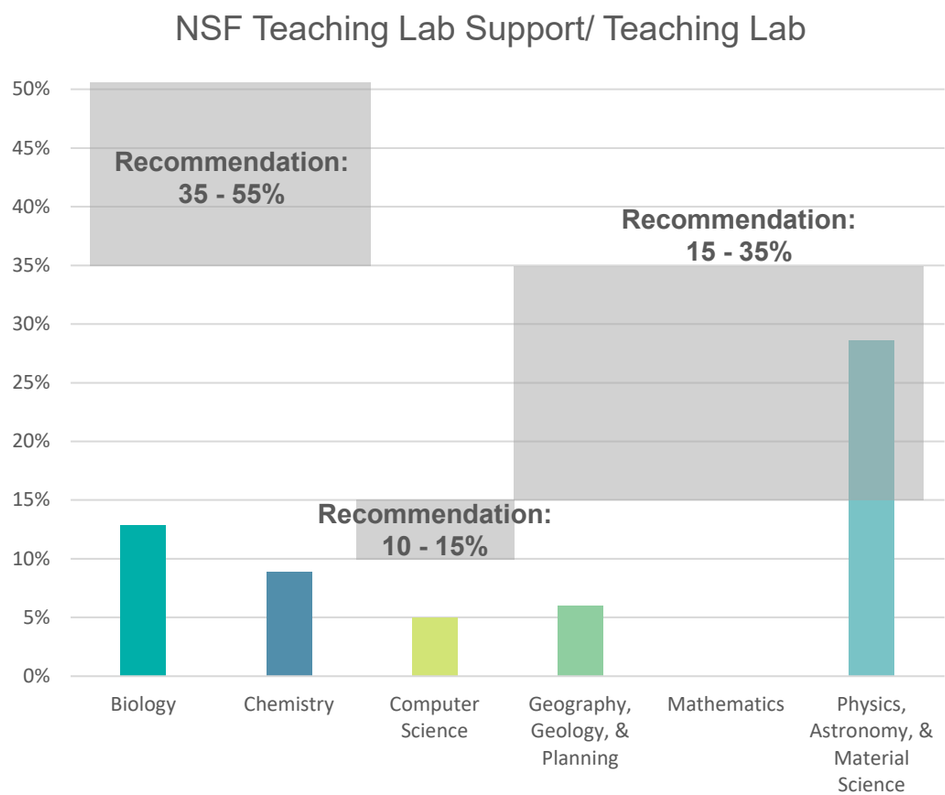
At Missouri State, since research activities are combined in the same buildings with teaching; ratios of approximately 35 - 50% can be achieved. Traditionally, lab support for physics is on the lower end of that range, with lab support for life sciences being on the higher end of the range.

It should be noted that lab support spaces are needed for computer science, although a much lower range is adequate for this program; typically 10 – 15% of research lab space.

Laboratory Assessment: Teaching Lab Support

Similar to research labs, teaching lab support areas include storage and shared instrumentation spaces as well as prep space where activities can be prepped before class. Overall, there is a significant deficit of support areas which significantly impedes academic uses of these spaces and the ability of faculty to effectively share teaching labs.

Department	NSF Teaching Lab Support / Student	Teaching Lab Support / Teaching Lab	Benchmark
Biology	2	13%	34-55%
Chemistry	4	9%	34-55%
Computer Science	0	5%	10-15%
Geography, Geology, & Planning	2	6%	15-35%
Physics, Astronomy, & Material Science	10	29%	15-35%



The average recommended ratio of teaching lab to support space is 34%, but advanced labs can require up to 55%. Recommendations for physics labs vary based on the ratio of theoretical to experimental research and the type of research occurring. Material Science recommendations vary significantly based on the type of research occurring as well. In GGP, Geology labs will require support space in the 35% range while other labs will require less.

Academic Space Assessment

Academic spaces including classrooms and teaching labs were analyzed. To perform this analysis, data was obtained from the Registrar's Office for the most recent 4 semesters: Fall 2019, Spring 2019, Fall 2018, and Spring 2018. Data from summer semesters has been excluded.

Only CNAS courses have been analyzed. We understand that other College's may use some of these spaces as well, which of course skews the data. Within CNAS, Hospitality courses have been excluded from the data as that program operates from the downtown campus and is not a focus of this study.

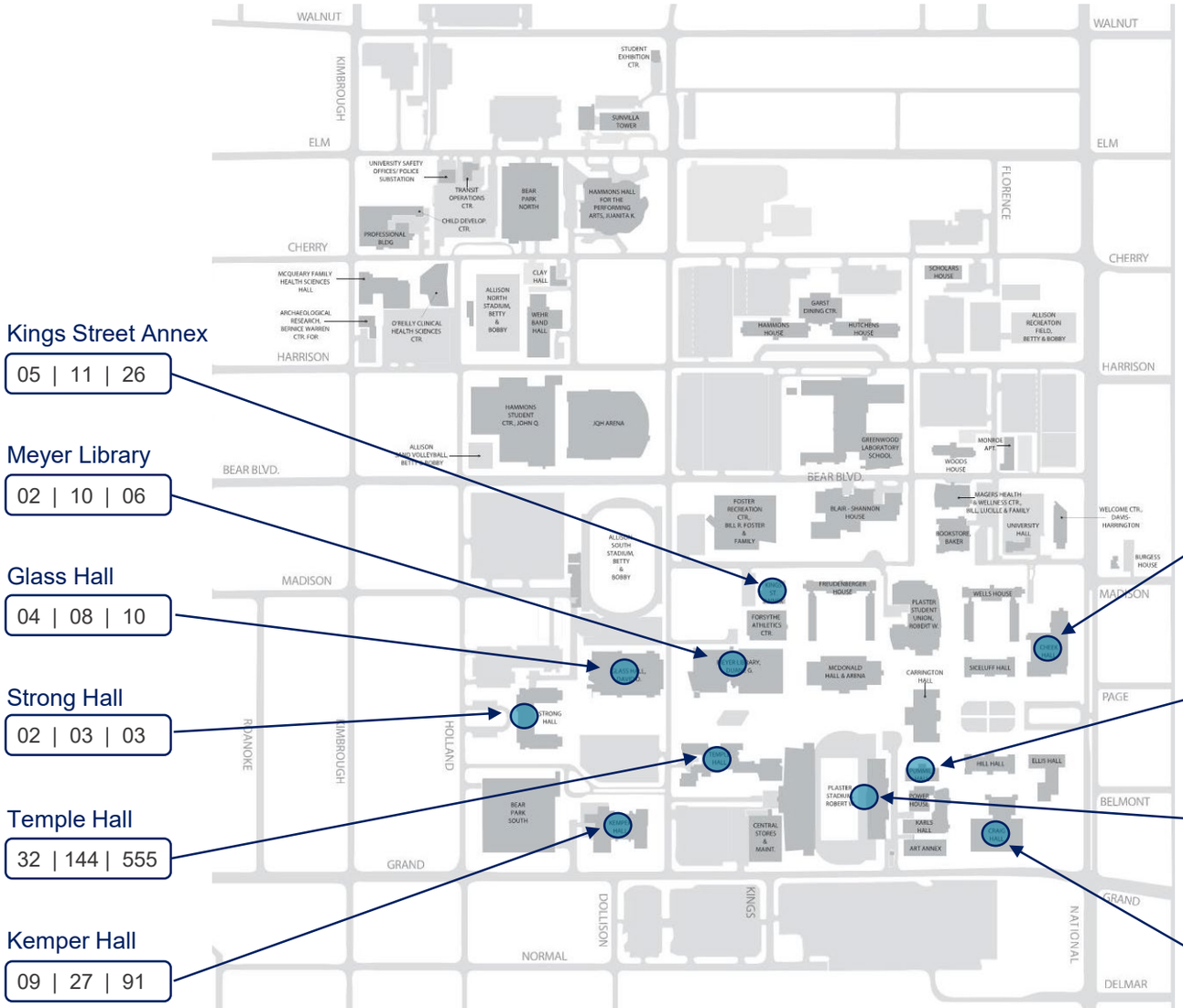
It's important to note that this analysis is based on past data. It is a reflection of how CNAS has been using spaces; not how they want to be using spaces. Additionally, the analysis is only as good as the data provided. We fully expect that there are small discrepancies between the data received and the reality of how a space functions. Additionally, there are often discrepancies between the perception of how a space is used as our analysis focuses on recorded data and does not include informal uses.

CNAS holds classes across **12 – 17 different buildings** depending on the semester.

On average, approximately **350 courses** are taught in **91 different classrooms**, with **over 940 hours of instruction per week** occurring each semester.

80% of all CNAS courses are taught within Temple, Cheek, and Kemper.

Most of the remaining courses – 14% - are taught in Plaster Stadium and PCTR.



Kings Street Annex
05 | 11 | 26

Meyer Library
02 | 10 | 06

Glass Hall
04 | 08 | 10

Strong Hall
02 | 03 | 03

Temple Hall
32 | 144 | 555

Kemper Hall
09 | 27 | 91

CASV
01 | 01 | 02

CASY
01 | 01 | 04

PCTR
09 | 27 | 69

Cheek Hall
16 | 83 | 103

Pummill Hall
01 | 01 | 01

Plaster Stadium
05 | 31 | 57

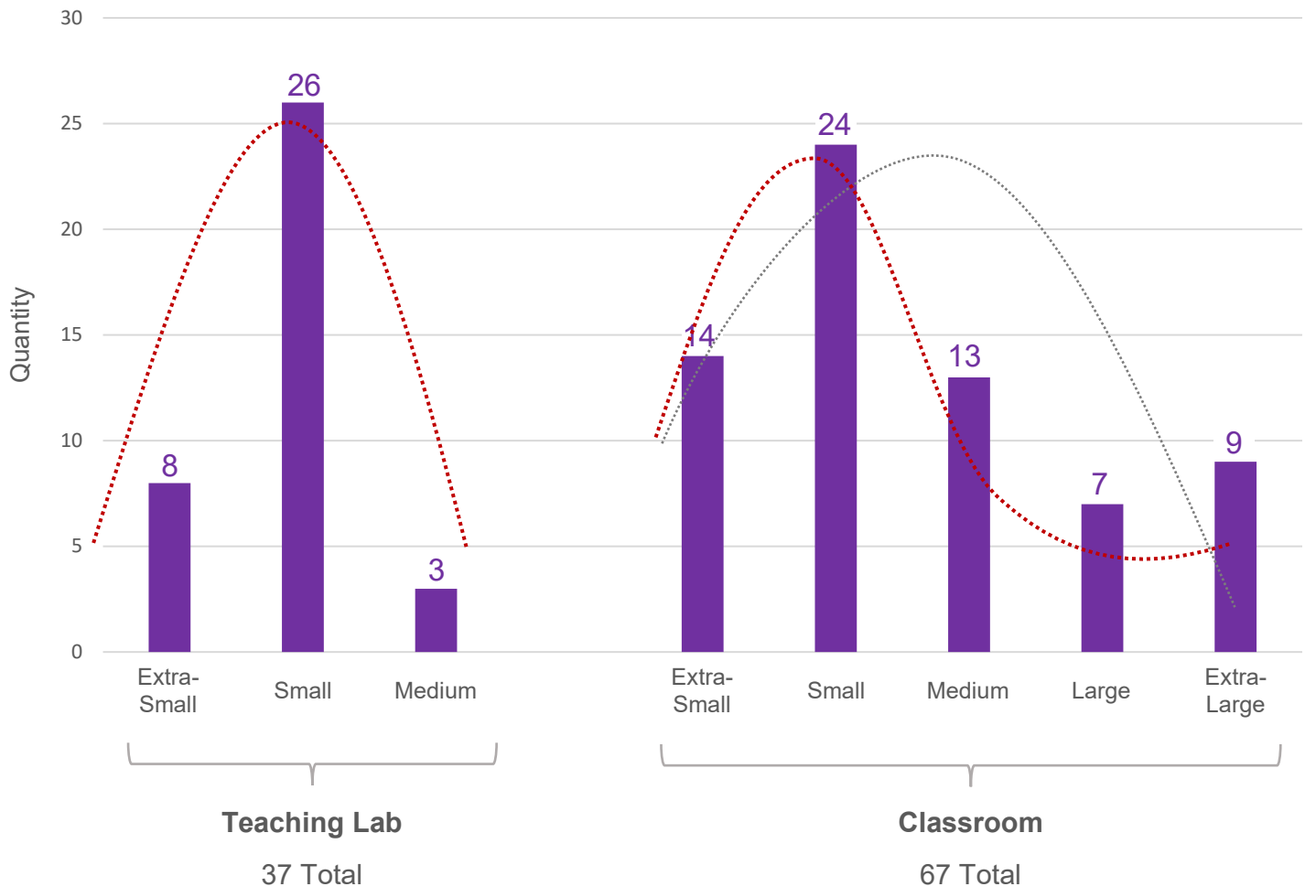
Craig Hall
02 | 03 | 01

Quantity of Classrooms Used by CNAS	CNAS Courses Held in Building	Avg. Hours of CNAS Instruction in Building / Wk

Note: Buildings averaging less than 1 hour of instruction across the data set were excluded.

Academic Space Type

In total, CNAS uses 37 Class Labs and 67 Classrooms of varying sizes. The distribution of classrooms across sizes is typical of Science / Lab Buildings.



Typical Room Distribution (Lab Building)

Typical Room Distribution (Traditional Academic Building)

	Seats
Extra-Small	<20
Small	21 – 35
Medium	36 – 55
Large	56 – 99
Extra-Large	100+

Teaching Labs: Room Utilization

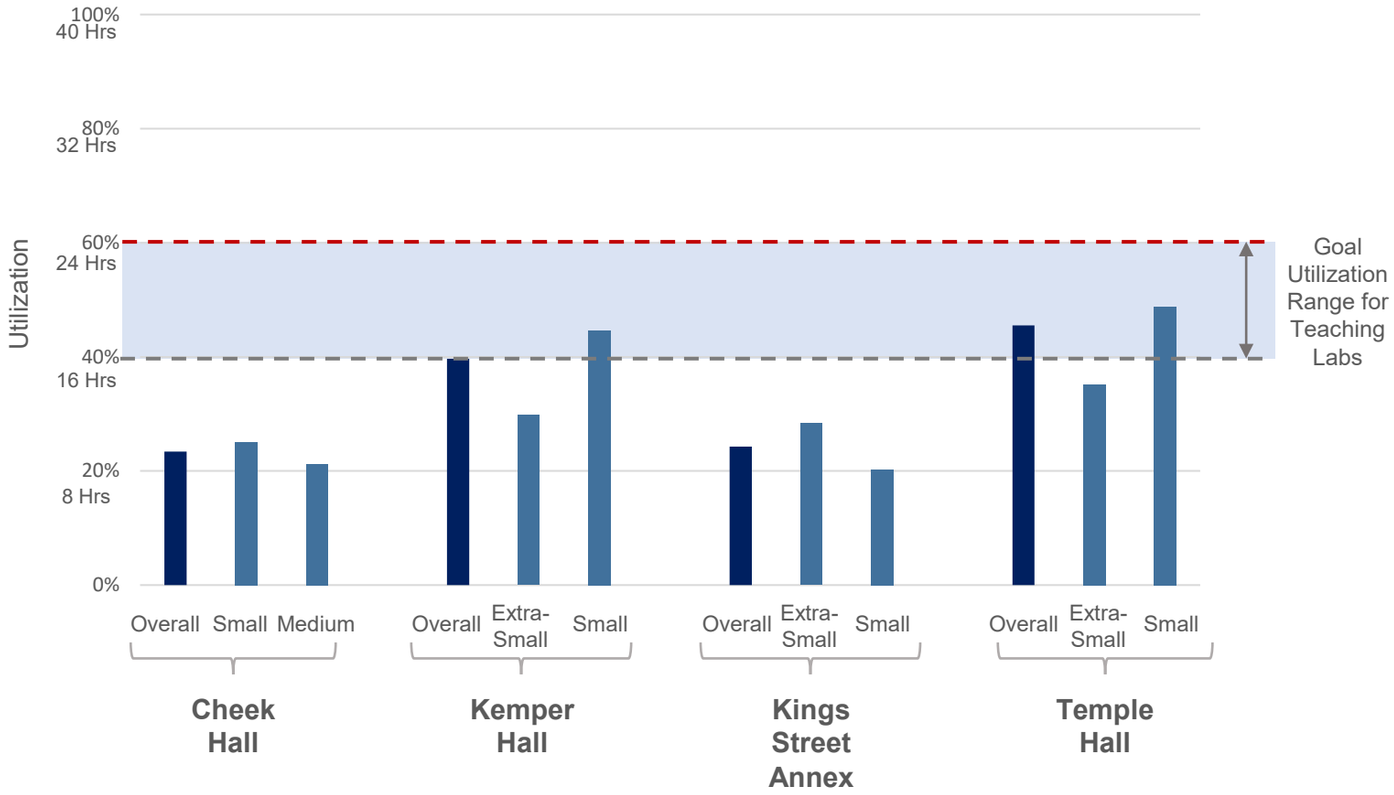
Room utilization reflects the average hours of academic instruction a room is scheduled for per week. It is an indicator of the adequacy of the number of classrooms available to CNAS and the college's optimization of those spaces.

$$\text{Room Utilization} = \frac{\text{Hours / Week a Room is Used for Instruction}}{\text{40 Hours}}$$

In lieu of prescribed University targets; the ranges and goals identified are based on national benchmarks and guidelines*. These benchmarks assume higher utilization goals for lecture and seminar classrooms and lower utilization goals for teaching lab spaces since set-up time is assumed between every class period.

The denominator, 40 hours, assumes that core academic instruction occurs between 9 AM and 4 PM, Monday through Friday. It is possible for rooms to have greater than 100% utilization.

**Guidelines and benchmarking data has been informed by both professional experience and data compiled by the Association for Learning Environments (formerly the Council of Educational Facility Planners).*

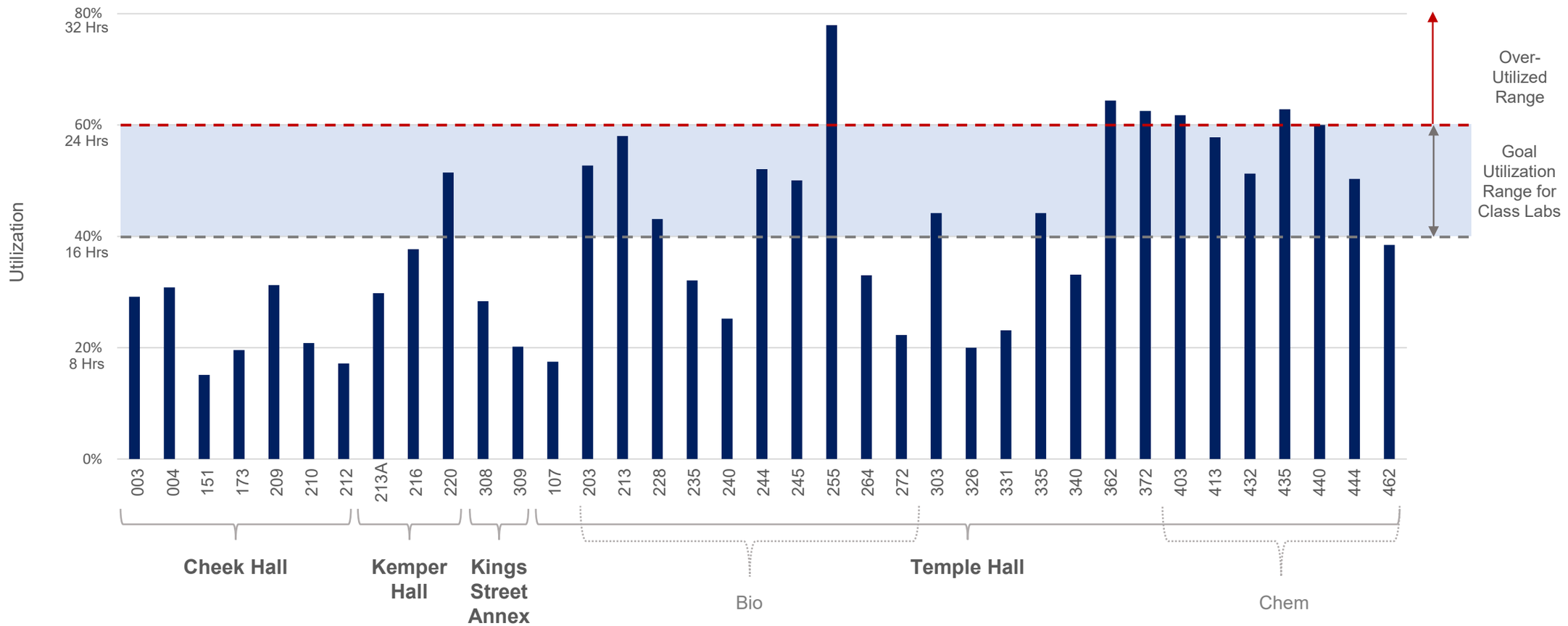


Teaching lab room utilization numbers across the core CNAS buildings appear to be low in Cheek and Kings Street Annex, but near normal ranges in Kemper and Temple.

Teaching Labs: Room Utilization (Detail)

When we look at utilization in more detail – it's clear that it's not evenly distributed. Some class labs are seeing very high utilization, while others are fairly low. There are several reasons a teaching lab may be under-utilized or over-utilized. Highly specialized spaces tend to be under-utilized, while newly renovated spaces are more often requested. Timing of classes impacts utilization as well as there is generally higher demand for classes M-Th between 10 AM and 2 PM.

To address the discrepancy there are two approaches: increase flexibility of teaching labs or increase quantities.



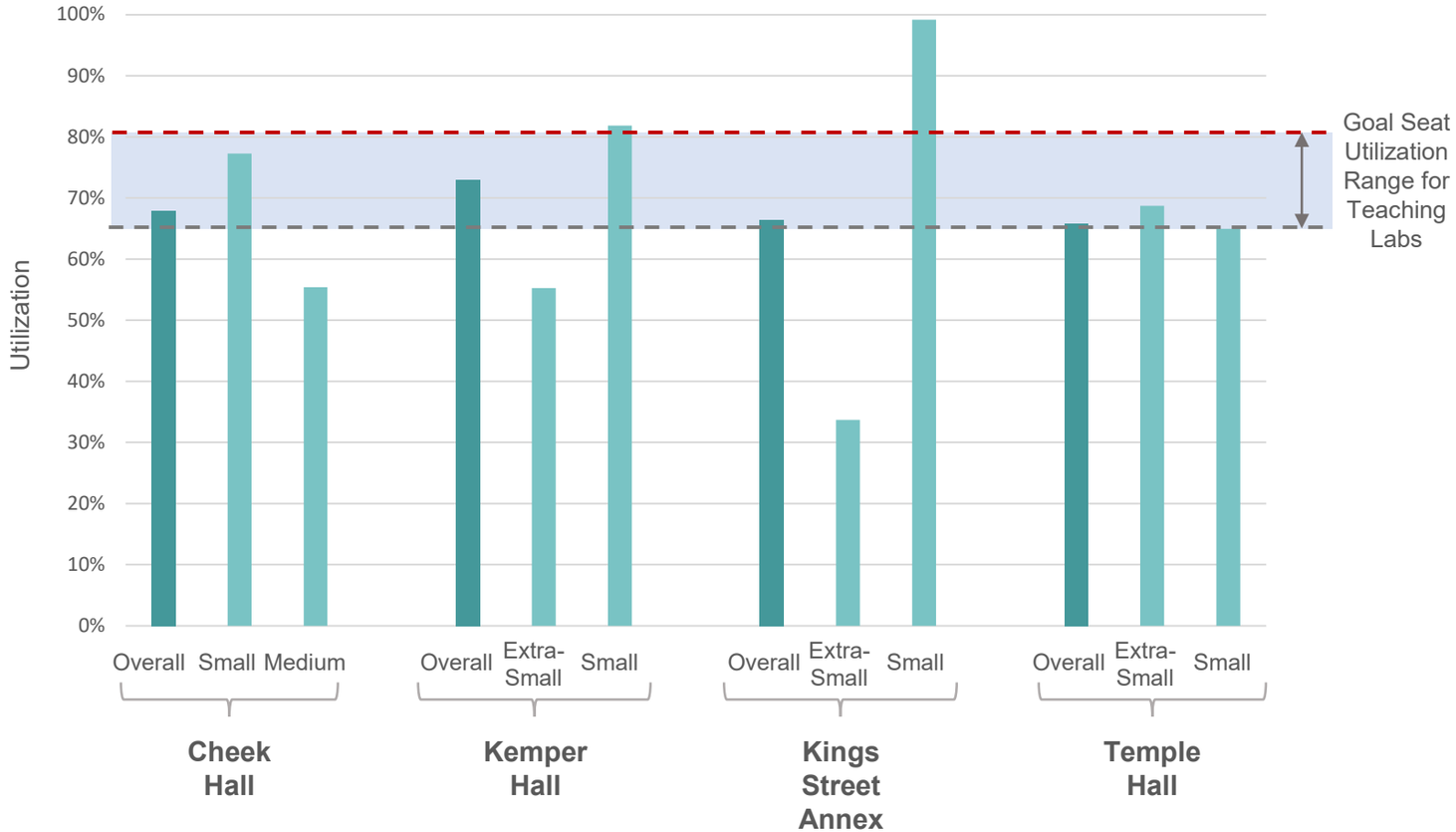
Teaching Labs: Seat Utilization

Seat utilization measures the percentage of full seats when a room is in use. This metric is an indicator of how well courses match room size and how well available classroom quantities are being optimized.

$$\text{Seat Utilization} = \frac{\text{Average Enrollment of a Room}}{\text{Total Enrollment Capacity}}$$

In lieu of prescribed University targets; the ranges and goals identified are based on national benchmarks and guidelines*. These benchmarks assume lower utilization goals for lecture and seminar classrooms and higher utilization goals for teaching lab spaces.

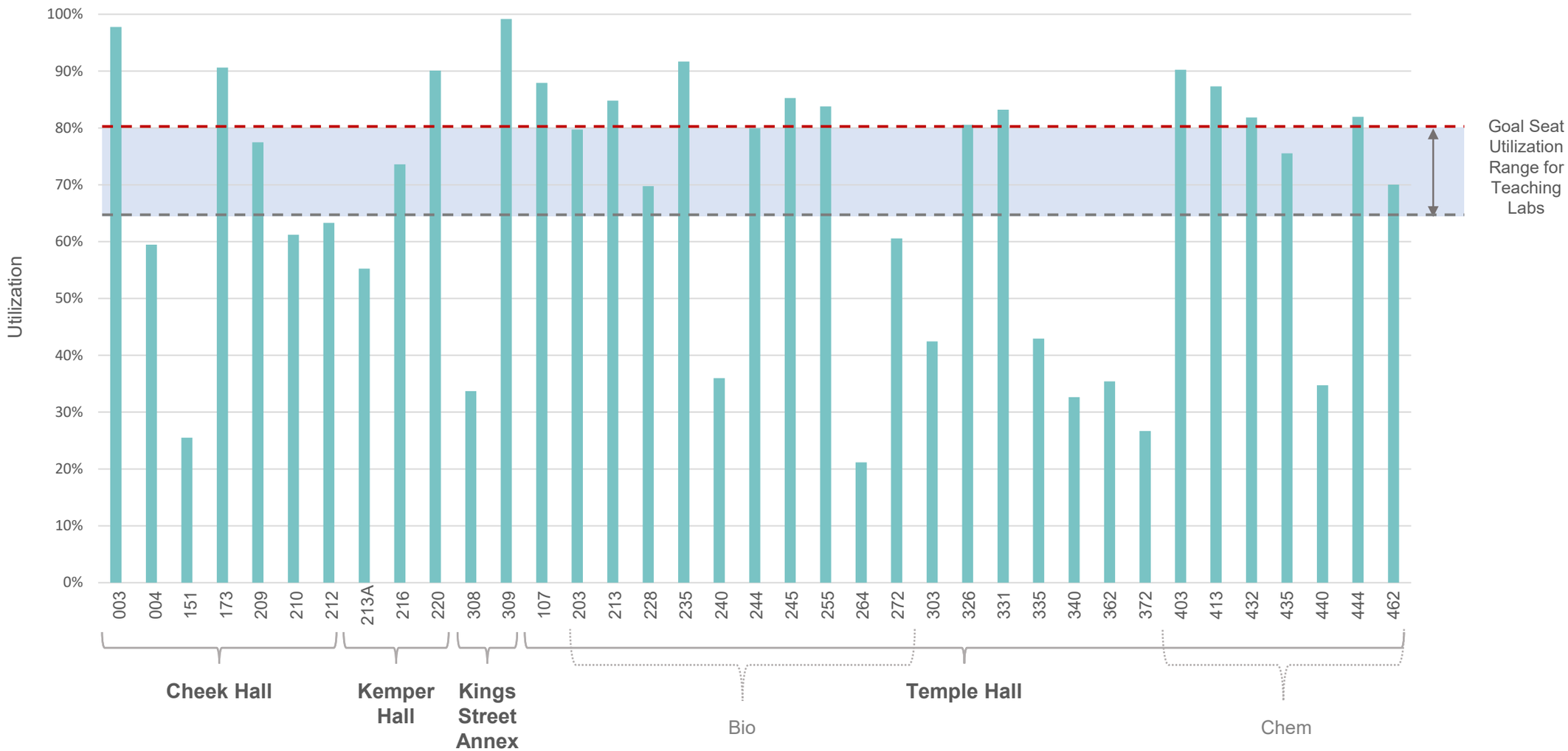
**Guidelines and benchmarking data has been informed by both professional experience and data compiled by the Association for Learning Environments (formerly the Council of Educational Facility Planners).*



Teaching lab seat utilization numbers across the core CNAS buildings appear to be near normal ranges across buildings.

Teaching Labs: Seat Utilization (Detail)

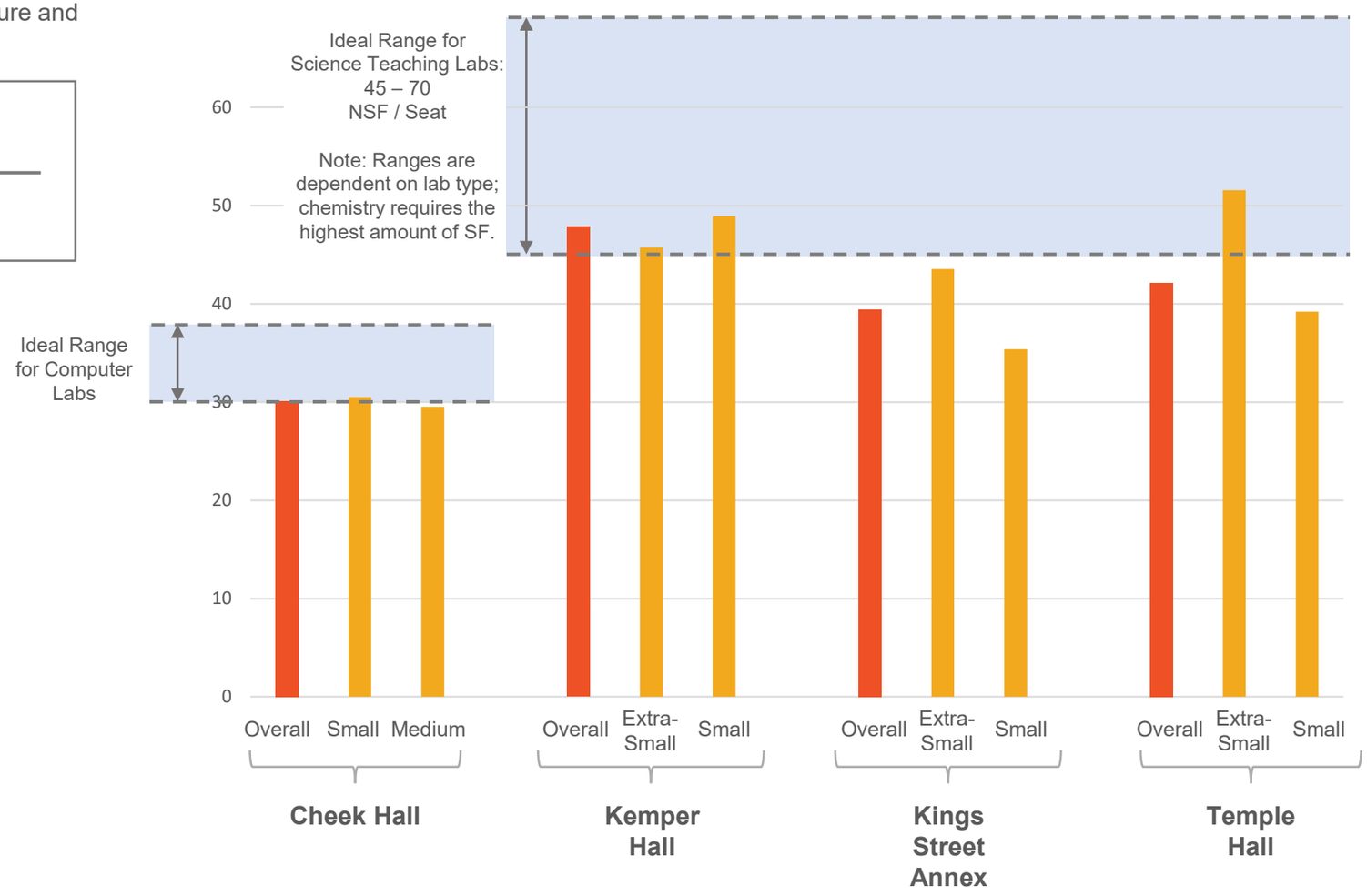
When we look at the detail of seat utilization by room, there are again significant discrepancies from space to space. Some teaching labs are seeing very high utilization, while others are very low.



Teaching Labs: NSF / Seat Allocation

The NSF (net square feet) / Seat Allocation provides an indication of how well rooms are sized for the furniture and activities that occur within them.

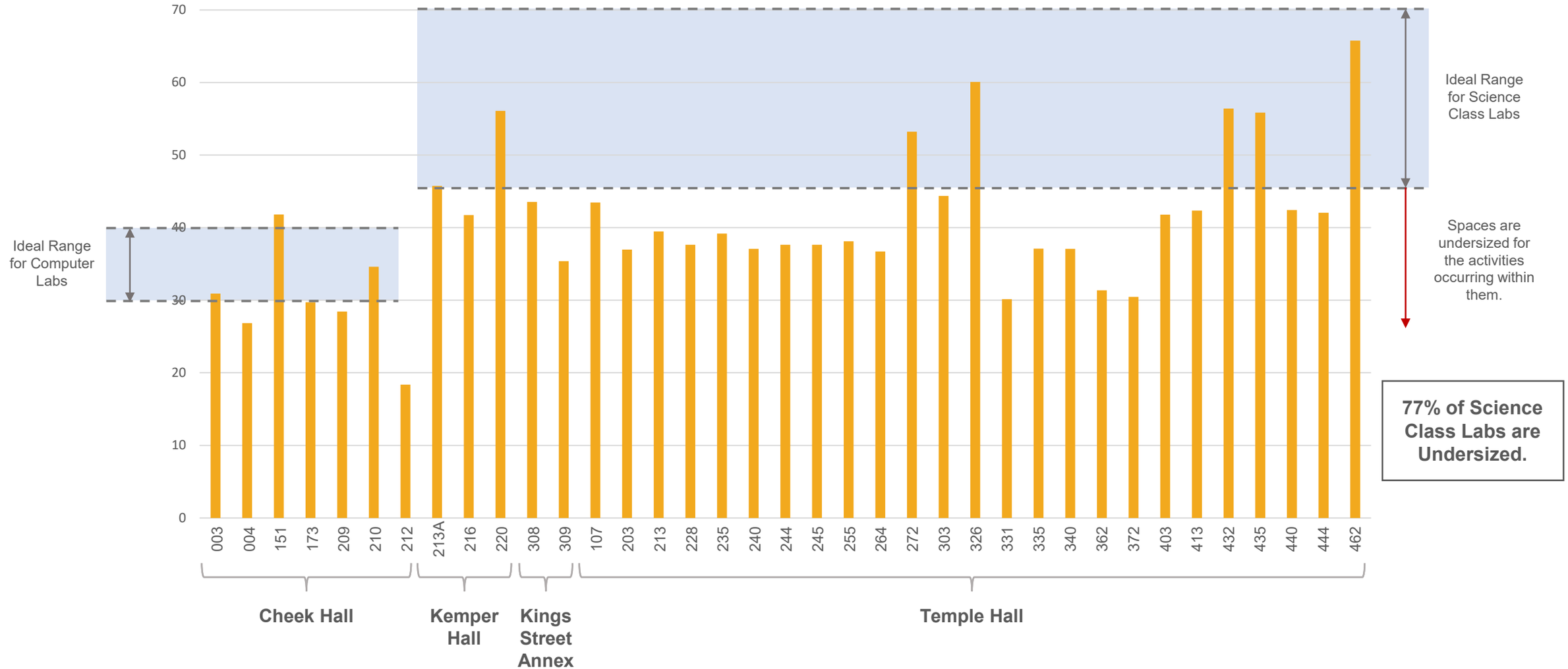
$$\text{NSF / Seat} = \frac{\text{Total Seat Capacity in a Classroom}}{\text{Classroom Area (in NSF)}}$$



On average, all class labs appear to be undersized.

Teaching Labs: NSF / Seat Allocation

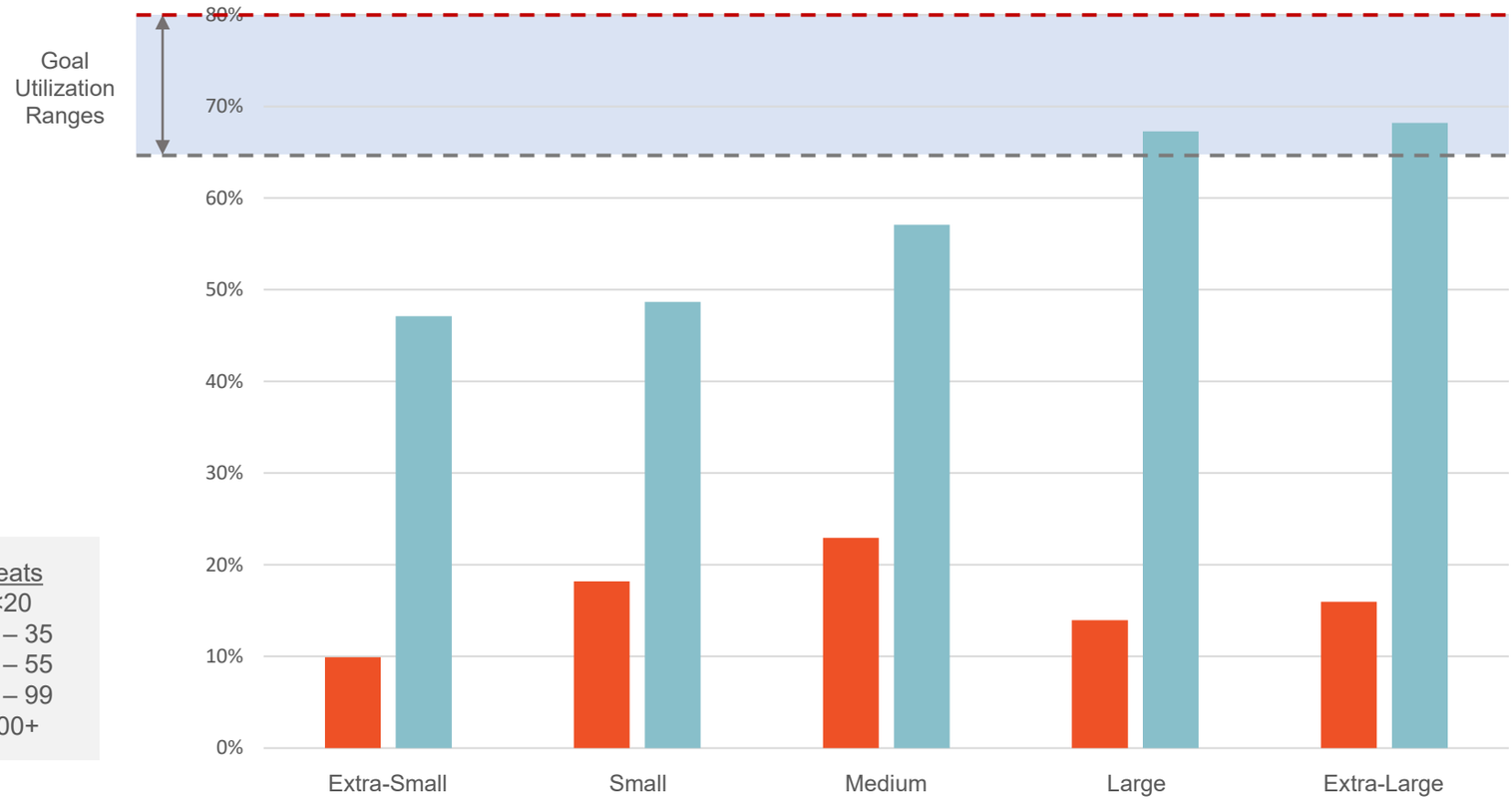
The vast majority of class labs are undersized. This problem is likely compounded by a lack of support spaces including storage and prep areas. Teaching labs likely feel crowded and difficult to navigate. Undersized teaching labs can present numerous safety concerns.



77% of Science Class Labs are Undersized.

Classroom Utilization

Overall seat and room utilization was studied for CNAS classrooms. Seat utilization for large and extra-large classrooms is right on target. We assume the low room utilization is a result of CNAS sharing these classrooms with other colleges.



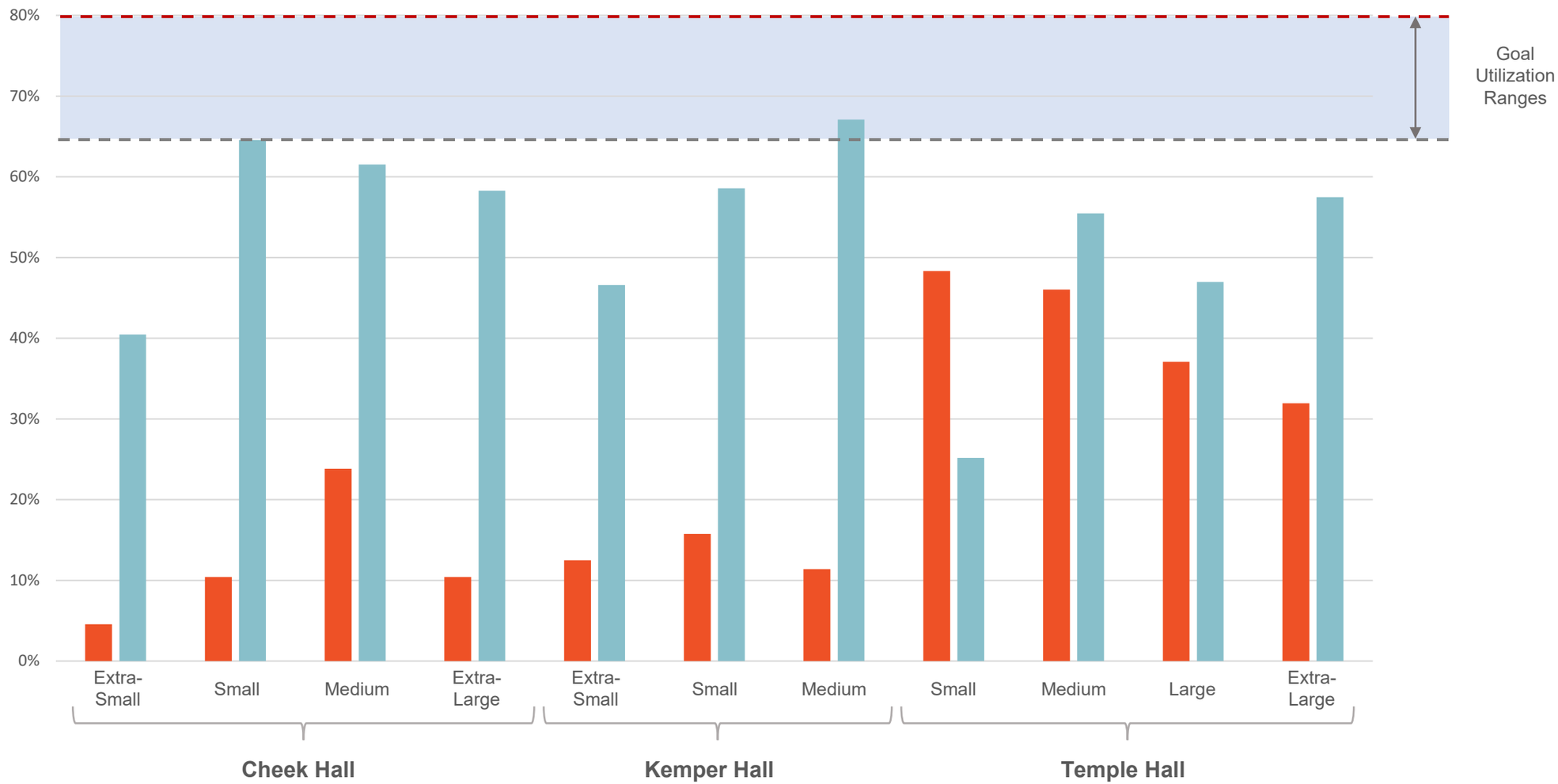
Room Utilization

Seat Utilization

	Seats
Extra-Small	<20
Small	21 – 35
Medium	36 – 55
Large	56 – 99
Extra-Large	100+

Classroom Utilization

Room and seat utilization numbers are low across all core CNAS buildings. We assume the lower numbers are a result of sharing spaces with other programs.



SPACE PROGRAM

Space Program Methodology

In creating the space program, the team realizes that CNAS needs evolve continuously as faculty and enrollment counts vary from year to year. To create a space program that reflected more than just a moment in time, the team built a program that was tied to relevant input data and projected growth rates so CNAS and MSU could easily modify the program over time.

Missouri State University

INPUTS

Spaces	Unit	Notes
OFFICE TYPES		
Sf/Faculty Office	*140*	120-140 MSU standard
Sf/Faculty Emeritus Office	*120*	
Sf/Staff Or Admin Office	*100*	
Sf/Head Office	*160*	MSU standard
Sf/Director Office	*185*	MSU standard
Sf/Assoc Dean	*185*	
Sf/Dean	*185*	
Sf/Grad Student Workstation	*64*	industry benchmark
Copy/Workroom	*200*	industry benchmark
Faculty/Staff Lounge	*350*	industry benchmark
TEACHING LABS		
Teaching Lab Support/Teaching Lab Sf	*35%*	industry benchmark
ORGANIC CHEMISTRY		
Sf/Student In Teaching Labs	*70*	industry benchmark
Avg Qty Students/ Teaching Lab	*24*	
Avg Sf/Teaching Lab	1,700	
OTHER SCIENCES		
Sf/Student In Teaching Labs	*53*	industry benchmark
Avg Qty Students/ Teaching Lab	*24*	
Avg Sf/Teaching Lab	1,300	
COMPUTER CLASS LAB		
Sf/Student In Teaching Labs	*40*	industry benchmark
Avg Qty Students/ Teaching Lab	*35*	
Avg Sf/Teaching Lab	1,400	

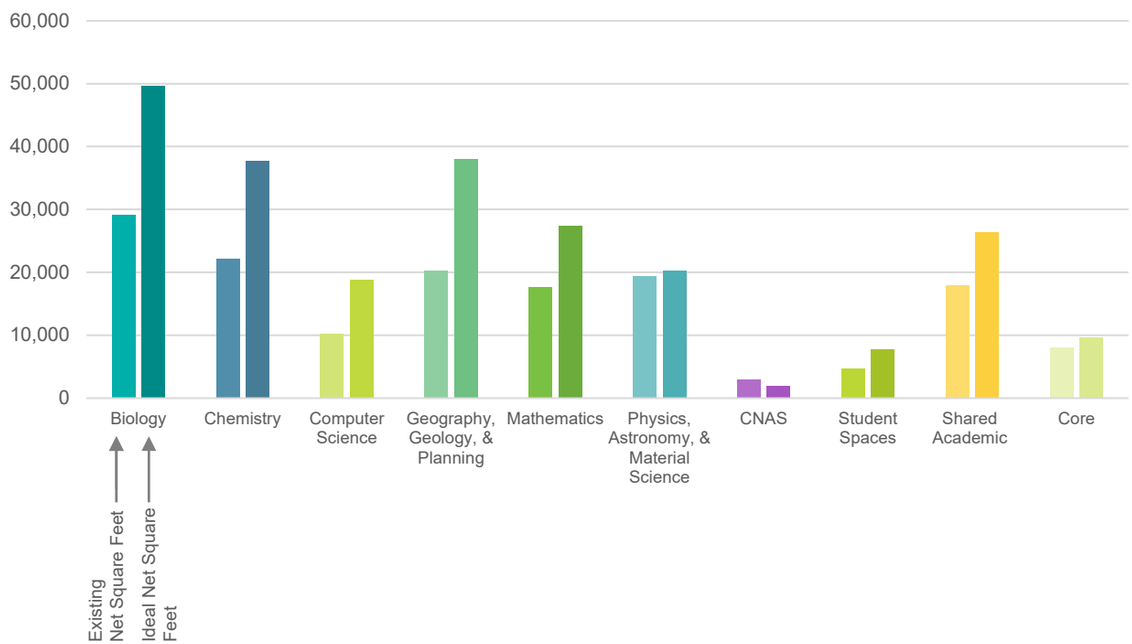
RESEARCH LABS				
Sf Research/Faculty	*380*	industry benchmark		
Research Lab Support/Research Lab Sf	*100%*	industry benchmark		
CLASSROOMS			# Students	Sf/ Student
SF XS Classroom	*600*		10	*60* MTMC, Flat
SF S Classroom	*1,000*		36	*60* MTMC, Flat
SF S Classroom	*1,100*		60	*32* MTMC/FTMC, Tiered
SF M Classroom	*2,500*		100	*32* MTMC/FTMC, Flat
SF XL Classroom	*3,800*		150	*32* FTA, Tiered
STUDENT SPACES				
Café	*1,200*			
SF/Enrolled UG Student - Student Spaces	*5*	industry benchmark		
SF/Enrolled Grad Student - Student Spaces	*8*	industry benchmark		
MISC				
Departmental storage	*350*	per dept		
Display space	*200*	per dept		
Match Existing * factor	*15%*			
GROSSING FACTOR				
% Grossing Factor	*35%*			

Ideal Space Program

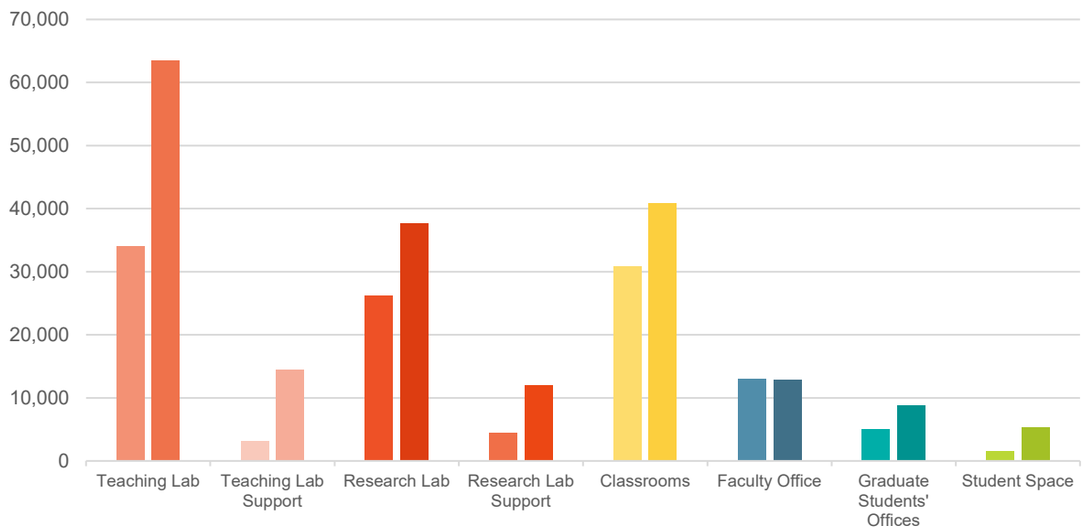
An “Ideal Space Program” was created by the team. This program of spaces reflects an idealized version of what CNAS would require if they were starting from scratch. Ideal program recommendations were vetted with each department head and scrutinized through several rounds of review. These recommendations form the basis of the master plan which concentrates on increasing space for research, teaching labs, and lab support areas as those spaces currently experience the largest deficits.

The detailed space program is included by appendix.

Existing and Proposed Net Square Feet by Department



Existing and Proposed Net Square Feet by Use



Existing Net Square Feet:	153,350
Ideal Net Square Feet:	240,000
56% increase from existing to ideal	

MASTER PLAN

Master Plan

A wide range of options of components were studied with a final multi-phase master plan created. Since swing space is not available, the master plan begins with new construction and is phased into the smallest viable increments to best align with funding streams.

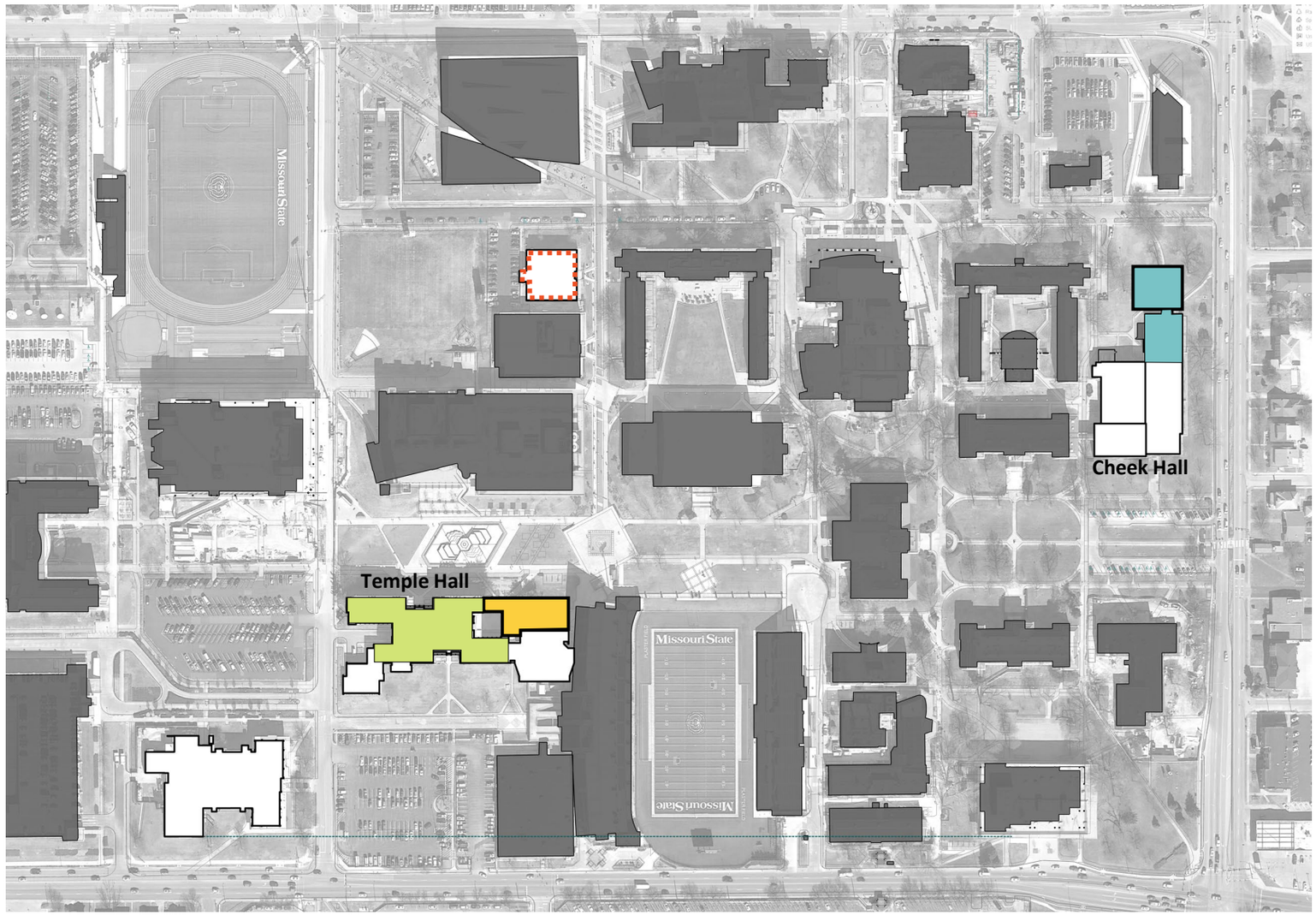
Phase 1: Temple Hall Addition
66,000 GSF 4-story new addition at the northeast corner of the building

Note: Kings Street Annex can be vacated by CNAS after Phase 1.

Phase 2: Temple Hall Backfill Renovations
48,000 GSF backfill renovations including ADA and life safety upgrades, and renovations to common areas
40,000 GSF lab refresh renovations

Phase 3: Cheek Hall Addition & Minor Backfill Renovation
32,000 GSF 2-story new addition
15,000 GSF light backfill renovation at the connection to the new addition

Note: GSF = Gross Square Feet



Phase 1: Temple Hall – Northeast Addition
Phase 2: Temple Hall – Backfill Renovations

Phase 1: The Northeast Addition features a 4-story, 66,000 GSF addition, connecting to Temple Hall through a two-sided elevator.

Research / Teaching Labs, Faculty / Grad, Student Offices and Collaborative Spaces are provided on every level.

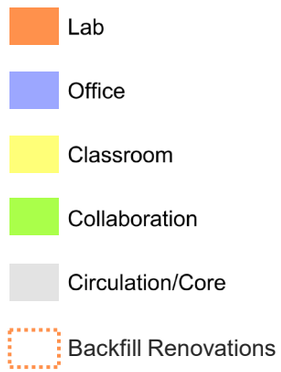
Phase 1 will accommodate relocating all spaces from Kings Street Annex to Temple and fulfilling space needs for BIO, CHEM, and GGP so those departments may be co-located with basic needs met. While all new spaces will be appropriately sized, this phase does not accommodate “right-sizing” existing spaces within Temple. To maintain desired space counts, these spaces would need to remain as is with only basic aesthetic upgrades.

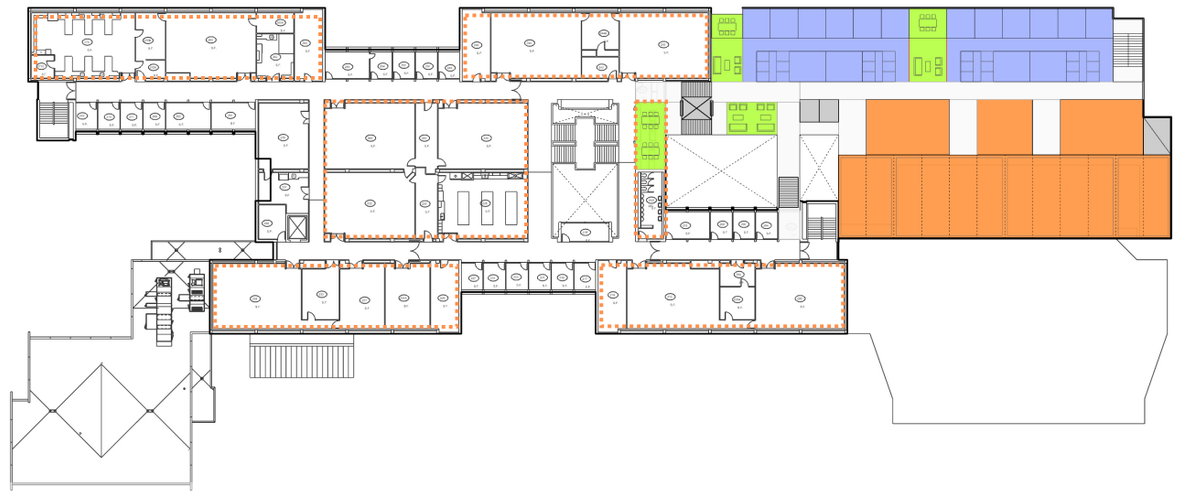
Note: A 3-story addition can be constructed as a cost reduction strategy.

<u>Pros:</u>
- An efficient floor plan that leverages the existing infrastructure of Temple.
- Ability to reimagine Temple and first impression of CNAS for students.
- Ability to put science and research on display.
- Enables future capacity for renovations in Temple Hall.

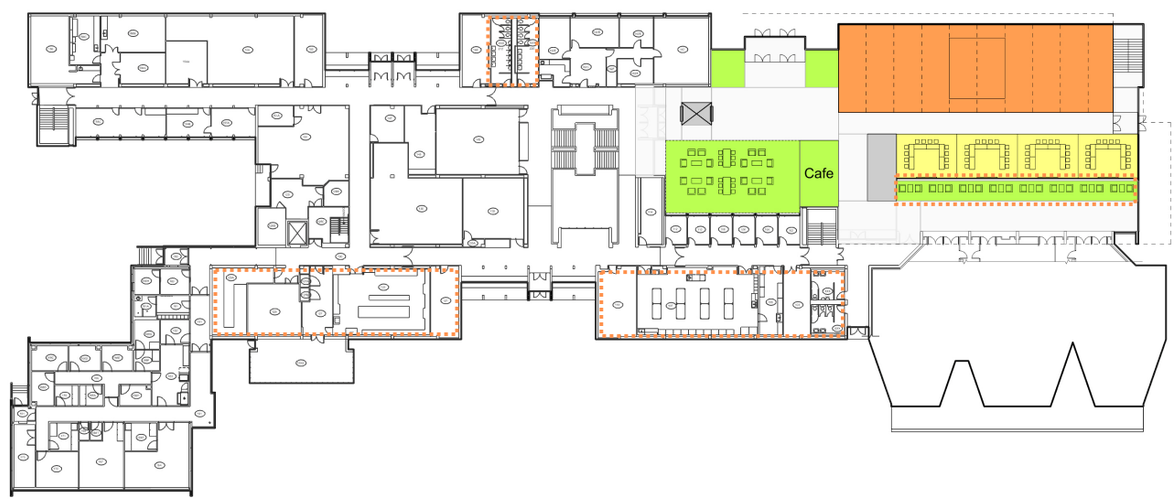
<u>Cons:</u>
- Construction will be disruptive to activities occurring within Temple.

Phase 2: Backfill renovations will focus on cosmetic and ADA upgrades to existing lab spaces, restroom renovations, whole-building fire protection, and renovations to common areas.



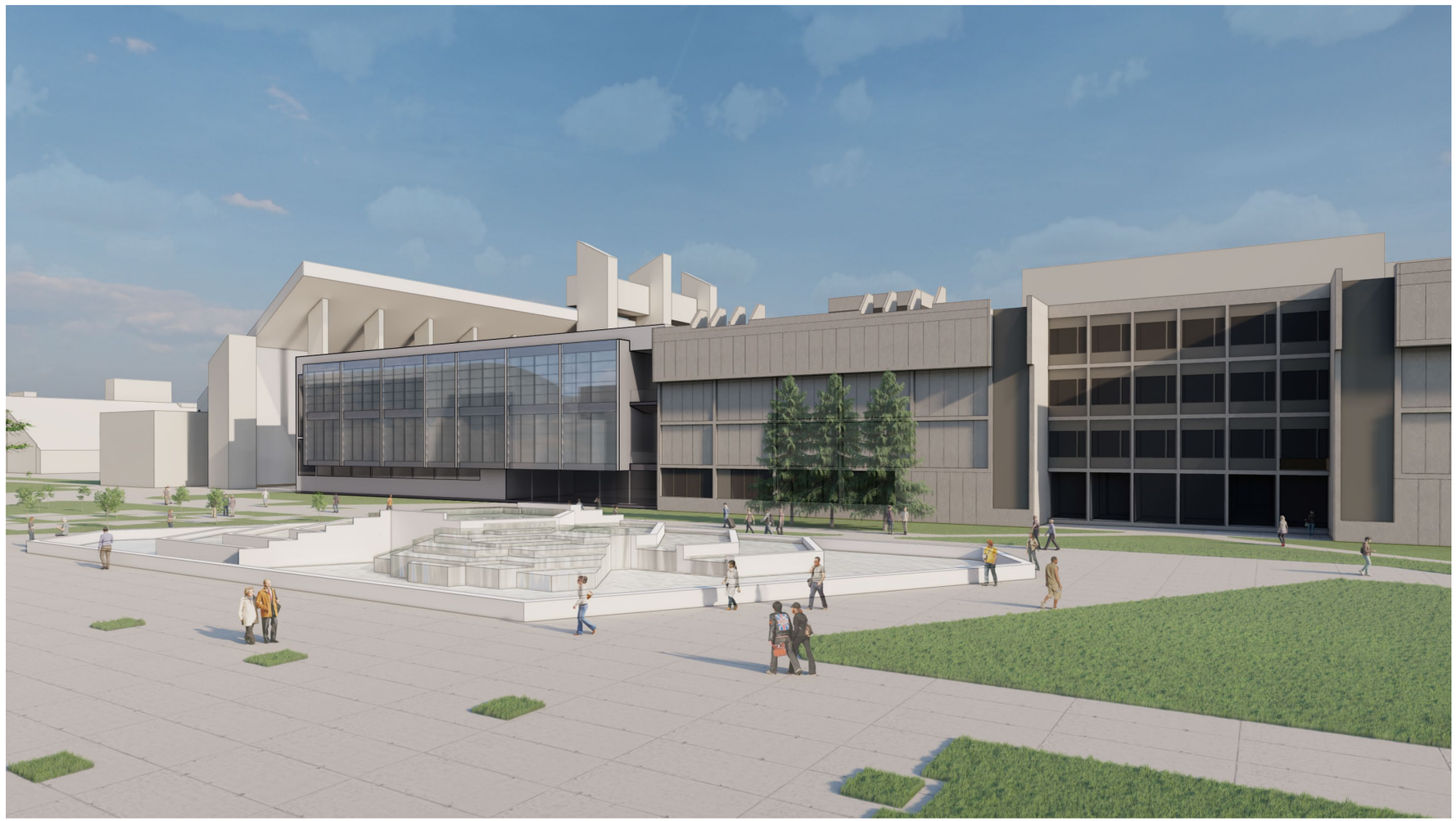


Temple Hall Levels 2 & 3



Temple Hall Level 1

Phase 1: Temple Hall – Northeast Addition



The sketch image above shows the 3-story option of the Temple Northeast Addition. While the sketch is not intended to be prescriptive of the final design, it does indicate that an expressed concrete structure with transparent infill would respond to the existing architecture of Temple while projecting a contemporary, more welcoming presence.

Phase 1: Temple Hall – Northeast Addition

The sketch image above shows the 3-story option of the Temple Northeast Addition. While the sketch is not intended to be prescriptive of the final design, it does indicate that an expressed concrete structure with transparent infill would respond to the existing architecture of Temple while projecting a contemporary, more welcoming presence.

Phase 3: Cheek Hall – Addition & Renovation

The North Addition to Cheek features a 2-story, 32,000 GSF addition containing classrooms, labs, and office suites, connecting to Cheek Hall through the existing north stair.

A 15,000 GSF light renovation to the existing Mezzanine Level of Cheek will optimize these spaces and enable the connection to the North.

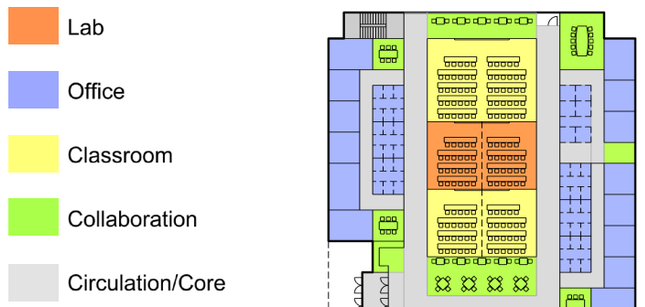
Phase 3 will accommodate all basic space needs for CSC and MTH, fulfilling all quantity requirements. Like Temple, this phase will provide appropriately sized new spaces, but it does not accommodate “right-sizing” existing spaces within Cheek.

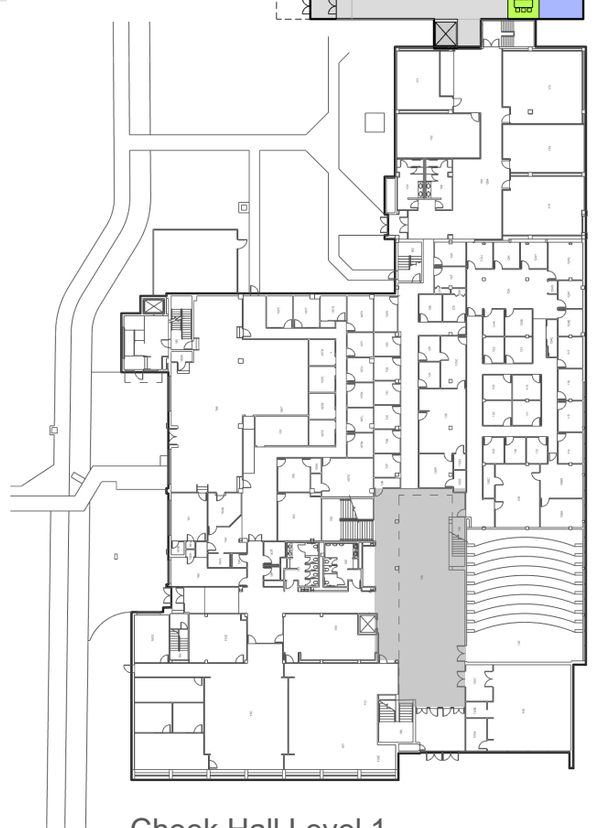
<u>Pros:</u>

- The site enables a very efficient floor plan while reinforcing the quad taking shape to the north.
- The plan right-sizes departments and encourages collaboration.

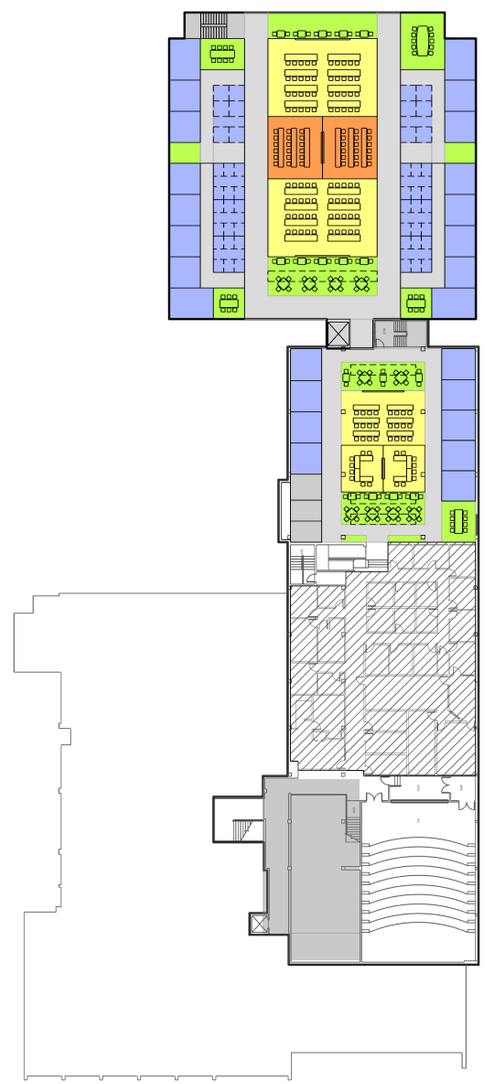
<u>Cons:</u>

- Construction will be disruptive to activities occurring within Cheek.
- The addition does not solve the current challenges with wayfinding and clarity in the existing building.



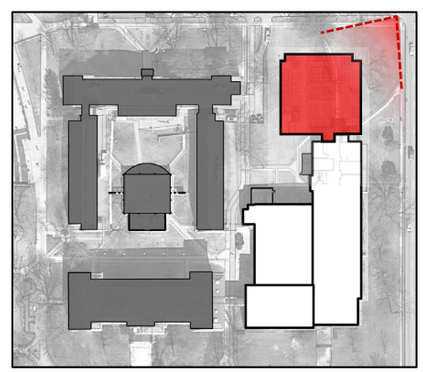


Cheek Hall Level 1



Cheek Hall Mezzanine Level

Phase 3: Cheek Hall – Addition & Renovation



The sketch image above eludes to the north addition of Cheek featuring a small two-story space with plentiful daylight to increase a sense of connectivity within the building.

Phase 3: Cheek Hall – Addition & Renovation

The sketch image above eludes to the north addition of Cheek featuring a small two-story space with plentiful daylight to increase a sense of connectivity within the building.

BUDGET SUMMARY

Master Plan Project Cost Summary

Phase 1: Temple Hall Addition

$40.8 - $42.2 Million

$438 - $453 / SF Construction Cost
$22.7 M Core & Shell Project Cost
$18.1 M Fit-out Project Cost
$1.5 M Site & Utility Project Cost

*A 50,000 GSF 3-story addition could be constructed for $35 Million (Project Cost)

Kings Street Annex can be vacated by CNAS after Phase 1.

Phase 2: Temple Hall Backfill Renovations

$2.9 - $20.7 Million

$41 - $117 / SF in Construction Costs

Phase 3: Cheek Hall Addition & Backfill Renovation

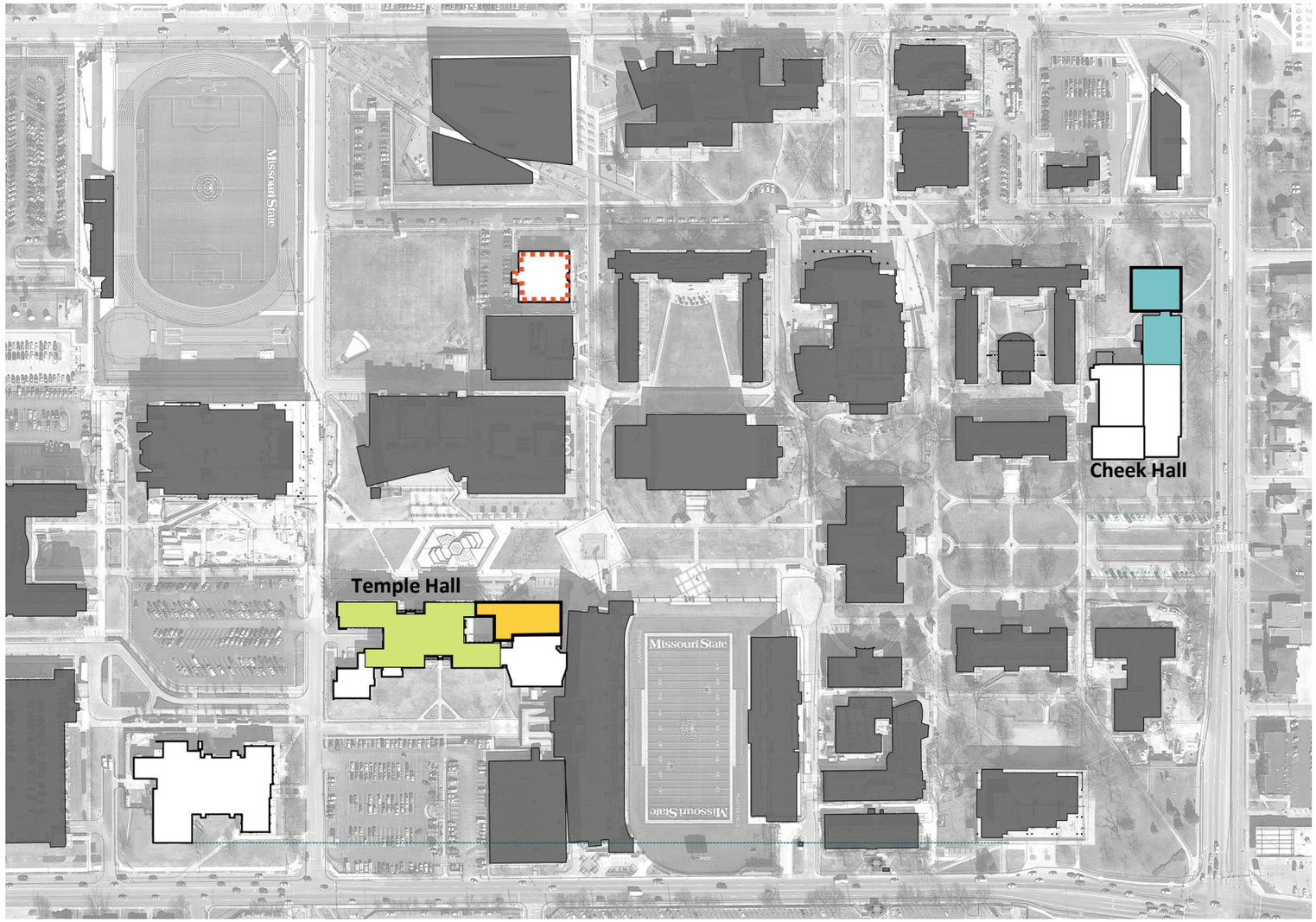
$17.4 - $18.5 Million

$14.6 - $14.9 M for New Addition
$2.8 - $3.6 M for Backfill Renovation

Notes:

All costs have been escalated to 2025 dollars.
A 3% escalation factor was used.

Project Costs include 40% for typical soft costs including but not limited to professional design fees, FF&E, project administration, and owner's contingency.



Master Plan Project Costs

Component	Construction Cost (2025)	Project Cost (2025)	Const. Cost / SF (2025)
Temple Hall - Maximized NE Addition			
Addition: Core and Shell (66,500 SF)	$ 16,200,000	$ 22,680,000	$ 244
Addition: Fit-out (66,500 SF)	$ 12,900,000	$ 18,060,000	$ 194
Sitework	$ 1,050,000	$ 1,470,000	$ 16
Deductive Alternates:			
Reduced Capacity Mechanical System in Addition	$ 482,000	$ 674,800	
Steel Structure Instead of a Concrete Structure in Addition	$ 568,000	$ 795,200	
Full Project Cost	**$ 30,150,000**	**$ 42,210,000**	**$ 453**
Minimal Project Cost (Accepting Deducts & Eliminating Backfill Renovations)	**$ 29,100,000**	**$ 40,740,000**	**$ 438**
Temple Hall - Reduced NE Addition (50,000 SF)			
Full Project Cost	**$ 25,150,000**	**$ 35,210,000**	**$ 503**
Minimal Project Cost	**$ 24,330,000**	**$ 34,062,000**	**$ 487**
Temple Hall - Backfill Renovations			
Backfill Renovation (126,000 SF)	$ 14,800,000	$ 20,720,000	$ 117
Deductive Alternates:			
Minimal Backfill Renovation	$ 5,680,000	$ 7,952,000	
Eliminate Cosmetic & ADA Upgrades at Existing Labs	$ 2,100,000	$ 2,940,000	
Eliminate Restroom Renovations	$ 820,000	$ 1,148,000	
Eliminate Whole-Building Fire Protection	$ 940,000	$ 1,316,000	
Eliminate Renovations to Common Areas	$ 1,900,000	$ 2,660,000	
No Reroof of Existing Building	$ 1,300,000	$ 1,820,000	
Full Project Cost	**$ 14,800,000**	**$ 20,720,000**	**$ 117**
Minimal Project Cost (Accepting Deducts & Eliminating Backfill Renovations)	**$ 2,060,000**	**$ 2,884,000**	**$ 41**

Notes:

All costs have been escalated to 2025 dollars.
A 3% escalation factor was used.

Project Costs include 40% for typical soft costs including but not limited to professional design fees, FF&E, project administration, and owner's contingency.

Minor backfill renovations could occur within Kemper Hall after GGP spaces are co-located back into Temple. Those costs are not included in the table as the scope of those renovations is largely undetermined at this time.

Master Plan Project Costs

Component	Construction Cost (2025)	Project Cost (2025)	Const. Cost / SF (2025)
Cheek Hall Addition			
Addition: Core and Shell (31,500 SF)	$ 6,400,000	$ 8,960,000	$ 203
Addition: Fit-out (27,500 SF)	$ 3,825,000	$ 5,355,000	$ 139
Sitework	$ 430,000	$ 602,000	$ 28
Deductive Alternates:			
Steel Structure Instead of a Concrete Structure	$ 232,000	$ 324,800	
Full Project Cost	**$ 10,655,000**	**$ 14,917,000**	**$ 338**
Minimal Project Cost (Accepting all Deducts)	**$ 10,423,000**	**$ 14,592,200**	**$ 331**
Cheek Hall Light Backfill Renovation (15,200 SF)	$ 2,550,000	$ 3,570,000	$ 168
Deductive Alternates:			
Minimal Enclosure Improvements in Existing Building	$ 232,000	$ 324,800	
Reuse Mechanical Equipment in Existing Building	$ 348,000	$ 487,200	
Full Project Cost	**$ 2,550,000**	**$ 3,570,000**	**$ 168**
Minimal Project Cost (Accepting all Deducts)	**$ 1,970,000**	**$ 2,758,000**	**$ 130**

APPENDIX

Appendix A: Space Inventory Floor Plans – by Use

Appendix B: Space Inventory Floor Plans – by Department

Appendix C: Detail Space Program

Appendix D: Additional Component Studies

Appendix E: Master Plan Components Building Systems Narratives

Appendix F: Detailed Cost Estimate

Appendix G: Master Plan Meeting Minutes & Stakeholder Notes

Appendix H: CNAS Provided Strategic Plans