UNIVERSITY OF NORTH DAKOTA

Merrifield Hall & Twamley Hall

Renovations & Associated Campus Modifications

PCL

JLG architects

AECOM

CONTENTS

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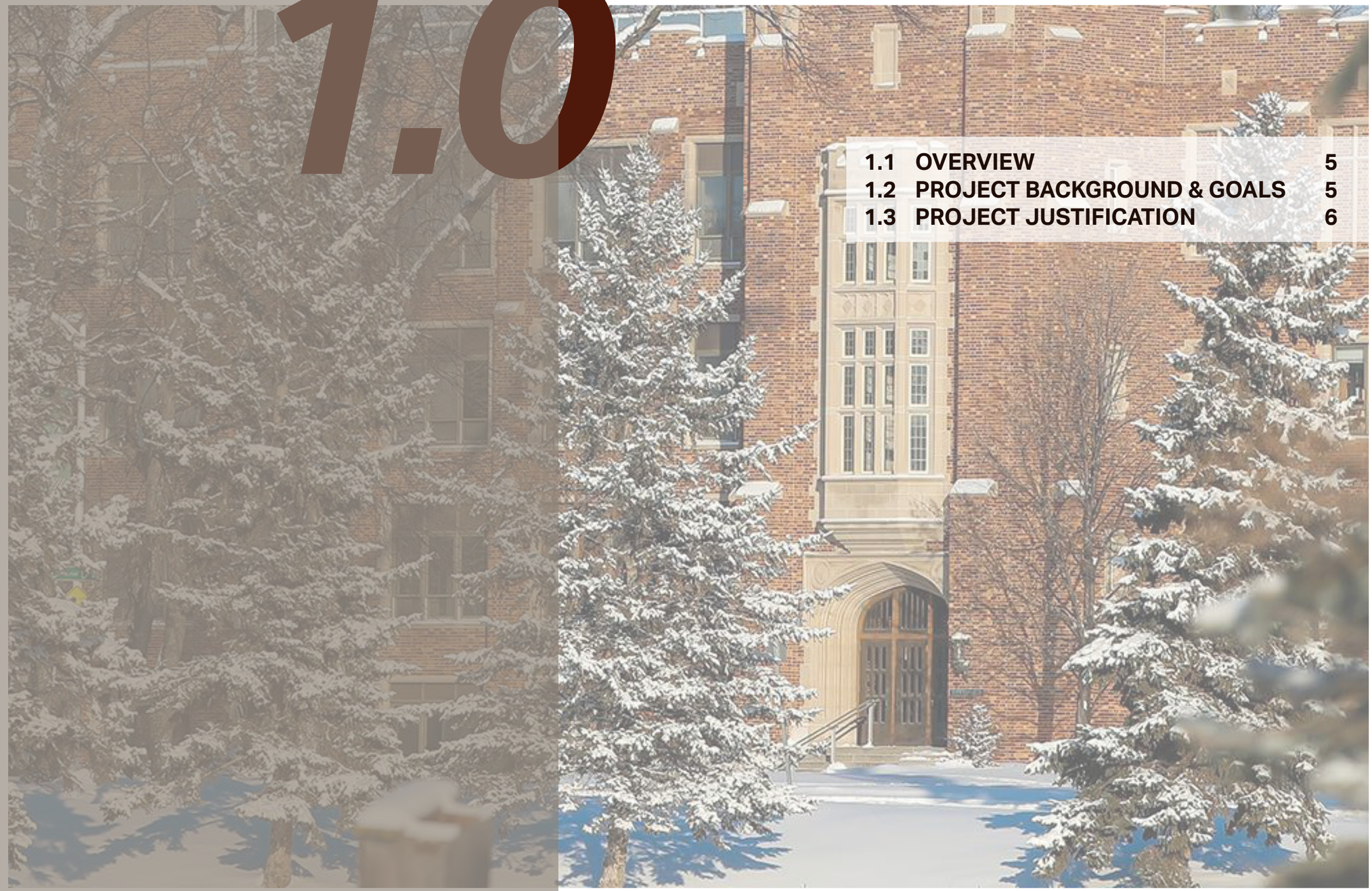

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1.0 Executive Summary

// Creating a connected ecosystem"

1.1 OVERVIEW

The University of North Dakota, founded in 1883, has been an institution of the Great Plains for almost 150 years. Adapting and changing with its times, the campus has expanded and contracted to reflect its home state. In recent years, the enrollment at UND in Grand Forks has dropped in correlation with changing demographics and demand, and as such has enlisted the help of consultants to help "right-size" the campus for its current and future needs. This document outlines the proposed changes across several buildings on campus to reduce deferred maintenance, improve existing facilities, and meet the needs for instructional, office, and collaboration space in addition to facilities such as parking.

1.2 PROJECT BACKGROUND & GOALS

The Design Team was charged with helping to understand the implications of reducing the UND Campus footprint by removing existing operating assets and consolidating programs together in a "Four Building Ecosystem". The Four Building Ecosystem is the holistic view of a physically connected Chester Fritz Library, Nistler College of Business and Public Administration, Merrifield Hall, and Twamley Hall to meet learning, study, and support needs in the university system. UND is requesting funding to renovate and upgrade the existing Merrifield and Twamley to complete a comprehensive ecosystem approach and improve the financial and educational aims of the university.

To ensure capital investment yields lasting returns, the project follows both the strategic plans of the University of North Dakota and the North Dakota University System. Additionally, goals for the project are as follows:

Increase Student Education Outcomes

- Design enables improved classroom pedagogy
- Increase faculty proximity and access to students
- Support student learning outside of the classroom

Reduce Operational Costs

- Grow class sizes
- Right-size the campus
- Improve building operational efficiency
- Increase space utilization

Repurpose Twamley Hall

- Shifting the focus of Twamley from Administration/Student Services to Academia and Faculty strengthens the campus core. The planning solution proposed involves providing the ideal number of faculty offices near a variety of academic classrooms, which then allows these classrooms to greatly improve their utilization to be more in alignment with state standards. Current Columbia Hall faculty will be moved into Twamley allowing further decommissioning of Columbia Hall.
    - 130 faculty teaching 4 courses per year equates to 520 courses taught within 20 classrooms gives you an 80% classroom utilization rate. This formula will be adjusted based on the final number of classrooms to be contained in the newly remodeled Merrifield.

Strengthen the Campus Academic Core

- Focusing investment in the academic core presents an opportunity for maximum physical connectivity between buildings, maximizes programmatic adjacencies and promotes academic collaboration.
    - Connectivity and mobility through buildings enhances accessibility for everyone. Sky bridges in the campus core ease circulation for students and faculty in the winter and also creates opportunities student collaboration.

The consulting team implemented a rigorous, data-driven approach to building design to ensure all spaces directly correlate to university performance improvement. This holistic view approaches buildings not just as structures but as enabling vehicles of operational goals.

As prominent and historic structures on the central quadrangle of the UND campus, the Design Team seeks to preserve the existing character of the structures while including appropriate enhancements to encourage lively, active, and highly utilized spaces in the center of campus. In total, more than 120,000 gross square feet will be improved and brought up to code to improve the longevity and usefulness of both Merrifield and Twamley.

The renovations to Merrifield will:

- Bring the building up to life safely code
- Improve the building envelope to ensure performance
- Replace building systems that are past their lifespan
- Improve universal accessibility
- Increase the health and wellbeing of occupants through improved finishes and indoor air quality
- Improve the overall building systems performance through window and envelope upgrades
- Provide adequate instructional space for non-lab programs with built-in flexibility for differing pedagogies.

Upgrades to Twamley are a vital marriage in the improved relationship between students and faculty and inspiring students to continue to pursue learning outside of the classroom. The building design congregates all faculty and staff previously

located in Merrifield and Columbia halls into one high performing space. Twamley upgrades will bring departmental classrooms and offices into a close network, create cross-disciplinary workplaces which allow for more collaboration and communication, and bring the building up to code from its original to the 1960's-era standard.

1.3 PROJECT JUSTIFICATION

This project has been pursued by UND for a variety of reasons, two of the foremost being to bring existing buildings up to life safety code and reduce deferred maintenance costs on several aging structures. Aside from these pertinent needs, the instructional spaces in Merrifield are woefully outdated and are highly underutilized, while the office spaces in Twamley are a mixed bag of space types and quality and are highly divided between departments. Basic accessibility issues exist and the experience of using these spaces is challenging to students, faculty, and staff.

This project aims to bring these buildings up to necessary codes and regulations, while also preserving and maintaining iconic areas of UND's campus for posterity.

Right-sizing Campus - The current 2018-20 Campus Master Plan recommends the consolidation and reduction of space in order to focus University resources. The Merrifield / Twamley project will provide the following reductions in square footage and deferred maintenance:

Building	Square Footage Reduction	Avoided Capital Renewal Needs & Eliminated Deferred Maintenance	Enhanced Life – Safety, Fire Protection and Accessibility
Gamble Hall (to be demolished)	120,120	$20,271,579	N/A
Columbia Hall (to be demolished)	280,200	$49,965,366	N/A
Twamley Hall (Renovated)	N/A	$12,467,085	$4,667,557
Merrifield Hall (Renovated)	N/A	$14,562,852	$2,753,804
Totals	**400,320**	**$97,266,882**	**$7,421,361**

What will happen if the state does not fund this project?

UND has been operating both Merrifield and Twamley for decades without holistic renovation or upgrades, and deferred maintenance continues to accrue. Without this project, the buildings will continue to deteriorate and create challenges for faculty, students, and staff. Minimal funding for deferred maintenance will contue to provide "Band-aid" solutions in both structures, but eventually both buildings in terms of envelope, systems, and functionality will begin to fail and become unusable.

Has adequate planning for this project been done? Should a planning appropriation be made first?

The document that follows comprises the initial planning studies that UND commissioned to better understand how to put Merrifield and Twamley to their highest and best use by increasing utilization and functionality. This document was created under the direction of a Steering Committee of UND leaders with design professionals to make appropriate recommendations, including probable project costs and schedules. Moving forward, this team will validate the planning that has been completed to date and ensure that the project stays on track while also executing the vision established in this initial phase of work.

Can another resource be used to finance this project? Can the cost be shared?

The scope of this project is such that the University does not currently have the capacity to fund its full intent, nor does it have the capacity to fundraise such a sum of money to support the full scope.

Would it be cheaper to renovate or remodel a used facility?

This project is focused on renovating two existing buldings to both preserve the historic integrity of the UND campus core but to also leverage the cost savings of utilizing existing structures.

Can this project be done next biennium?

This is possible, but the longer this project waits the more that these building fall into disrepair, mounting deferred maintenance costs. Additionally, the cost to complete this scope of work will increase with inflation, causing a higher total cost.

VIEW FROM QUAD OF PROPOSED NEW ACCESSIBLE EAST ENTRY TO MERRIFIELD AND NISTLER COLLEGE OF BUSINESS BUILDING IN THE BACKGROUND.

VIEW FROM STEPS OF NEW EAST ENTRY TO MERRIFIELD.

Before considering new requests, have current facility needs been met?

Yes--the needs for volume of space are being met, but quality and types of space are not currently being met. Based on our programming study herein, we believe the best scenario for both buildings is to make them more efficient and effective while also reducing deferred maintenance costs.

Are there alternative funding scenarios for this project?

No– UND and the Alumni Foundation is prepared to fund raise as much as possible to support this project but will not be able to support the full cost of the project.

Operating and Maintenance costs over the life of the project?

If completed in accordance with the plan outlined here, the operating and maintenance costs of the buildings will be reduced over time as they will be brought up to proper code compliance and deferred maintenance will be remedied.

What would the proponents of this project cut if they could only receive 80% of funding?

The Steering Committee has prioritized the completion of renovation to Merrifield, which constitutes about $35m of the total project cost. If project funding is reduced, the priority would be to retain the original scope of the Merrifield renovation, and reduce the scope of the renovation in Twamley to save cost.

Have all costs been presented?

The estimate of probably costs included with this document outline to the best of the team's ability all costs associate with this project.

What are the economies or (dis-economies) of scale?

Completing full renovations of each building as a single scope of work is the most cost-effective option available; separating renovations into phases or multiple scopes of work will only extend the schedule and increase costs over time. As such, the project outline here includes the full renovation of both buildings completed all at once, which allows the demolition of Gamble and Columbia Halls completing the scale of economy.

Who is against this project?

No one that we are aware of– the team creating this document engaged with faculty, students, and staff and our current understanding is that the campus community is ready and open for updates to these buildings provided that the historic integrity of the structures is maintained.

How do recent/proposed federal budget and tax actions affect the need for and cost of this project?

Not applicable.

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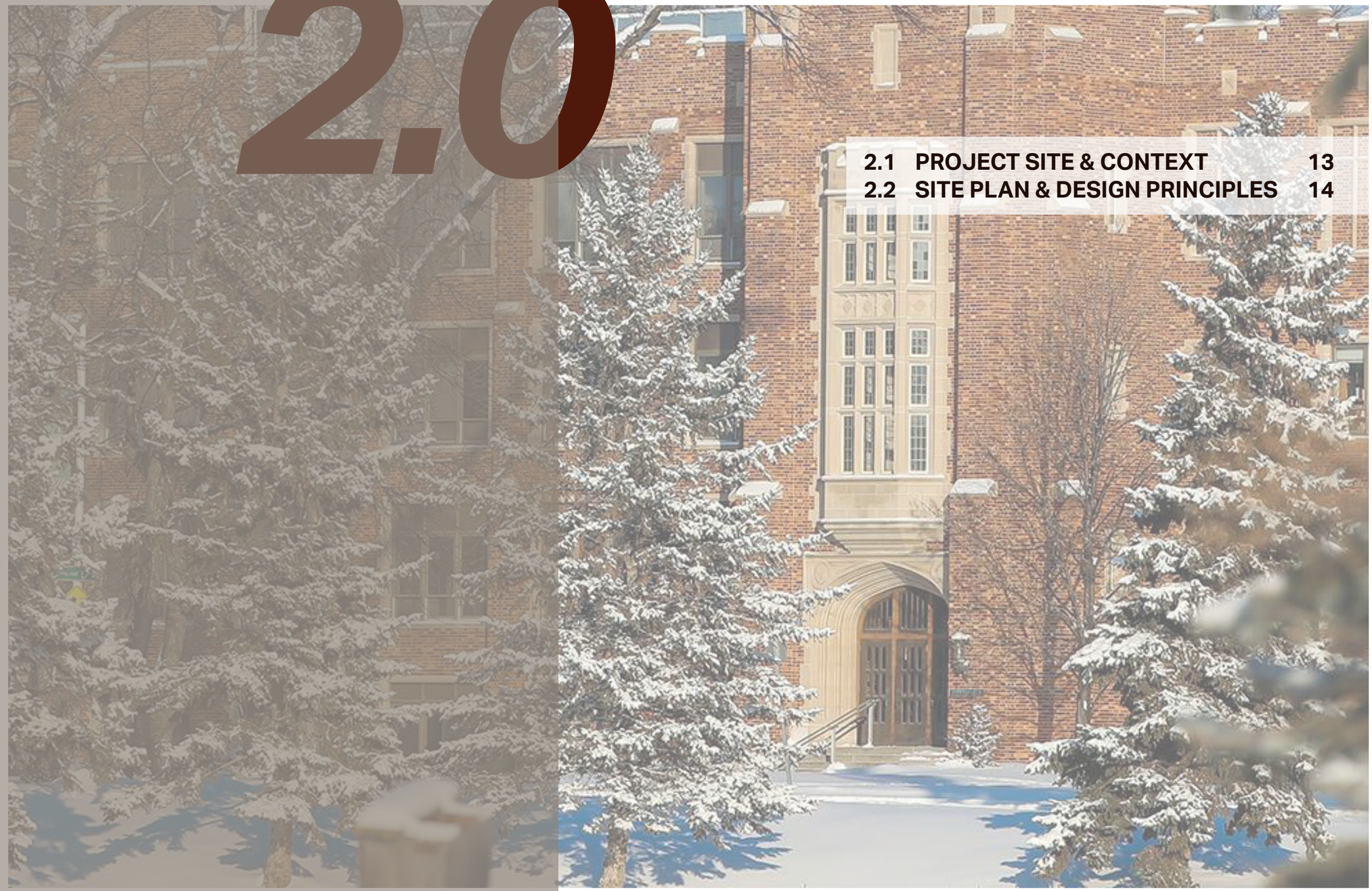

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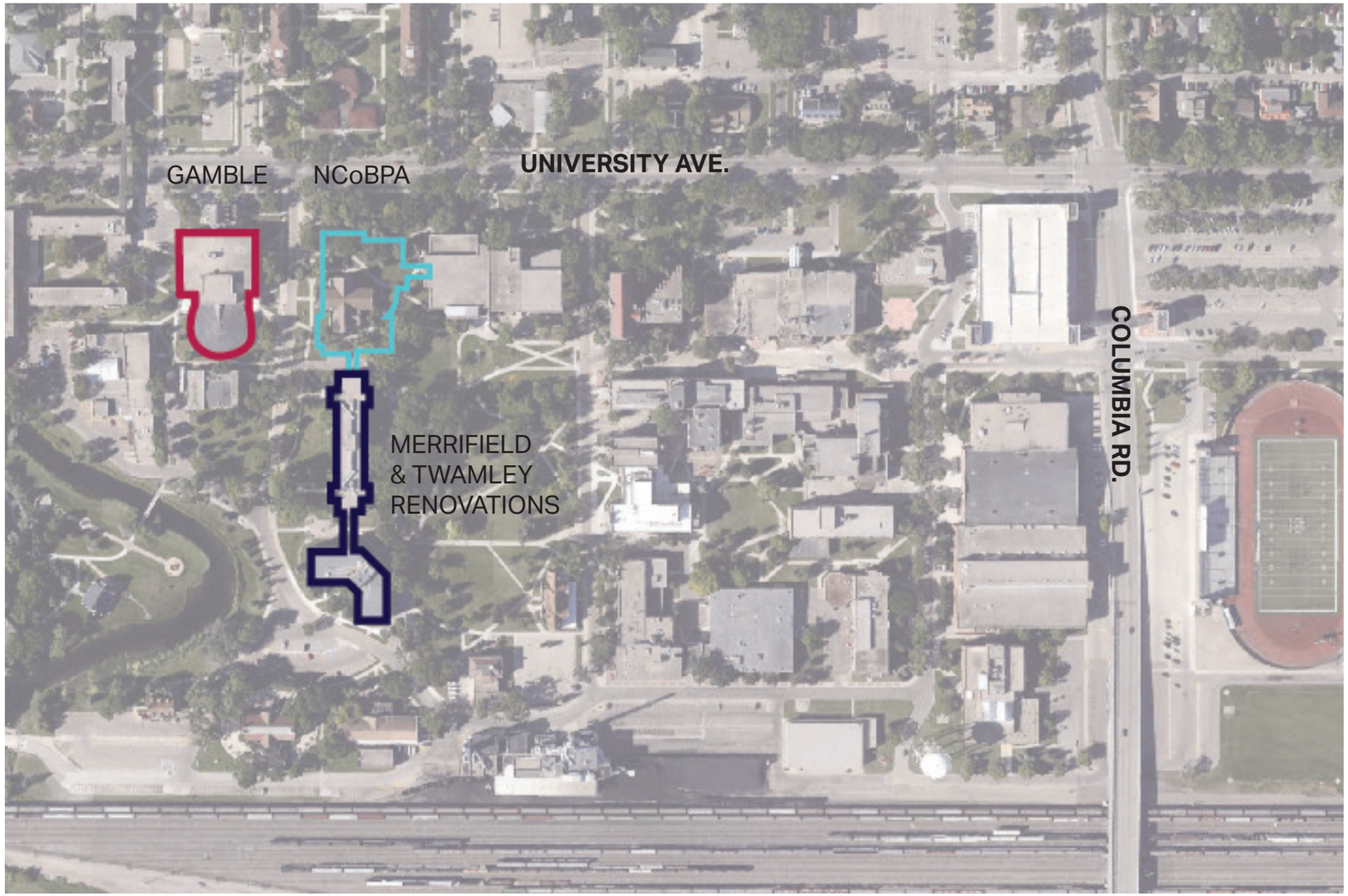
2.0 Site Design & Criteria



SITE PLAN WITH CAMPUS CONTEXT AND UPCOMING PROJECTS.

2.1 PROJECT SITE & CONTEXT

Located along the historic central quad at the heart of UND's campus, Merrifield Hall and Twamley Hall help to frame the daily experience of students and staff alike. Merrifield Hall, completed in 1929, stands as an icon of the campus, and we have heard from students and faculty that it represents the best of what they love about their campus.

Between both buildings rests the Eternal Flame, a symbol of the historic location of Old Main, which contributes to the district of distinctive architecture and iconography of the campus. The Design Team is engaged with the design of all of these components, in addition to the overall redesign of the Quad and other surrounding areas. This holistic approach allows for the integration of the design of the landscape around and between these buildings to become part of a larger fabric that is cohesive and timeless.

As our team has evaluated the design around these structures and how they tie into the overall campus, several areas of importance stand out:

- Creating more welcoming architectural gestures from Merrifield and Twamley to the Quad, to not only provide a contemporary refresh to these buildings, but to also aid in wayfinding for visitors and new students.

- This also ties into access, as Merrifield provides a sub-par experience currently for those with disabilities. The new design seeks to provide a more equitable approach, while also integrating with the beautiful landscape of the Quad.

- Several developments and changes are happening in this area of campus, including the current construction of the NCoBPA, which will connect directly via a skybridge to Merrifield, the demolition of the Power Plant, and re-alignment of Centennial Drive. The site, landscape, and infrastructure for these projects is seeking to allow for these future changes while providing a positive experience for these facilities in the meantime.

The conceptual design included here is a preliminary idea of how we can achieve these goals while complying with Campus Standards and maintaining focus on providing a positive exterior experience for all users who visit Merrifield and Twamley.

TOP: VIEW OF MERRIFIELD AND TWAMLEY FROM CAMPUS QUAD.

RIGHT: VIEW OF ETERNAL FLAME AND TWAMLEY HALL.

2.2 SITE PLAN & DESIGN PRINCIPLES

The solid dignity of these historic buildings speaks volumes about the past and present integrity and permanence of the University of North Dakota. Like the two halls, the spaces surrounding them give users a feeling of being part of the rich history. Students are joined with a continuum of scholars and learners reaching back through history as well as forward into the future.

Plans for the spaces around Merrifield and Twamley endeavor to make this connection real. In response to the historical architecture found here, the architecture of the landscape has some formal geometry to it, with clear east-west and north-south axes. We've taken a classical approach to the "fit and finish" of landscape elements to give a sense that they have been here as long as the buildings have been. Throughout the project area, enhanced lighting will ensure that the spaces are welcoming, safe, and attractive both night and day.

At the northern end of the project area is the Second Avenue Promenade, a critical corridor that links the campus from its eastern edge to its west side. This portion of the Promenade will continue the elements designed for it throughout: decorative paving, good lighting, attractive plantings, and benches placed periodically along the route. The north-south Centennial Drive corridor then links the Promenade to other areas of campus.

In this design, Merrifield Hall becomes a key central point in a mid-campus east-west axis, linking and engaging users from the Quad to the east, through the Hall itself, and to the Coulee to the west. The broad, sweeping arc of a pathway that surrounds the Quad links directly to the new primary entrance into Merrifield via a gently sloping, universally-accessible walkway. The east entry to Merrifield is a garden area that incorporates two outdoor "rooms" giving students a place to meet up, hang out, or study and that can also be used as outdoor classrooms on mild days. Integrated benches and planters will populate the spaces.

Moving south from Merrifield, multiple campus paths come together and draw users into the attractive meeting-and-gathering spaces that is the new entry plaza area for Twamley Hall. This "front door" area for Twamley will become a natural connection space for campus users, with its attractive paving, seat walls, and landscaping that frames the area. The pleasing and welcoming aesthetics of the space are important for students and faculty making their way through campus, as is the fact that all walkways and landscaping are designed to ensure that emergency vehicles can traverse the space if necessary.

Site Rendering

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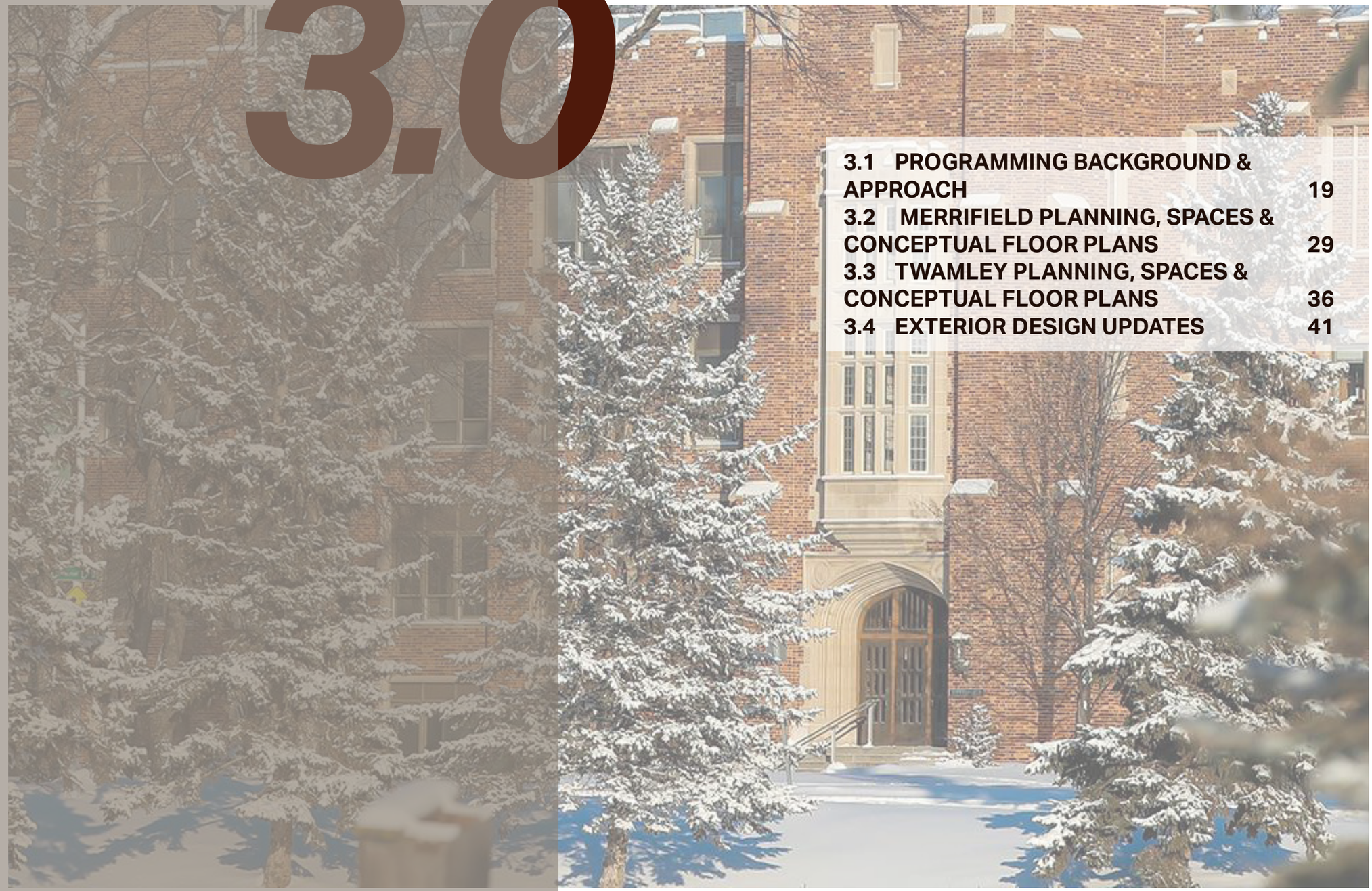

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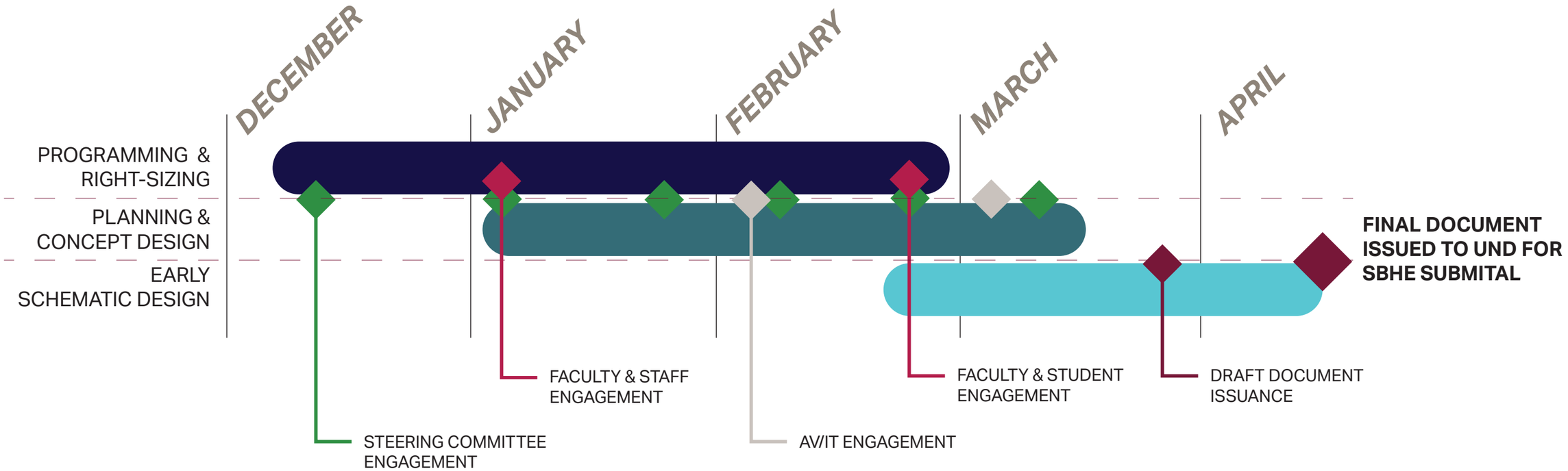
3.0 Program, Concept Planning & Design



3.1 PROGRAMMING BACKGROUND & APPROACH

3.1.1 Project Goals & Background

The aim of this study is to improve the learning mission of UND by aligning the strategic goals of the university to specific spaces that help to realize these goals. The output of this study is a four building ecosystem that creates a holistic campus experience for UND students, faculty, and staff. The data and analysis provided herein describes the current state of affairs for Merrifield and the Arts & Sciences programs at a larger scale, outlining the issues that the campus currently has in acheiving accepted standards of utilization. In addition to issues related to the quality of the learning environments and workplace environments in these buildings, increasing the overall efficieny of spaces will help UND to achieve their goals of “right sizing” the campus.

3.1.2 Guiding Principles

Improve student education outcomes:

- Increase Active Learning Pedagogies
- Increase Faculty Proximity and Access to students
- Support student learning outside of the classroom

Reduce Operational Costs

- Grow Class Sizes
- Right Size Campus Assets
- Improve Building Operational Efficiency
- Increase Space Utilization

3.1.3 Process & Approach

Over the course of nearly four months, the design team engaged with the Steering Committee comprised of UND leadership, as well as faculty, students, and staff representatives in order to gain information on the goals and vision for these two building renovations in addition to gathering the tangible data needed to drive the eventual outcomes contained here. Overall, this group of stakeholders agreed to pursue a data-driven approach to developing the spatial requirements for this scope of work, in order to ensure that there was a sound foundation to build upon as the project moves forward.

Finally, in looking at the campus holistically, we were able to measure the capacities of both Merrifield and Twamley as they relate to other building and space needs and confirm the ability of the campus to reduce their overall physical assets and achieve greater efficiencies over the coming decades.

3.1.3.1 Engagement

As part of our process, we engaged with faculty and students to understand their vision for a new Merrifield learning environment The visioning exercises we utilized collected data on existing instructional spaces on campus in both O'Kelly and Merrifield as well as Non-Scheduled Study Space to better understand what might inform the future design of the building. The findings here will be carried forth in the vision for the future of Merrifield.

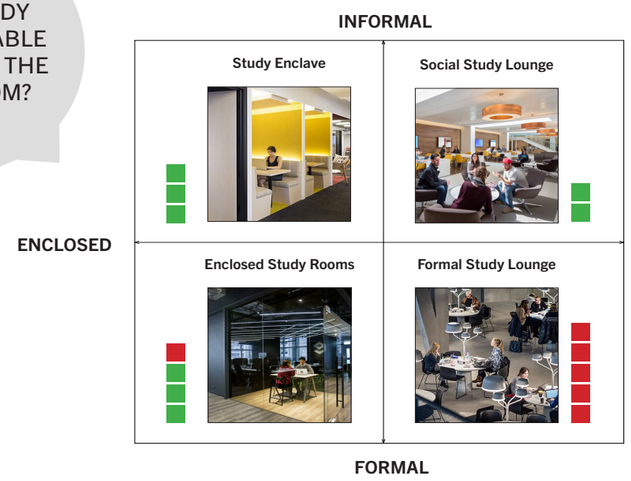
Exercise 1:

Study space is a vital space component in the learning ecosystem. This workshop asked participants which types of study and group environments enabled success in the classroom. Group projects are increasing as part of typical course assignments as they have great alignment for students as they enter the workforce. Environments that enable group study and allow for casual interactions were preferred as a result of this study.

Exercise 2:

To produce high quality space within the proposed building renovation, participants were asked to weigh in on their experience in similar spaces on campus. O'Kelly is another core education building that recently had renovations to vastly improve classrooms. Participants appreciated the flexibility and interactiveness these new learning spaces provides and also pointed out several design considerations for new construction to create a more comfortable environment. Participants also divulged their opinions on the outdated Merrifield rooms, which will enable the design to maintain the best building characteristics while upgrading the technology and environment to suit current needs.

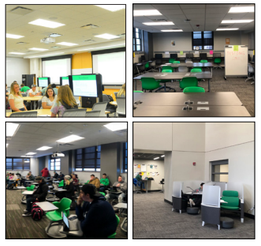
WHAT STUDY SPACES ENABLE SUCCESS IN THE CLASSROOM?



- Ensure video conference capability
- Flexible space
- Areas to host up to 8 students in a study group
- Formal study lounges are best served in the Library only
- Informal spaces should be away from the classrooms for noise control
- Informal enclosed spaces, such as study enclaves, are highly desirable

WHAT DO STUDENTS AND FACULTY LIKE AND DISLIKE ABOUT THE LEARNING SPACES ON CAMPUS?

O'KELLY



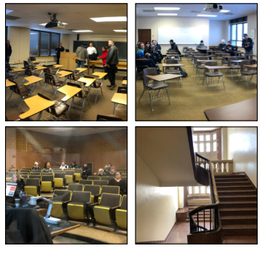
WORKS

- Access to central campus nodes
- Bathrooms located more centrally
- Common gathering space (housing food/coffee)
- Multiple writing surfaces
- Interactive classroom spaces with tables
- High quality spaces

DOESN'T WORK

- Glass doorways distracting, "fishbowl" experience
- Feels stale, corporate, clinical
- Mismatch interior and exterior styles
- Narrow halls
- Need presenter view in technology setup

MERRIFIELD

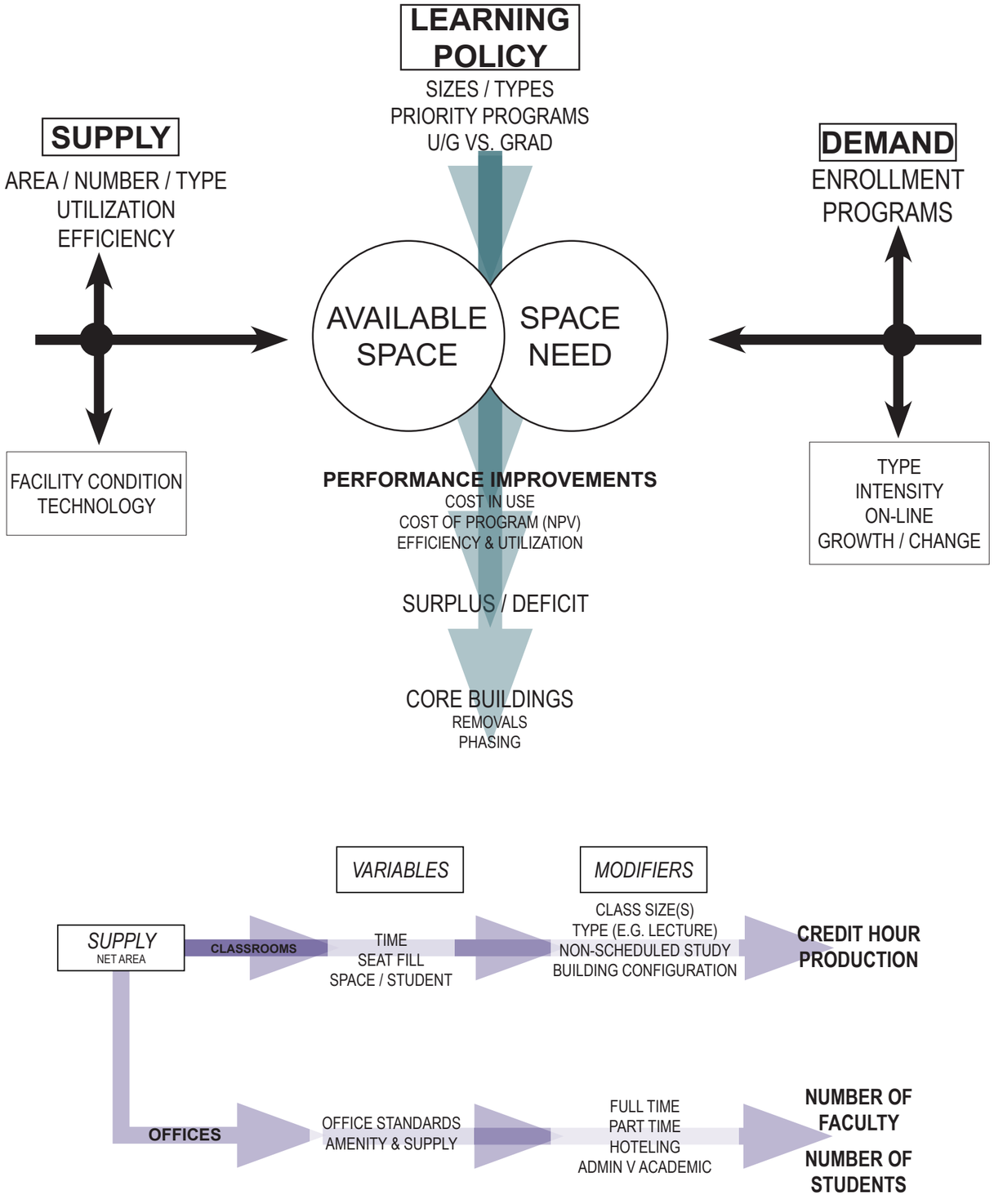


WORKS

- Historical Architecture
- Private offices allow for undisrupted calls and space for books
- Lecture-style classrooms with chalkboards
- Study space
- Close, homey environment
- Office space in proximity to classrooms
- Natural light
- Small class sizes
- Department identity
- Variety of classroom setups

DOESN'T WORK

- Outdated technology
- Lack of gathering space
- Inviting and well lit
- Heating and cooling system
- Design of large lecture - doors should not be in the front
- Accessibility
- Should have restrooms on every floor
- Need more outlets
- Reliable WiFi
- Larger desks and comfortable seating



3.1.4 Data Collection & Analysis

The renovation plan of Merrifield and Twamley is determined by a supply and demand analysis of campus resources to right size space need within the available envelope. Supply analysis consists of understanding the quantity of space which currently exists, its utilization, condition, and technology capabilities. This is juxtaposed with ideal standards for university pedagogy and the identification of ideal classroom types and support systems to enhance the university mission. The result of this process will drive immense performance improvements with the addition, reduction, and right-sizing of space to meet efficiency and utilization targets and improve cost performance.

The diagram at left describes how the team collects and analyzes data to create a demand-driven program model. This process involves thoroughly understanding the existing conditions, such as supply of space and its condition, as well as the demand for space based on enrollment, number of students in programs, and anticipated changes over time, This data is then filtered through the operational side of the institution, namely the curriculum, in order to evaluate what needs to change in order to meet the need that exists.

In UND's case, they are experiencing slow decline in enrollment over time, and declining in-person student counts as the popularity of online courses increases. The campus currently has physical assets to support a much larger student population, and as such part of this exercise was to help validate how to best reduce these physical assets to save operational costs.

At bottom, the diagram represents the flow of how demand information is established, by evaluating existing spaces against the standard metrics for utilization and configuration as well as how the spaces will be used. The data-driven space prediction approach is applied to the constant variables, or standards, in each space type, and then modified to achieve various performance metrics. In classrooms, quantity of student time in class, area per student, and room utilization standards creates the footprint of needed classroom space. This lump sum can then be divided across different class sizes and learning environments to create a detailed learning portfolio mixed with supplemental study space within the defined building envelope. The availability and type of learning environment defines the quantity of credit hours that can be produced in the facility, and respectively, the throughput of students through the university system.

Offices are defined by university office space standards, and dictate the amenities and area included within each type of workspace. Office space is then allocated to the projected quantity of employees and distributed based on full time status and roll at the university. The quantity of faculty and staff the university can support is a direct correlation to the quantity of students the university can educate. These two calculation streams are inextricably tied and show the necessity of a combined approach to learning and office environments, such as the design process to Merrifield and Twamley.

At the end of this process, the consulting team delivers a program that is responsive to the demand (both current and future), as well as to how to support this program in the existing framework provided by campus assets.

3.1.5 Understanding the Current State

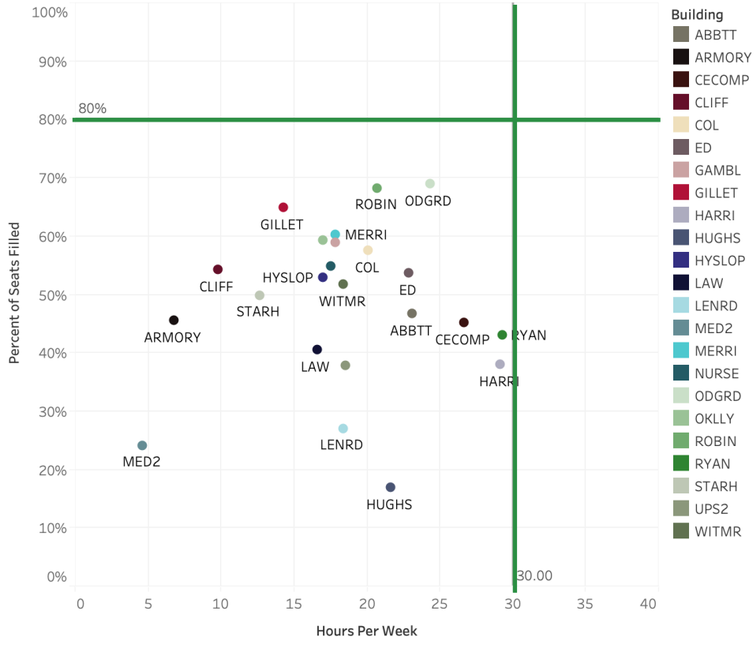
In order to build a baseline understanding of the current state at UND, the consulting team analyzed existing data from UND leadership and the Registrar's office for the full campus, including enrollment, program data, class-level enrollment, building space capacities and typologies, and existing campus standards. This data analysis revealed or confirmed several areas of improvement for UND; mainly that spaces are currently highly underutilized across all buildings and space types, and that the existing spaces do not fit the existing need or function in many cases.

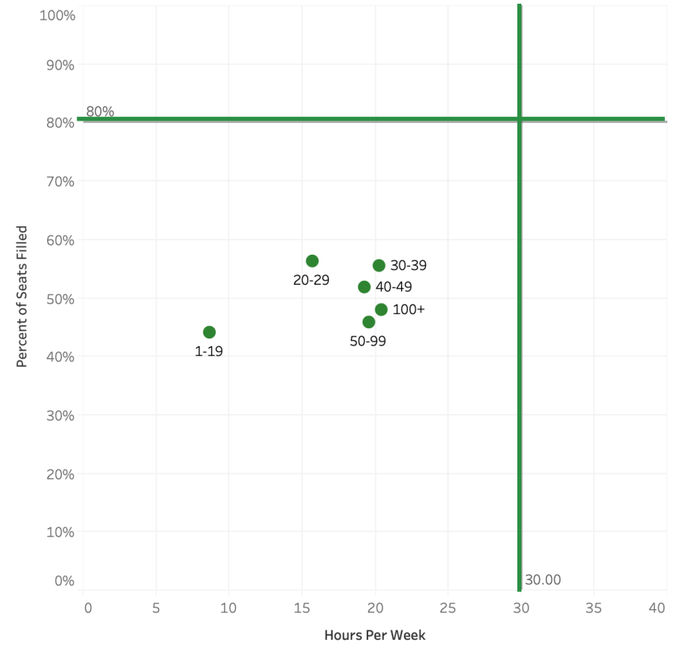
The graphics at right measure utilization across a variety of locations and space types with the targets highlighted in bold lines for reference. Utilization targets for campus classrooms are measured in two ways:

- **Hour Utilization: Each classroom should be scheduled for an average of 30 hours/week, this is plotted on the x-axis of these graphs.**
- **Seat Utilization: 80% of seats should be filled by students enrolled in a class, these are plotted on the y-axis of these graphs.**

Definitions:

Seat/Hour: The learning capacity on campus as defined by the amount of space (by seat) and time (by hour) available for instruction at target utilization.





Campus Total Seat/Hours: 238,560

Current Campus Seat/Hour Use: 95,276

Total Seat/Hour Utilization: 40%

"The campus uses less than half its capacity"

Detailed Methodology: Campus Space Utilization

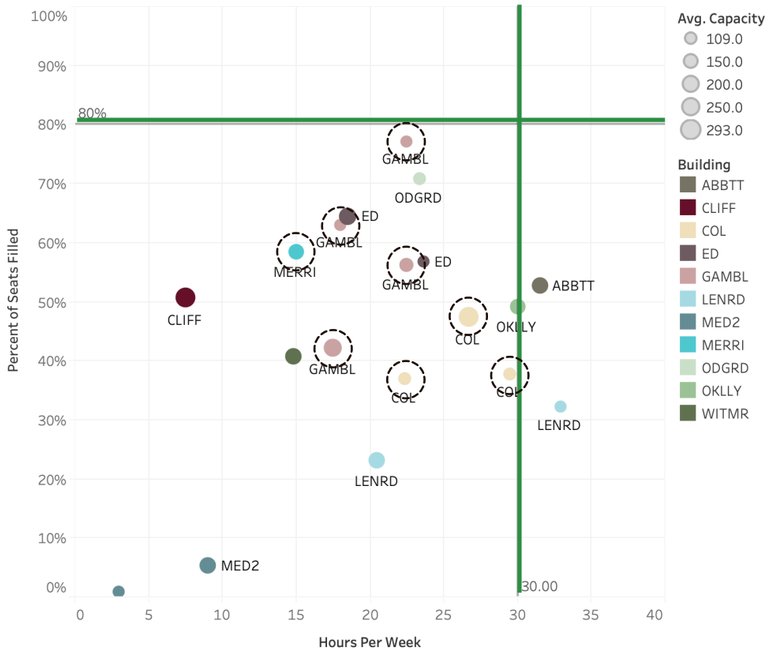
Understanding campus utilization of learning environments shows the surplus or deficit of spaces and prompts questions for further investigation.

UND is underutilized in both seat and hour utilization metrics across all buildings indicating a surplus of space on campus. If all utilization targets are met, the campus can accommodate over 230,000 seat hours. **Currently, the campus uses less than half this amount at 95,000.** Solutions to increase the efficiency of campus environments include demolition of campus buildings, improved scheduling, and renovation of current campus spaces to create high-performing environments.

Detailed Methodology: Campus Space Utilization - Size Analysis

Analysis was also performed for different sized learning environments on campus. In this image, hour and seat utilization are marked for different sized rooms, with the size of the circle correlating to the quantity of rooms that size. In general, all size classrooms perform at the same utilization, with classrooms under 30 seat capacity scheduled the least amount of hours. **Classrooms between 20-39 seat capacity typically see the highest enrollment. The largest classrooms typically see the lowest enrollment as a percentage of the room filled.**

This chart indicates that no particular room size is in high demand. Instead, renovation should focus on developing learning environments that meet the direct need of it's occupants by section size, pedagogy, and technology to create highly efficient classrooms that meet the education goals of the university.



Campus Total Seat/Hours: 77,472

Current Campus Seat/Hour Use: 30,791

Total Lecture Seat/Hour Utilization: 40%

Detailed Methodology: Campus Space Utilization - Lecture Halls

Specific attention was paid to lecture halls as they are the most space-intensive, yet pedagogy is shifting away from this style of teaching towards more active learning in the classroom. Across the board, lecture halls do not meet their enrollment targets while very few meet their hour utilization target. **If fully utilized, lecture halls could accommodate over 75,000 seat hours, however they currently employ less than half that at roughly 30,000.** Planned demolition of Columbia and Gamble halls and reconfiguration in Merrifield will reduce the quantity of lecture halls by 28,000 seat hours and go very far in right-sizing campus to future lecture hall needs. **It is recommended that no new lecture halls are constructed as this scheduled demolition right-sizes this particular learning space on campus.** Instead, focus should be placed on increasing utilization of current large lecture spaces on campus by taking a university-wide approach as opposed to a departmental perspective in course scheduling.

3.1.5 Understanding the Demand

After establishing that the anecdotal evidence provided by UND leadership was supported by the data in that spaces on campus are highly underutilized, the consultant team sought to understand what the space demand would be based on programs, enrollment, and evaluating what the best fit would be for a new configuration within the renovated Merrifield envelope.

The team also had initial findings about how to start shaping the initial program based on the analysis of the current state, as follows:

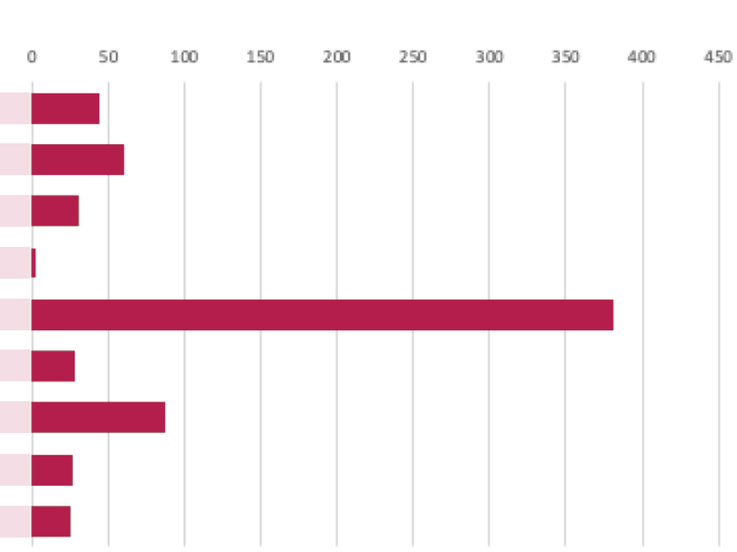
- The current ideal class size is 20-39 seats, however, UND leadership wants to insitute operational changes to increase these class sizes.
- The campus does not need additional large format instructional spaces, as the existing spaces will improve in utilization once some physical assets are demolished or renovated.

These findings helped to focus the next area of investigation to better understand what the actual demand for the campus is.

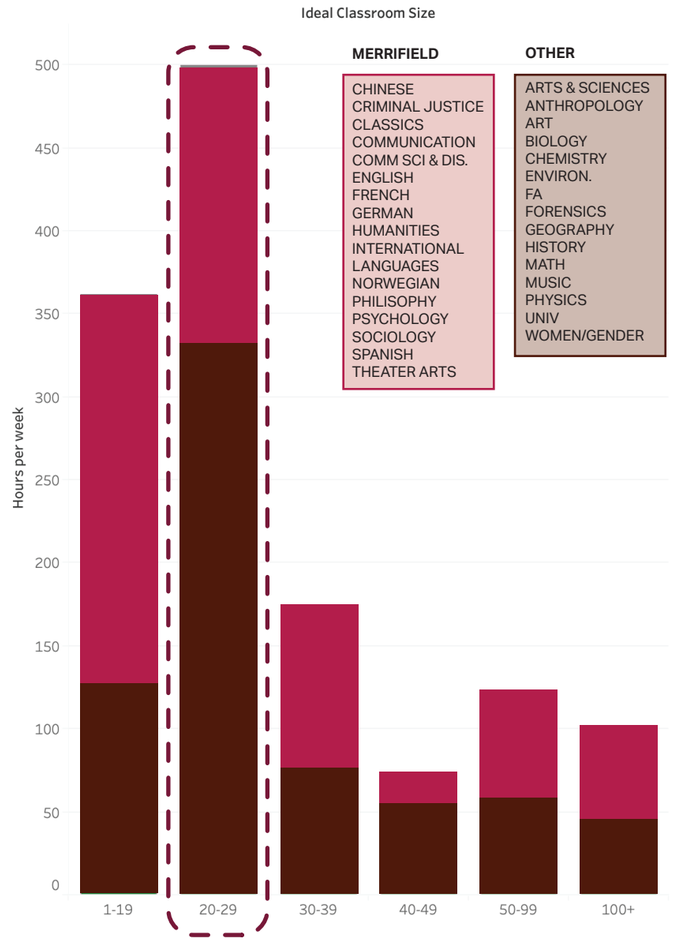
Detailed Methodology: Merrifield Design - Core Department User View

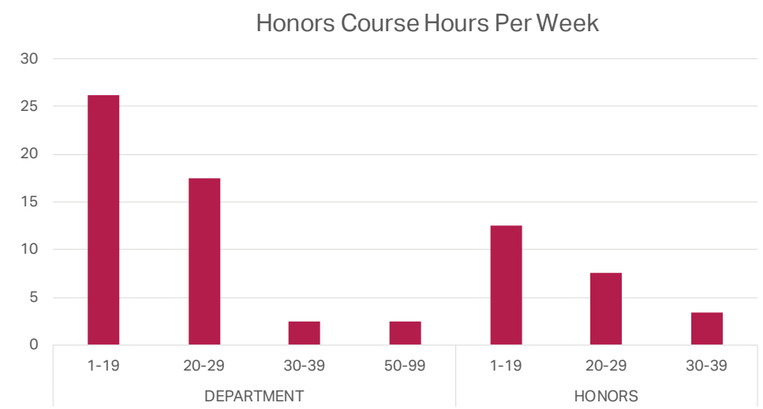
The new Merrifield building is designed to combine the general learning needs of all department occupants in Columbia and Merrifield halls. A look at the general learning credit hours (non-lab or specialty environment classroom) gives a first understanding of the space requirements needed to accommodate all nine departments that currently reside in Merrifield, and existing instructional spaces in Columbia. At 681 credit hours offered in the fall term of 2019, **23 classrooms would be required to fit this course load**. Further investigation in this document determines the mix of classroom sizes needed to fulfill specific course requirements.

PROGRAM	CREDIT HRS PER WEEK
Communication Sciences & Disorders	44
Communication	60
Criminal Justice	30
Humanities	2
Languages (including English)	381
Philosophy & Religion	28
Psychology	87
Sociology	26
Theater Arts	25
TOTAL CREDIT HOURS	**681**
TOTAL CLASSROOMS NEEDED	**22.7**



"Less lecture halls will increase utilization and active learning"





Honors Program Space Request	Recommendation
Two (2) 30-seat classrooms	Access to: One (1) 20-seat classroom One (1) 30-seat classroom
Five (5) private offices	Six (6) private offices, with shared collaboration spaces
Reception with two (2) workstations	
Conference Room for 18	Conference for 10 and shared collaboration space
Student Lounge	Shared collaboration space

"The new Honors Program will support up to 800 students"

Detailed Methodology: Campus Space Utilization

Investigation was completed on the section sizes of core building occupants and the wider College of Arts & Sciences enrollment to gauge if alternative departments could be a better fit in the new building. **The ideal size classroom for department courses is 29 seats and under.** A design goal for the new Merrifiield Hall is to increase classroom size. While the prospective core building occupants have a majority of small section offerings, no other Arts and Science program is a clear fit for a new large format classroom building. This would indicate that operational procedures need to be put in place to increase course sizes across UND departments.

Detailed Methodology: Honors Program

The Honors Program currently resides in Columbia Hall, which has been slated to be removed as a campus asset, and therefore the program will need a new home. This program has been in growth mode for the past several years, and is currently acting as a recruitment tool and a focal point to draw students to campus.

A fully built-out Honors Program will be incorporated into the new Merrifield design and will feature an entire suite of spaces including office, conference and lounge space for an all-inclusive Honors Program experience. Approximately one third of honors courses are held in honors department controlled classrooms. The new design will designate two classrooms adjacent to the suite as high-end honors student classrooms and will serve in increasing the potential capacity to the honors program to 800 students.

The suite will also include all honors faculty and administrative office and a variety of informal and formal collaboration spaces for students and staff, including an expansive lounge for student to study and and socialize.

The Honors Program will serve as a core enrollment driver for the university at large, and the suite provided will both allow the capacity for growth while increasing the outcomes of being admitted to the prestigious honors program at UND.

3.1.6 Detailed Space Calculation Processes

Learning Space Calculation

The prediction for learning space needed at the university is derived from credit hours and courses offered by departments at the university as an indication of how much learning space is needed to meet the current educational offerings. To predict future education space needs based on changes in pedagogy, course enrollment and quantity of sections are incorporated to indicate quantity and size of courses. Predicted undergraduate enrollment decline is layered into the current offering to result in a reduce quantity of multi-section courses and smaller enrollment in undergraduate classes. **Individual course enrollment is placed into a room size category based on an 80% seat utilization target, and courses are summed to predict the quantity of room sizes needed to accommodate all courses at a 30 hour per week utilization target.**

Office Space Calculation

Office space is determined by counting the number of full time equivalent employees per department, per employee classification. Each faculty member is allocated a private office while large and small workstations are allocated to administrative staff and graduate students respectively. Conference and lounge space is quantified by a set allocation as part of the quantity of offices in the building. All spaces are adjusted to appropriately fit within the building envelope, meet the needs of future occupants, and comply with office space standards.

Student Life Space Calculation

Student life spaces to meet the needs of student study and social space can be determined by starting with the full time equivalent number of students occupying a building. Each student is allocated an average amount of time predicted to be using non-scheduled space and is distributed through the variety of space types offered by intensity of use. Utilization metrics are layered on top to ensure there is enough space for the desired use rate.

LEARNING SPACE CALCULATION

CREDIT HOURS OFFERED BY DEPARTMENT → **QUANTITY OF COURSE SECTIONS** → **ENROLLMENT SIZE** → **FUTURE POPULATION ADJUSTMENT** → **UTILIZATION TARGETS**
80% SEAT FILL
3O HOURS/WK
→ **FORECASTED LEARNING SPACE** (NASF) →

ROOM TYPE
ACTIVE CLASSROOM
TRADITIONAL CLASSROOM
↓
ROOM CAPACITY

OFFICE SPACE CALCULATION

DEPARTMENT → **EMPLOYEE BY TYPE (FTE)**
FACULTY
STAFF
GRAD STUDENT
→ **OFFICE SPACE PER EMPLOYEE**
OFFICE
CONFERENCE
LOUNGE
ADMINISTRATIVE
→ **OFFICE SPACE** (NASF) →

ROOM TYPE	FICM
OFFICE	310
CONFERENCE	350
LOUNGE	650
MEDIA	530
SERVICE	MANY

STUDENT LIFE SPACE CALCULATION

QUANTITY OF STUDENTS (FTE) → **HOURS IN USE** → **DISTRIBUTION OF TIME BY SPACE TYPE** → **UTILIZATION** → **STUDENT SPACE** (NASF) →

ROOM TYPE	FICM
STUDY ROOM	680
OPEN STUDY	410
LOUNGE	650
MEETING ROOM	680
SERVICE	MANY

"Accommodating 1,750 full time students per semester"

3.1.7 Proposed Optimal Program & Best Fit

Detailed Methodology: Merrifield Design

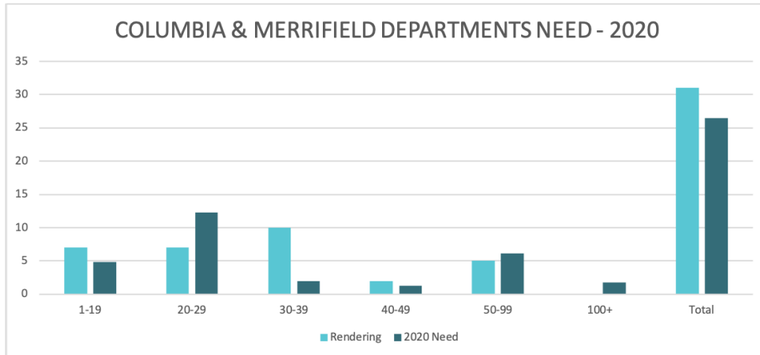
The design of the new Merrifield general classroom building marries the needs of the core building occupants with the future pedagogical and operational goals of UND.

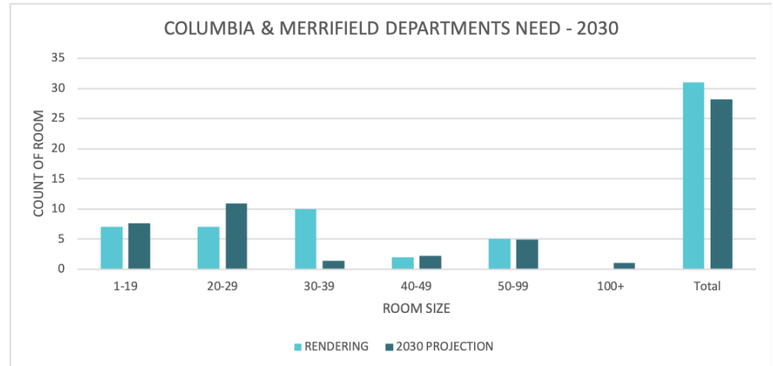
Core building occupants currently hold the majority of their classes with enrollment of under 30 students. The new Merrifield Hall will contain five seminar rooms for classes 10-19, and seven 20-29 person rooms to meet this existing need. **Additionally, a mix of 20-29 seat classrooms and 30-39 seat classrooms balances the existing need for 25-29 seat classrooms while allowing for additional growth in class sizes.**

Course projections for 2030 accounts for reduced campus enrollment and predicts new section quantities and course sizes. The ten-year projection for department courses indicates a good fit within the building design with room for section size growth. With the new building as a catalyst for change, it is advised that policies and procedures are put in place to increase section sizes of courses with under 30 students enrolled.

The demolition of several campus buildings in conjunction with the construction of new high-quality learning environments in Merrifield Hall begins to right size the campus to achieve future operational goals. New construction gets the campus closer to reducing surplus space and growing larger section sizes while still providing for the current needs of campus. Additional considerations need to be made in the future for additional building demolition and renovation to adjust the existing education infrastructure to match the current and future needs of the university.

Optimal Classroom Program			Provided in Planning				
Classroom Capacity	**QTY**		**GL**	**G**	**L2**	**L3**	**Total Provided by Capacity**
10-12	2		1	1			2
16-24	3		4	5	1		10
25-29	11						0
30-39	3		2	2	4	2	10
40-49	4					2	2
54-65	2		1	1			2
65-80	2				2		2
90	1					1	1
Total Optimal	28	Total Provided by Level	8	9	7	5	29
Honors Program							
24	1			2			2
30	1						
Total Optimal	**30**	**TOTAL PROVIDED**					**31**





"To allow for growth to larger class sizes"

Program	Faculty & Staff Need	Grad Students
Communication	14	12
Humanities	1	
Languages	18	25
Philosophy & Religion	8	
Psychology	35	12
Theater Arts	16	
Totals	**89**	**49**

Detailed Methodology: Office requirement

The key component to creating a holistic four-building ecosystem is creating more direct lines of communication and access between students and staff. While Merrifield will become the premiere general education building on campus, Twamley will serve the complimentary function of a faculty home base physically linked to encourage student access.

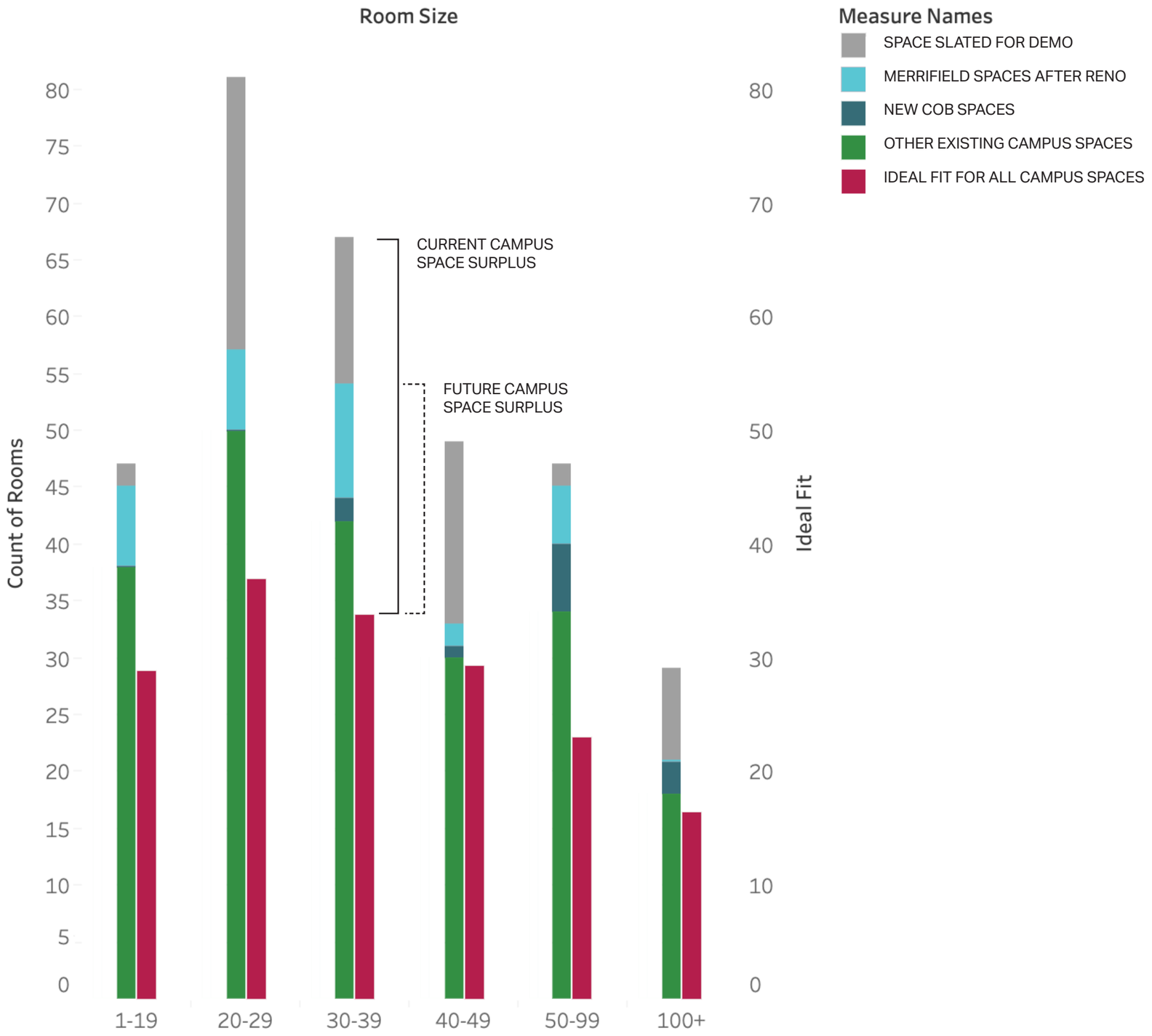
The majority of departments who will be using Merrifield as their primary classroom building will hold all department offices in Twamley, including graduate student offices. An abundance of conference rooms and an additional faculty lounge space will set the stage for interdisciplinary collaborations to develop between previously sectioned-off departments, and facilitate a greater sense community within university faculty. Meeting rooms stationed throughout Twamley and Merrifield enable more opportunities for students to access faculty office hours and create lasting relationships.

The third floor of Twamley will transition from the UND President's suite to the Arts and Sciences Dean's Suite. This move will allow for improved communication between Arts and Sciences leadership and faculty with little renovation to the Dean's floor.

3.1.7 Confirming Right-Sizing & Next Steps

The demolition of several campus buildings in conjunction with the construction of new high-quality learning environments begins to right-size the campus to achieve future operational goals. Renovation of Merrifield and Twamley gets the campus closer to reducing surplus space and growing larger section sizes while still providing for the current needs of campus. Additional considerations need to be made in the future for additional building demolition and renovation to adjust the existing education infrastructure to match the current and future needs of the university.

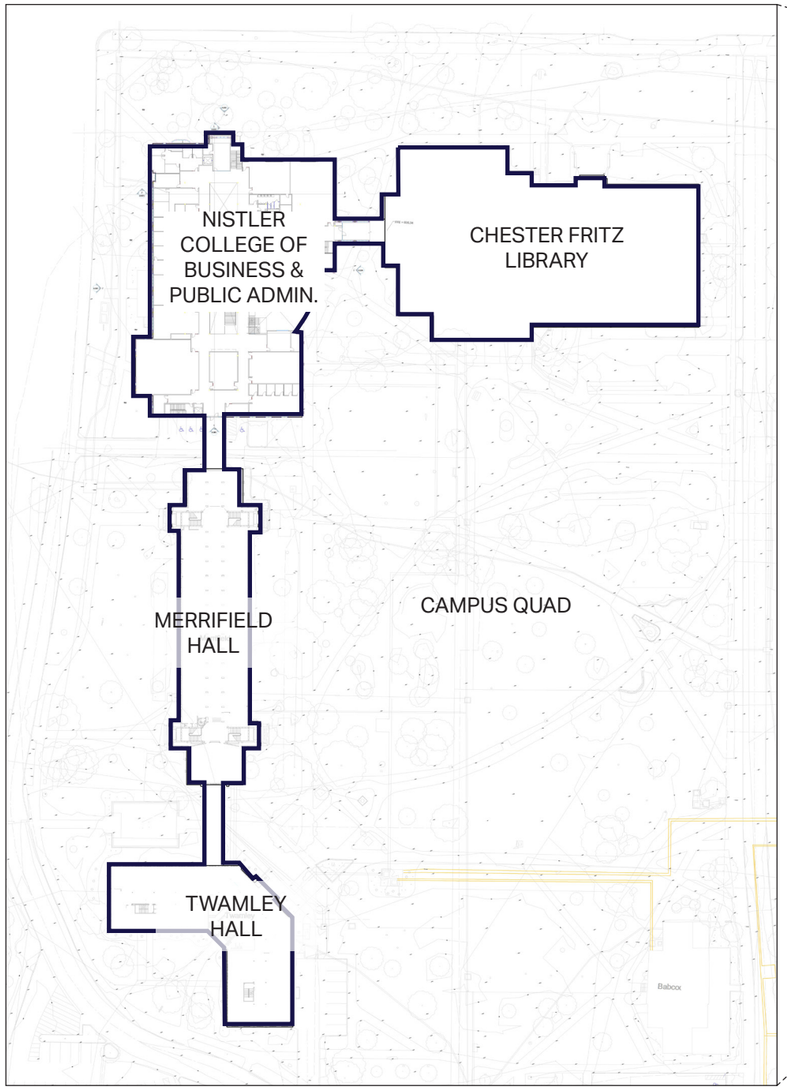
The graphic at right illustrates how the future state after completion of the Merrifield and Twamley renovations and demolition of Columbia and Gamble will impact overall campus utilization. The "Ideal Fit" is calculated based on current and future projections of enrollment as compared with existing and future space condtions. While this scope of work illustrates huge progress in right-sizing the campus, it also underscores the need for additional reductions over time to help save operational and maintenance costs.



3.1.7.1 Campus Master Planning & Four Building Ecosystem

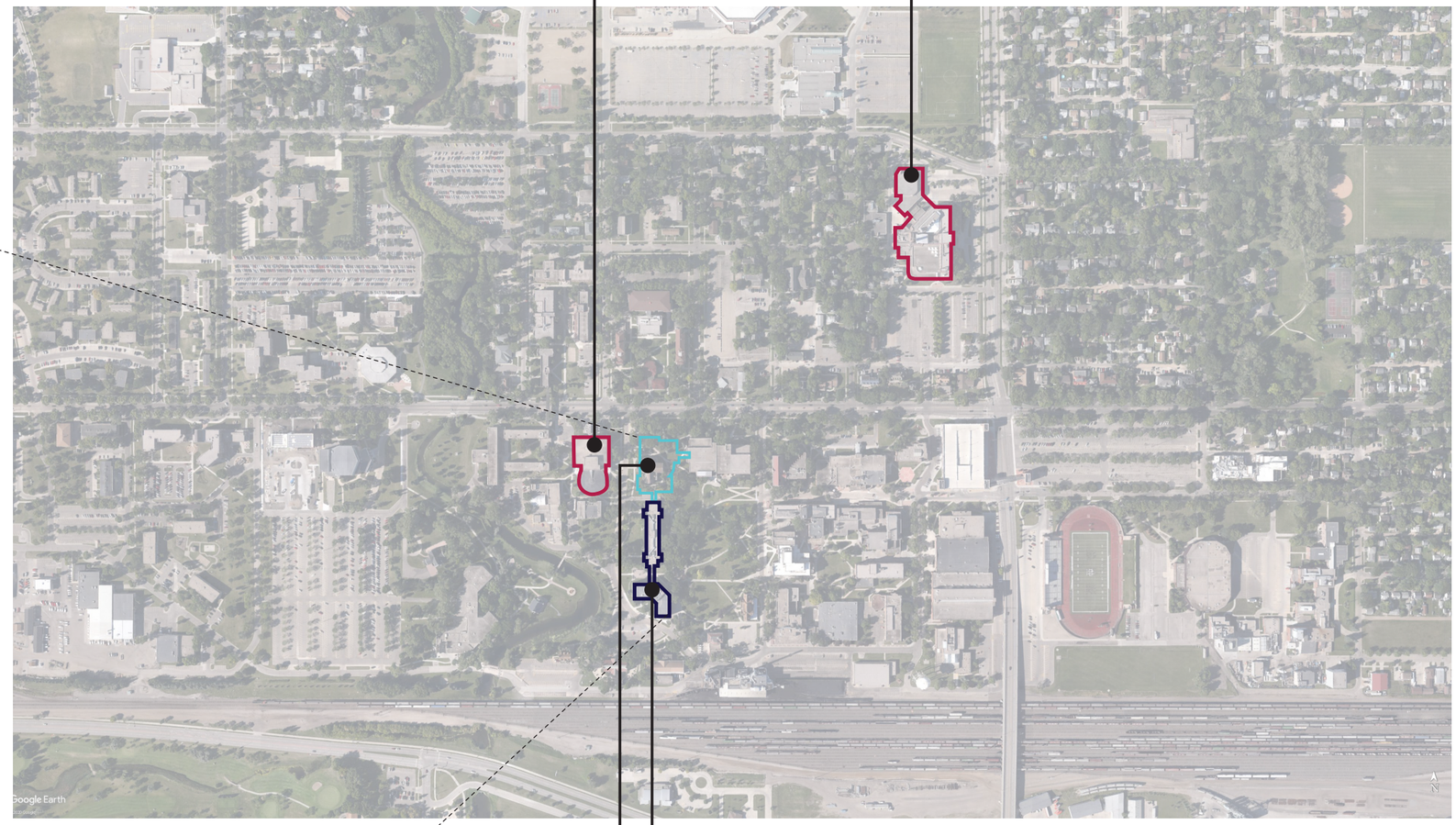
In looking holistically at how this scope of work affects space and strategic planning on campus, this team has found that this effort will support a variety of campus goals from addressing deferred maintenance, to reducing overall surplus of space, to enhancing the on-campus experience for students, faculty and staff.

In addition, the added benefit of creating the Four-Building Ecosystem within the core of the UND campus creates a new focus and heart for everyone coming to these buildings for decades to come.



Gamble Hall: to be demolished
Replacing existing classroom capacity in COB
To be replaced with surface parking

Columbia Hall: to be demolished
Replacing existing classrooms, offices and Honor Program in Merrifield
Other programs to be relocated: research labs, specialty teaching spaces, DigiComm Lab



College of Business: to be constructed
Adding classroom capacity to campus

Merrifield, Twamley & Sky Bridge
Consolidating classrooms, offices, and Honors Program while creating a Four Building Ecosystem
Site work, surface parking, and landscaping

"Achieving 90% of utilization target"

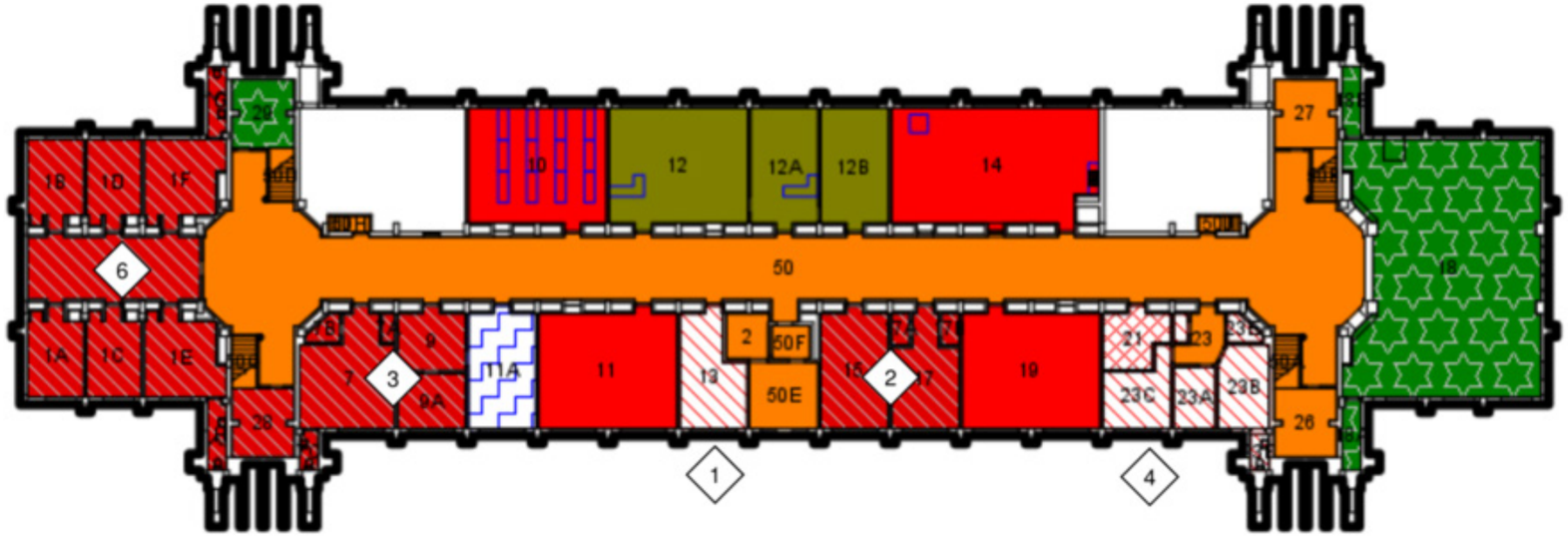
3.2 MERRIFIELD PLANNING, SPACES & CONCEPTUAL FLOOR PLANS

3.2.1 Merrifield Existing Conditions

Merrifield Hall, originally completed in 1929, is a beloved icon on campus, but has not been significantly updated since the 1970's and does not support a positive learning environment. Dark double-loaded corridors, malfunctioning windows, and poor technology all contribute to a lack of functionality and ethos for the College of Arts & Sciences.

Nine departments are currently housed in the building, each siloed and laid out much like a patchwork quilt in the narrow building footprint. Smaller classrooms prevail mixed in with office suites and student interaction or collaborative space wedged in where space is available.

The biggest takeaway from our user engagement is that students and faculty love the stairs the most as they are an iconic part of the architecture of the building and convey a sense of the collegiate experience. Other than these elements, not much else supports either students, faculty, or staff in their day-to-day experiences.



EXISTING MERRIFIELD HALL DEPARTMENTAL ORGANIZATION PLAN.

VIEW OF EXISTING DAYLIT NORTH STAIRWELL BALCONY AT LEVEL 3.

EXISTING MERRIFIELD INTERNAL DOUBLE-LOADED CORRIDOR.

INTERIOR VIEW OF EXISTING CLASSROOM WITH CHALKBOARDS.

3.2.2 Merrifield Planning Approach

Merrifield's planning, inherently driven by the narrowness and structural bays of the building, was inspired by creating both an efficient organization while also providing more space for connection and interaction. The largest design move– creating a new, centrally-located entry point on the east facade facing the Quad– is meant to improve accessible connection to the exterior landscape, as well as wayfinding and daylight into the building.

Additionally, the Honors Program has been integrated into the planning of the building as a feature element, connected to this central space to act as both a beacon for students on campus and a recruiting tool for future students.

The current double-loaded corridor configuration of Merrifield results in a multitude of smaller classrooms, and a lack of access to daylight throughout most of the building. In order to both meet the optimal program mix of classroom sizes and also improve the quality of shared spaces in the building, the team has currently created a mix of planning layouts:

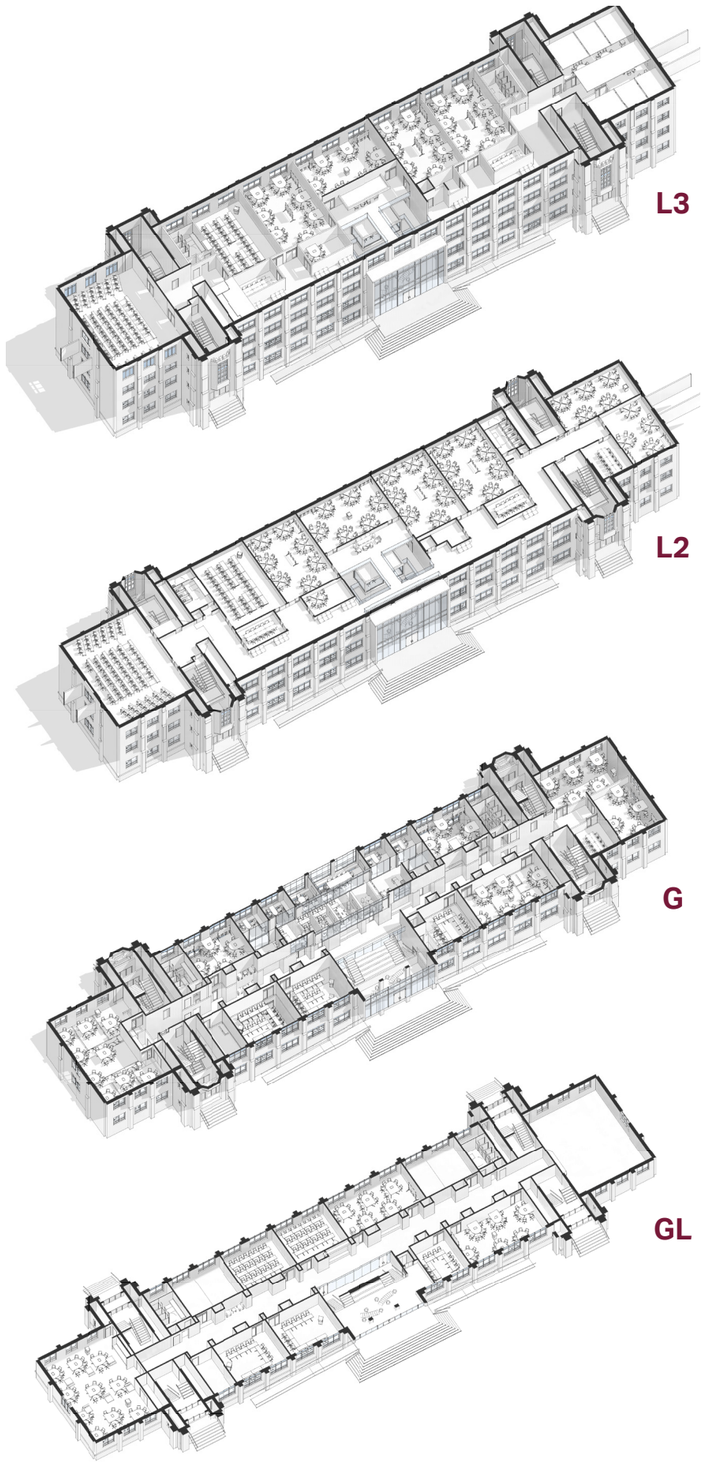
- The Garden Level and Ground Level floor plans will remain in a central corridor configuration, focused on providing mainly smaller classrooms while also connecting directly to the new central atrium space.

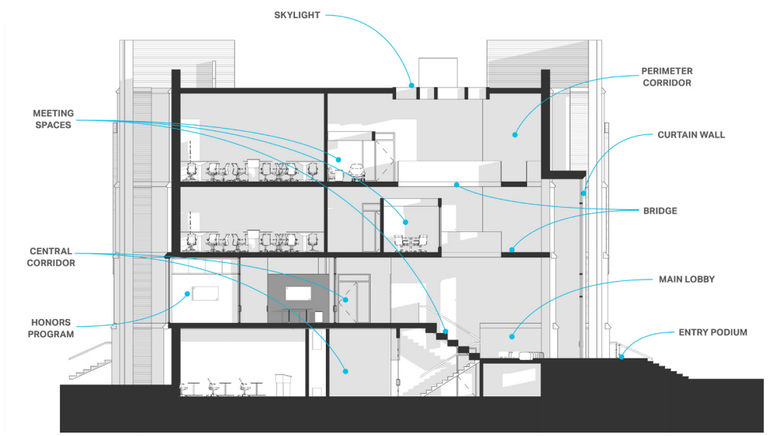
- The Second and Third floor plans will be focused around a new planning paradigm– an offset corridor configuration– that allows for the formation of larger classrooms coupled with collaboration and breakout space.

The design team has studied a multitude of planning options and we feel that this program mix and planning solution creates the most ideal solution for both today's space needs as well as for shifting needs into the future so that UND can have flexibility as pedagogies change over time.

"Space for collaboration and interaction"

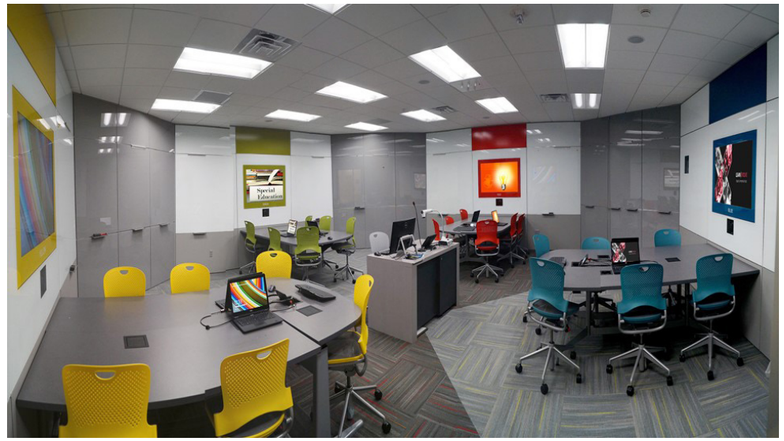
PERSPECTIVE CUTAWAY SECTION THROUGH PROPOSED CENTRAL ATRIUM ENTRY SPACE.





SECTION THROUGH CENTRAL ATRIUM WITH PROGRAM ELEMENTS.

"A new, centrally-located entry"



3.2.3 Space Design Criteria

A primary goal for renovating Merrifield is to bring the instructional spaces currently housed there and in other facilities into the 21st century, and prepare them to be adaptable for many years to come. There are several parameters that we have leveraged in the design of these spaces for the new Merrifield:

Flexibility & Adaptability

We are planning for higher densities of power and data so that students are able to use their devices through out classrooms and collaboration spaces alike. Spaces are designed to be able to flex between different types of pedagogies with flexible furniture and ample infrastructure, so that faculty can employ methods as they see fit over time. We have also considered the use of moveable partitions between some classrooms so that they can be expanded to hold larger format classes as needed.

Classrooms for the Future

Please refer to the Technology Program in Section 4.0 for more detail-- the Audiovisual and IT infrastructure for instructional spaces will be designed to support classes not just now, but well into the future. The criteria for these spaces has been informed by test cases on campus, as well as by targeted users and stakeholders on campus who leverage this technology.

Maintaining the Collegiate Spirit

One of the biggest things we heard from students on campus was that they love Merrifield because it defines the collegiate experience for them. We want to not only maintain this, but also enhance it by creating classrooms that extend this feeling. By increasing access to daylight, providing state-of-the-art infrastructure, and creating appropriately scaled and comfortable collaboration spaces we aim to create a learning environment that supports this spirit.

3.2.3.1 Active Learning Classrooms

UND is ahead of many institutions in that they are embracing Active Learning Style Classrooms across campus, and pushing their faculty to rethink their teaching methods to respond to modern demands from students. Problem-Based Learning is increasingly becoming a popular pedagogical paradigm as students gain hands-on experience with creative problem solving.

The classrooms in Merrifield are designed to be able to function in both didactic and active learning styles, with an emphasis to move especially larger classrooms to a more active learning style. These classrooms will be enabled with flexible furniture and power so that faculty can reconfigure spaces as needed. Smaller format Active Learning Classrooms (up to 36 seats) feature a perimeter format with displays on all walls and a single attention wall for instructor projection. Larger format rooms (up to 80 seats) will be oriented towards a common attention wall, with individual displays at each table so that a single instructor can still have students focused in one area, and students can still break out to do group work.

Finally, one 90-seat "Active Style" Lecture Hall has been included to blend different pedagogies while allowing teaching capacity for larger classes. Ideally, this space will be reconfigured with two rows of seating per tier, each with flexible chairs and fixed tables, so that students can turn around and collaborate across rows. This space will improve upon the current Lecture format by also providing enhanced accessibility and technology to allow for flexible modalities of teaching.

3.2.3.2 Didactic Classrooms

More traditional didactic-format classrooms such as Seminars remain in Merrifield to support smaller departments and class sizes for more discussion-based classes. These spaces will have flexible furniture and ample power to allow for reconfiguration of the space depending on the instructor and the group size as well as pedagogy.

3.2.3.3 Shared Collaboration Spaces

Around and in between instructional spaces, the learning environment is enhanced by providing appropriately-scaled collaboration spaces for students to break out before or after classes, hold meetings with faculty, study, or hang out with friends. As the design of Merrifield is further detailed, we will include a variety of collaboration space types to allow for a variety of interaction to occur throughout the building.

Enclosed collaboration spaces should be designed in a similar fashion to conference rooms with digital displays and powered furniture for collaboration. Open collaboration spaces will encompass more loose, lounge-style furniture and flexible tables for studying or meetings.

3.2.3.4 Honors Program

As a central component of the Merrifield Hall renovation, the design team has integrated the inclusion of the Honors Program into the Planning as it has inherent synergies with the instructional program programmed for the building. Please refer to Section 3.3 for information on office, conference, and associated space types for design criteria.

3.2.4 Merrifield Conceptual Floor Plans

The conceptual floor plans shown herein represent what the design team considered to be the best concept that meets programmatic needs, and achieves the best of our design vision. We have studied other options which can be found in Section 6.0 (Appendix) for more reference. As we move forward with validating the program in the next phase of work, we will work to ensure that we maintain all of the goals set forth in this document while also building in enough flexibility to respond to space needs over time.

There are several items to note in reviewing these plans, which represent the design vision collectively created with the Steering Committee and Design Team:

- All building systems will be removed and replaced in Merrifield and brought up to code.
- The existing elevator, which is past its useable life and is not adequately accessible, will be removed and replaced in a new location.
- Existing corridors have been shifted on the upper floors, allowing for larger classrooms and more daylight penetration into the building.
- The design also accommodates centralized restrooms for both genders throughout the building, stacked for efficiency.
- Basic coordination has occurred to plan for operational and systems spaces. The existing data hub in the basement is assumed to remain.
- New roof access through one of the existing stairs will be needed as the existing spiral staircase does not provide adequate access.

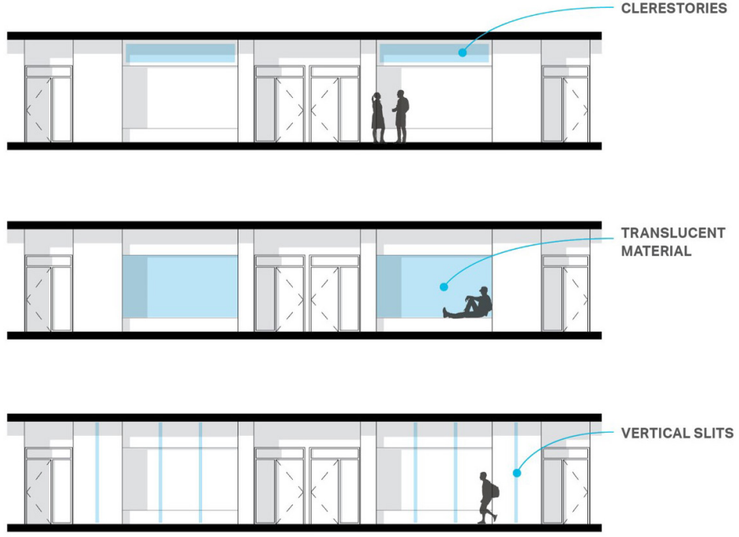
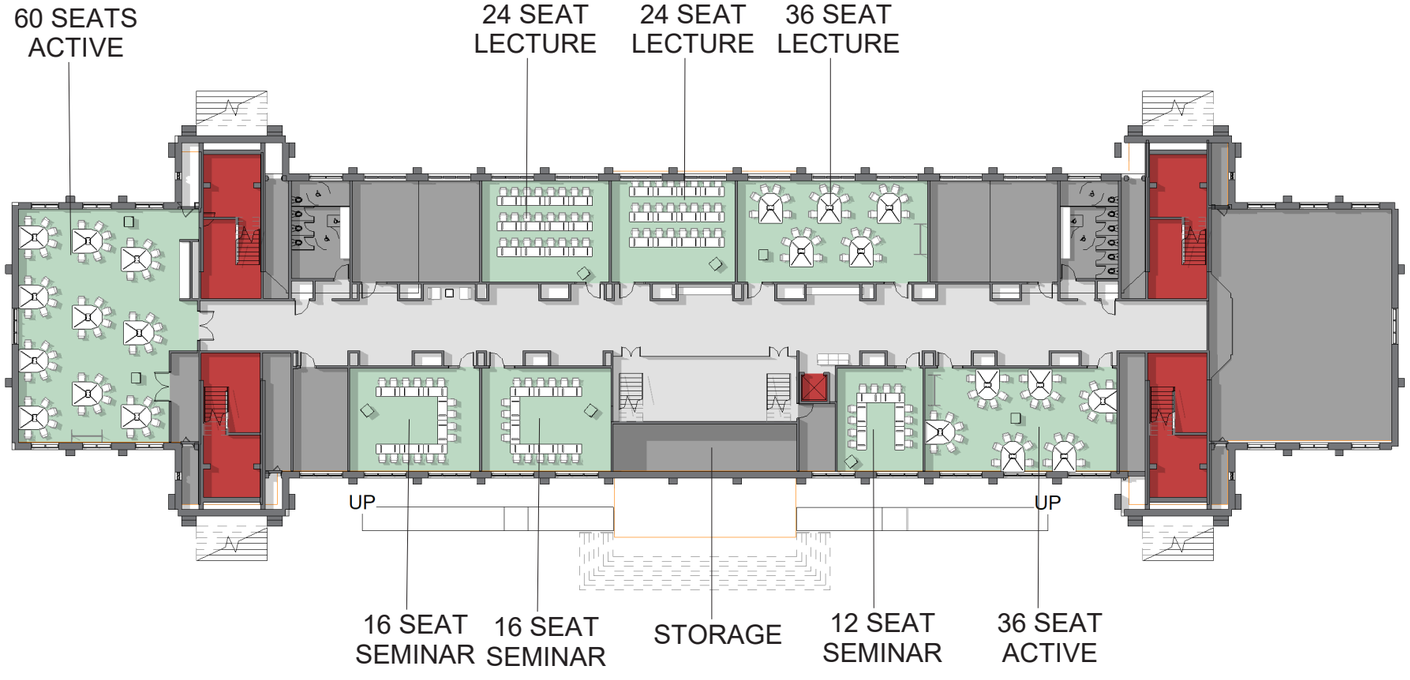
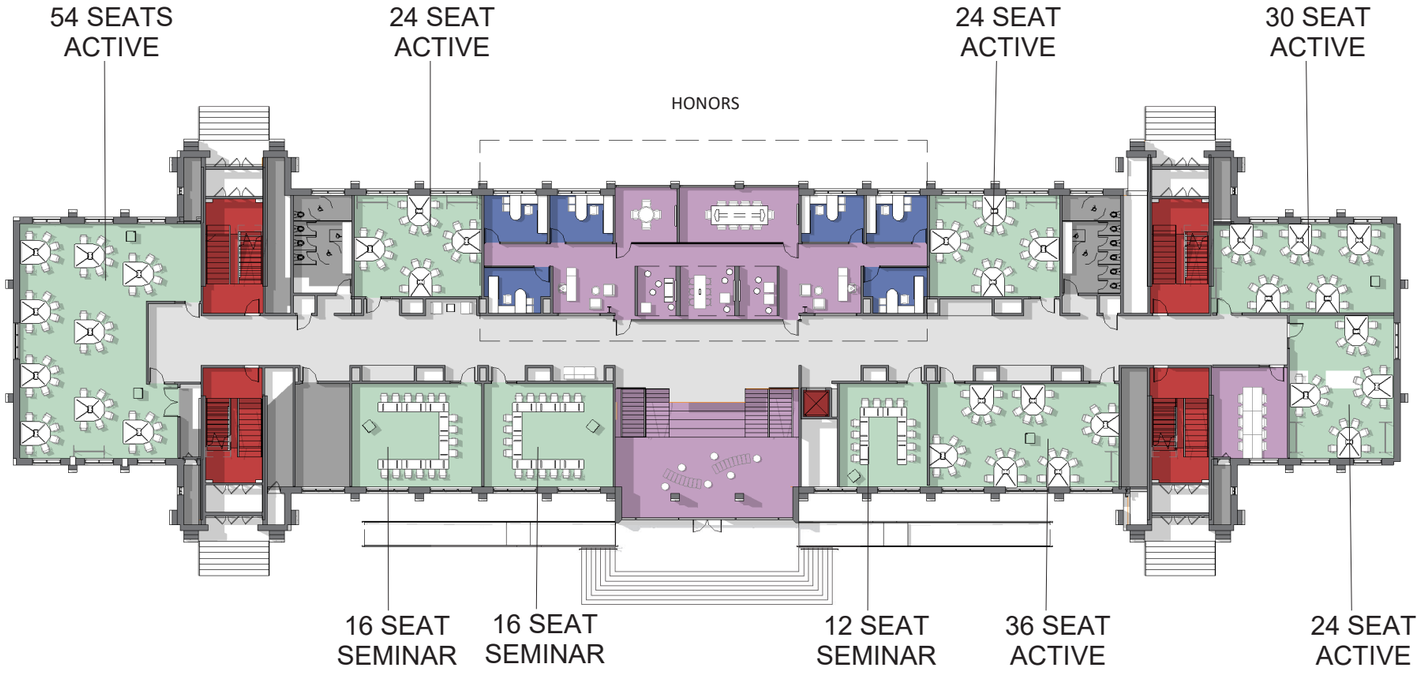


DIAGRAM OF TRANSPARENCY STRATEGIES.

"To bring spaces into the 21st century"



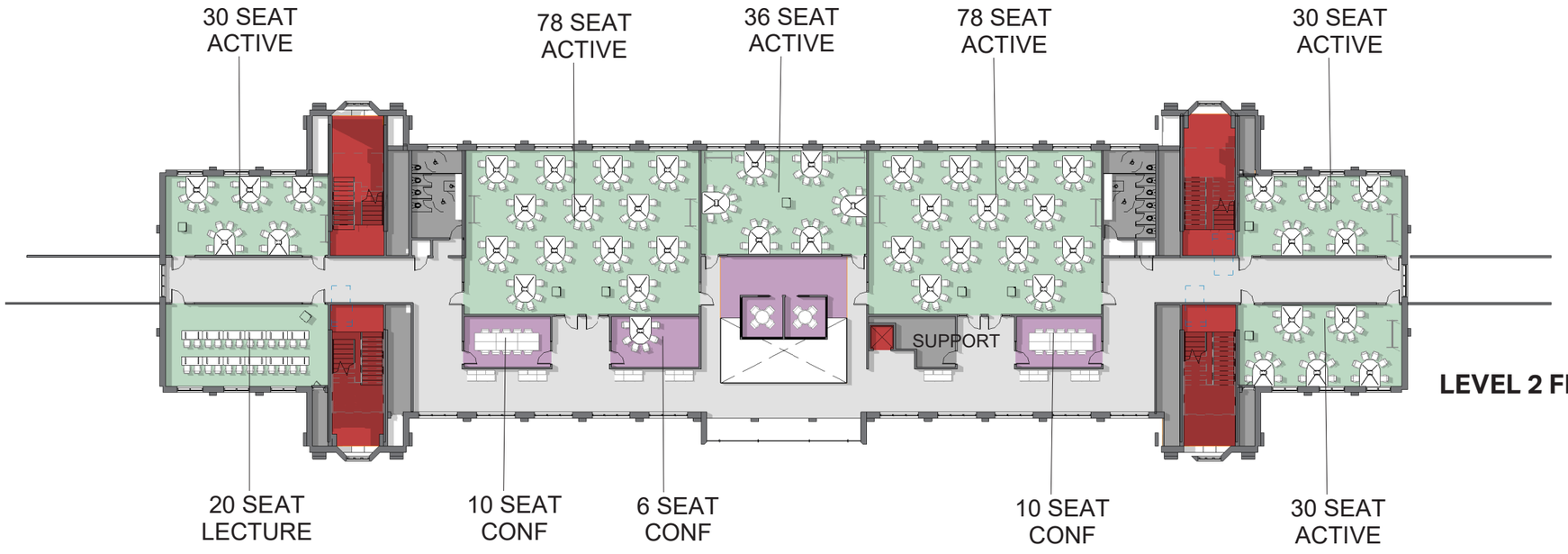
GARDEN LEVEL FLOOR PLAN



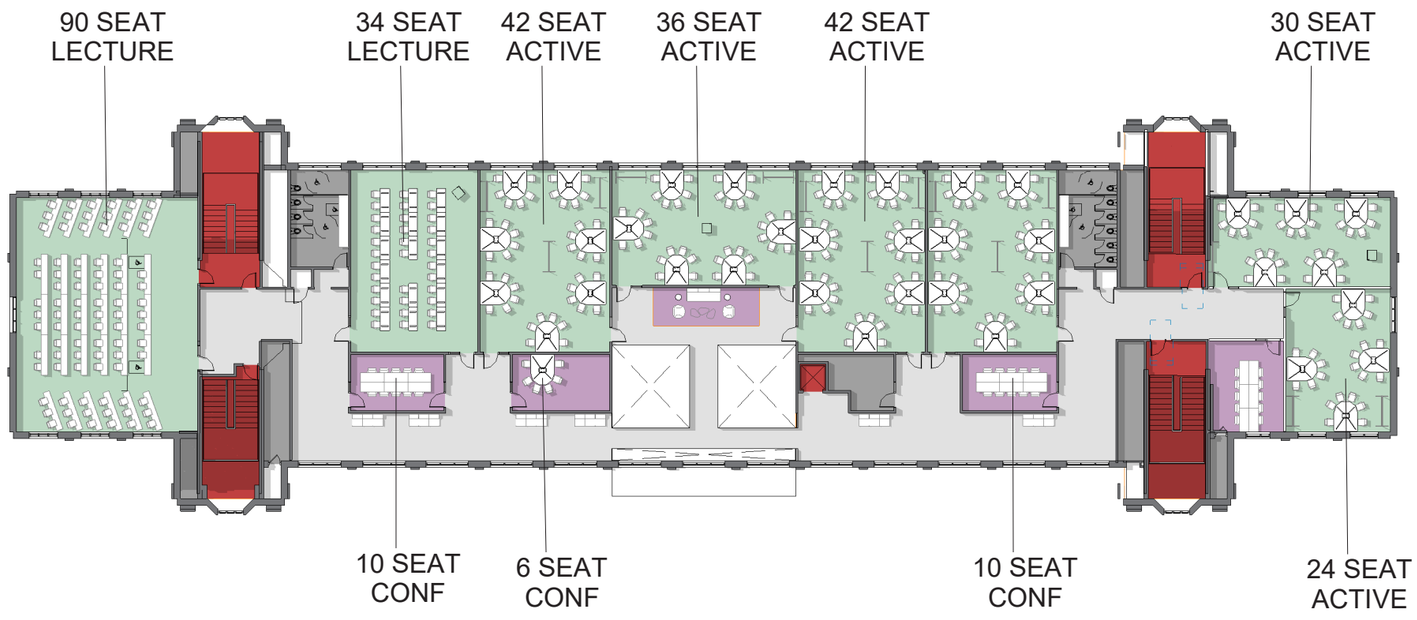
GROUND LEVEL FLOOR PLAN

- SYSTEMS/SUPPORT
- CIRCULATION
- CLASSROOM
- COLLABORATION
- OFFICE
- STAIRS/ELEVATORS

0 16 32 64



LEVEL 2 FLOOR PLAN



LEVEL 3 FLOOR PLAN

- SYSTEMS/SUPPORT
- CIRCULATION
- CLASSROOM
- COLLABORATION
- OFFICE
- STAIRS/ELEVATORS

0 16 32 64

3.3 TWAMLEY PLANNING, SPACES & CONCEPTUAL FLOOR PLANS

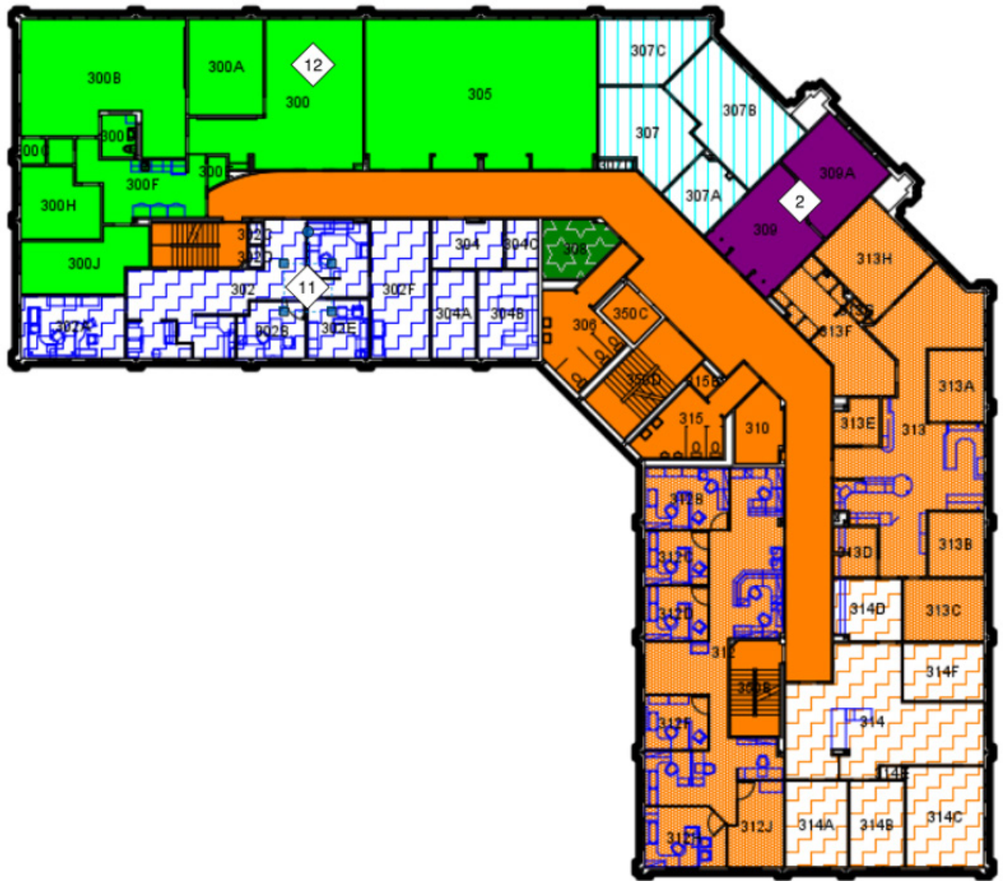
3.3.1 Twamley Existing Conditions

Twamley Hall, completed in the 1960's as an Administration Building, has always been a patchwork of many departments, functions, and varied styles and dates of interior fit-out. The full renovation of this project would seek to not only bring the building up to modern building codes and accessibility regulations, but also aspires to create a new paradigm for the working environment of faculty and staff on UND's campus.

Over the last four decades, the building has been updated in a piecemeal fashion by department or office suite resulting in a variety of office sizes and standards. Restrooms and public areas in some cases have not been updated since the building was built, and encompass a variety of accessibility issues. The traditional double-loaded corridor with divided office suites results in not only low interaction amongst groups, but also less shared amenity and collaboration space.

The interior renovations at Twamley Hall should aim to:

- Support how people work
- Create an open and welcoming environment and culture.
- Create more opportunities for collaboration as well as concentration
- Engender innovation and creativity
- Reflect and showcase the heritage of the site.
- Enable flexibility.



EXISTING DEPARTMENTAL ORGANIZATION FLOOR PLAN OF TWAMLEY.

EXISTING DOUBLE LOADED CORRIDOR.

VIEW OF EXISTING TWAMLEY LOBBY AND ELEVATOR.

INTERIOR VIEW OF EXISTING TWAMLEY OFFICE SUITE.

3.3.2 Design Principles

Create environments that both support and encourage all kinds of collaboration

The workplace should support learning, social interaction, knowledge sharing, and idea creation.

Formal and scheduled collaboration

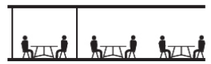
Provide the right number and size of meeting rooms and conference facilities

Informal, or ad hoc, collaboration

Environments designed to promote chance encounters and spontaneous interaction.

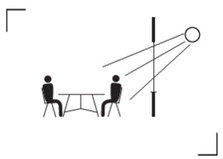
Remote, or virtual, collaboration

Meeting rooms to be equipped with the right technology (software and hardware) to connect with colleagues and students.



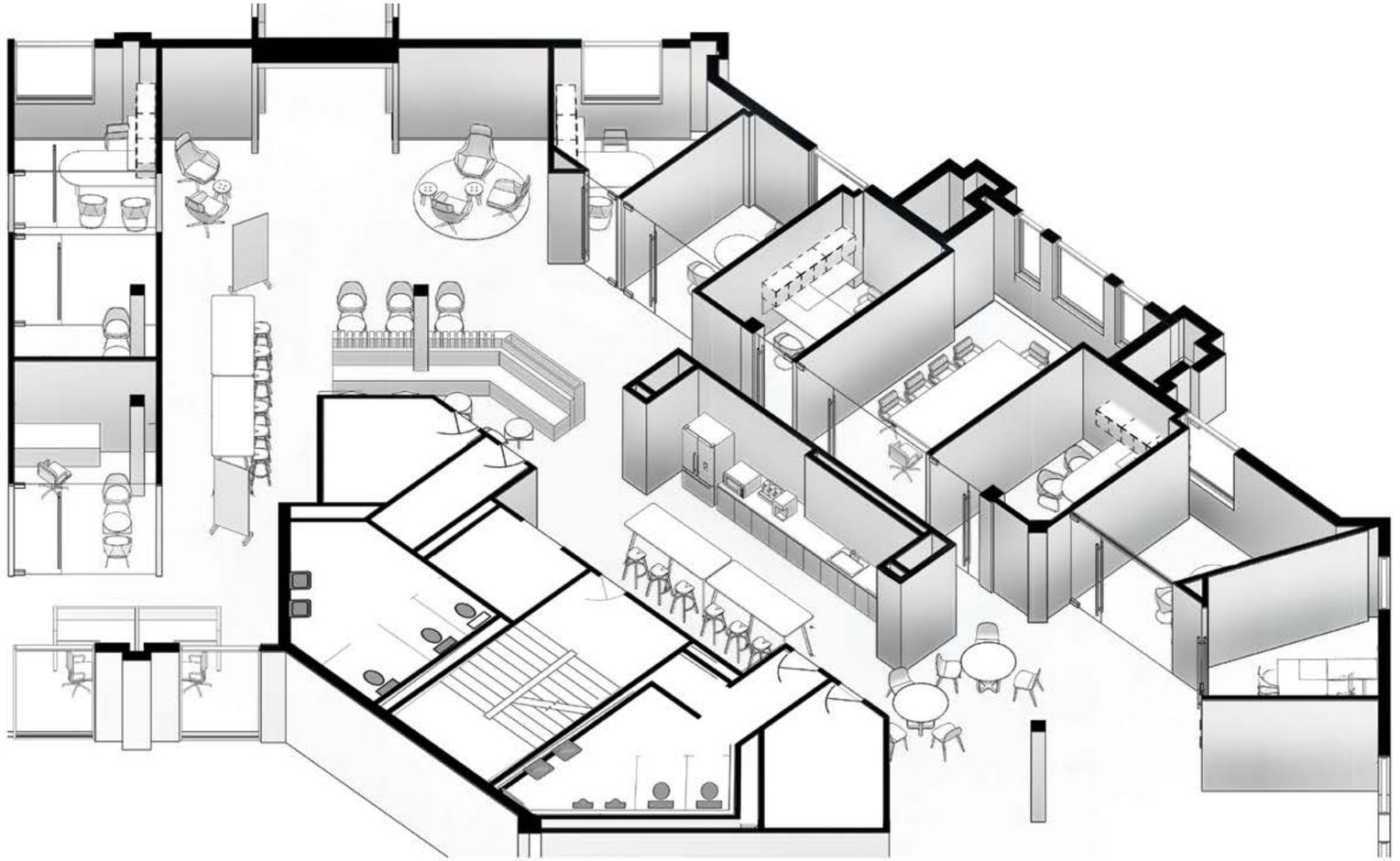
A mix of open and enclosed settings

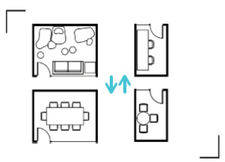
The number and kinds of enclosed areas should be balanced with a proportional number of open/semi-open areas that invite, rather than discourage, people from coming in and/or through. Where enclosed spaces are provided, ensure that natural light and views are maintained wherever possible through the use of glass walls and partitions.



Maximize natural daylight

Research has shown that quality of light directly affects quality of life in the workplace; people are happier, healthier, and can work more effectively when they have access to daylight and views to the outside. The workspaces have been planned to create a feeling of openness by taking advantage of natural light and using glazed fronts as much as possible, whilst still meeting programmatic needs.





Create modularity

The space planning should allow for as much flexibility as possible, so that the space can adapt as program requirements change. Therefore, room sizes and blocks should be modular to allow easy reconfiguration if required. In addition, systems furniture should be modular and easily reconfigurable to facilitate semi spontaneous assembly and dissolution of teams. Loose furniture will be light weight (both aesthetically & physically) allowing users to configure and reconfigure their space to suit their work style or team requirements.

"To bring spaces into the 21st century"

3.3.2 Space Design Criteria

Work Café/Pantry

Description: The work café is where users can informally interact and socialize. It is a multifunction, semi-open area providing on floor access to refreshments. These spaces should encourage faculty and students to stop and engage with each other.

Planning principles: One large work café should be provided per floor linking teams and planned close to primary circulation routes.

Furniture and Equipment: Furniture should be casual and support multiple functions providing a break from dedicated work areas. A mix of different height settings encourages impromptu discussions and informal meetings. Provide durable surfaces for ease of maintenance, recycling/waste systems to be in line with University of North Dakotas facility management and to ensure millwork meets ADA requirements.

Meeting Rooms

Description: Meeting rooms should be able to facilitate varying group sizes, both physical and virtual collaboration. AV, Markerboards; magnetic surfaces and movable flip charts should be accommodated. Acoustic privacy is important, provided to mask amplified speech. Glazing film should be used to help provide confidentiality, aid clear and simple wayfinding and provide information on booking facilities (manual or electronic).

Planning principles: Locate in entrance spaces, with easy access to refreshment facilities and comfortable break out seating. Balance transparency, for visual connectivity and access to natural light, with the need for occasional visual privacy.

Furniture and Equipment: Furniture must be comfortable/ ergonomic to occupy for a few hours at a time, lightweight and flexible. Provide on table power and data connections. Refreshment/ equipment credenza should be considered depending on planning location. Provide lighting to support presentations and control over daylight.

Offices

Description: 10x12 offices with a dual function of a formal enclosed meeting space for 3 people. Acoustic privacy is important, provided to mask amplified speech.

Planning principles: Locate adjacent to primary circulation. Cluster together with other enclosures to create a clear distinction between support/amenities to open workspace. Balance transparency, for visual connectivity to the workplace and access to natural light, with the need for occasional visual privacy.

Furniture and Equipment: Furniture must be comfortable/ ergonomic. Coat closets, markerboards and pin up surfaces should be provided along with storage.

Open Collaboration

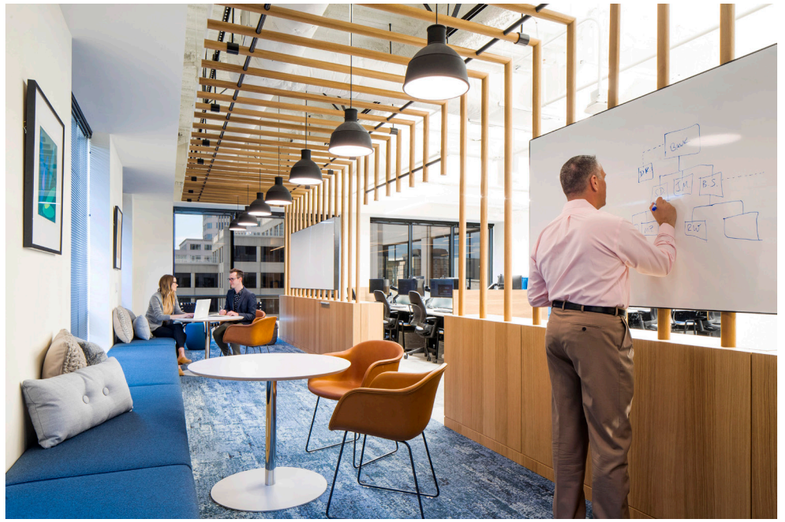
Description: Open collaboration spaces serve as break-out areas for idea sharing, project display and informal meeting. These spaces are not bookable, used for ad hoc meetings.

Planning principles: Locate these spaces with proximity to work areas and primary Circulation routes to encourage ad hoc meetings away from workstations. They should be semi-enclosed and provide wall space for writable/magnetic surfaces.

Furniture and Equipment: Soft furniture, such as lightweight armchairs and stools should be combined with layout tables. Provide mood and atmosphere with lighting effects and materials. Feature finishes should be used create a sense of destination and distinction, helping stimulate creativity and collaboration.

Open Workstations

Description: 8 x 6 Workstations with 49" H gallery Screen. Gallery screen to provide privacy but not block natural daylight into inbound private offices.



3.3.3 Design Elements

Finishes

The finish selection should reflect the Universities history and provide a timeless, sophisticated, warm and welcoming palette.

The office finishes should be considered in terms of durability, maintenance, brand and look and feel.

In the work cafe, harder, more durable and wipeable finishes should be specified, such as polypropylene chairs and melamine tables. Warmth should be added through vinyl upholstery and warm wood finishes. LVT, porcelain/stone tile or acrylic infused flooring finishes should be considered within this space.

In the workspace a durable carpet tile should be specified that can be easily replaced, removed or repositioned, aiding future flexibility and ongoing maintenance.

Ergonomics

The design should be safe, healthy, accessible and comfortable environments for staff and visitors.

Flexibility

Flexible furniture will allow space to be easily reconfigured depending on use. Therefore, provide light-weight loose furniture, both aesthetically and physically, wherever practical.

Alternatively select pieces which are modular and easily reconfigurable.

3.3.4 Conceptual Floor Plans

The conceptual floor plans shown herein represent what the design team considered to be the best option to move forward with-- a full renovation of Levels 1-3. We have studied other options which can be found in Section 6.0 (Appendix) for more reference. As we move forward with validating the program in the next phase of work, we will work to ensure that we maintain all of the goals set forth in this document while also building in enough flexibility to respond to space needs over time.

There are several items to note in reviewing these plans, which represent the design vision collectively created with the Steering Committee and Design Team:

- All building systems will be removed and replaced in Merrifield and brought up to code.
- Existing core elements such as the elevator and stairs will remain.
- The design will address existing accessibility issues with the restrooms.
- Basic coordination has occurred to plan for operational and systems spaces. Additional systems space was added to support the change from wall-mounted HVAC units to roof-mounted AHUs, and to allow for control between electrical and telecom systems.

LEVEL 1 FLOOR PLAN

	8X8 WORKSTATIONS	23
	10X12 OFFICES:	32
	CORE / RESTROOMS	
	OPEN COLLABORATION	04
	AMENITY	01
	COPY/PRINT	02
	ENCLOSED COLLABORATION	05

LEVEL 2 FLOOR PLAN

NEW BRIDGE CONNECTION TO MERRIFIELD

	8X8 WORKSTATIONS	21
	10X12 OFFICES:	30
	CORE / RESTROOMS	
	OPEN COLLABORATION	04
	AMENITY	01
	COPY/PRINT	02
	ENCLOSED COLLABORATION	05

LEVEL 3 FLOOR PLAN

SECTION VIEW THROUGH NEW ATRIUM AND EAST ENTRY TO MERRIFIELD

REFERENCE IMAGE OF SIMILAR ATRIUM SPACE

VIEW FROM QUAD OF PROPOSED NEW ACCESSIBLE EAST ENTRY TO MERRIFIELD

3.4 EXTERIOR DESIGN UPDATES

3.4.1 Merrifield Hall East Entry

In alignment with the goals to improve the educational experience of students in Merrifield, the design team studied the possibility of creating a new aperture in the east side of the building in order to provide more access to daylight and also create more internal connections across the four floors of the existing building. The new east entry portal helps to alleviate accessibility issues with the existing entry points, and also helps to reinforce the wayfinding and identity of the building on the building's most prominent face– towards the historic and iconic Quad.

Envisioned as a modern yet historically appropriate framed design feature, this entry portal opens directly to a central atrium space that provides transparent visual connections across all floors. A new skylight at the top of the atrium will alow even more daylight to filter through this space, penetrating classrooms and collaboration areas.

This exterior modification will entail removing a portion of the existing brick facade and windows, while keeping the existing structure intact. This opening will then be enclosed with a new system of glazing framed by a solid element reminiscent of the stone accents at the north and south entries. The entry level will be accessed via a grand staircase as well as two flanking universally accessible ramps that tie directly into the Quad landscape design. The stairs are envisioned to act as both circulation and outdoor learning spaces, providing flexibility for a variety of uses.

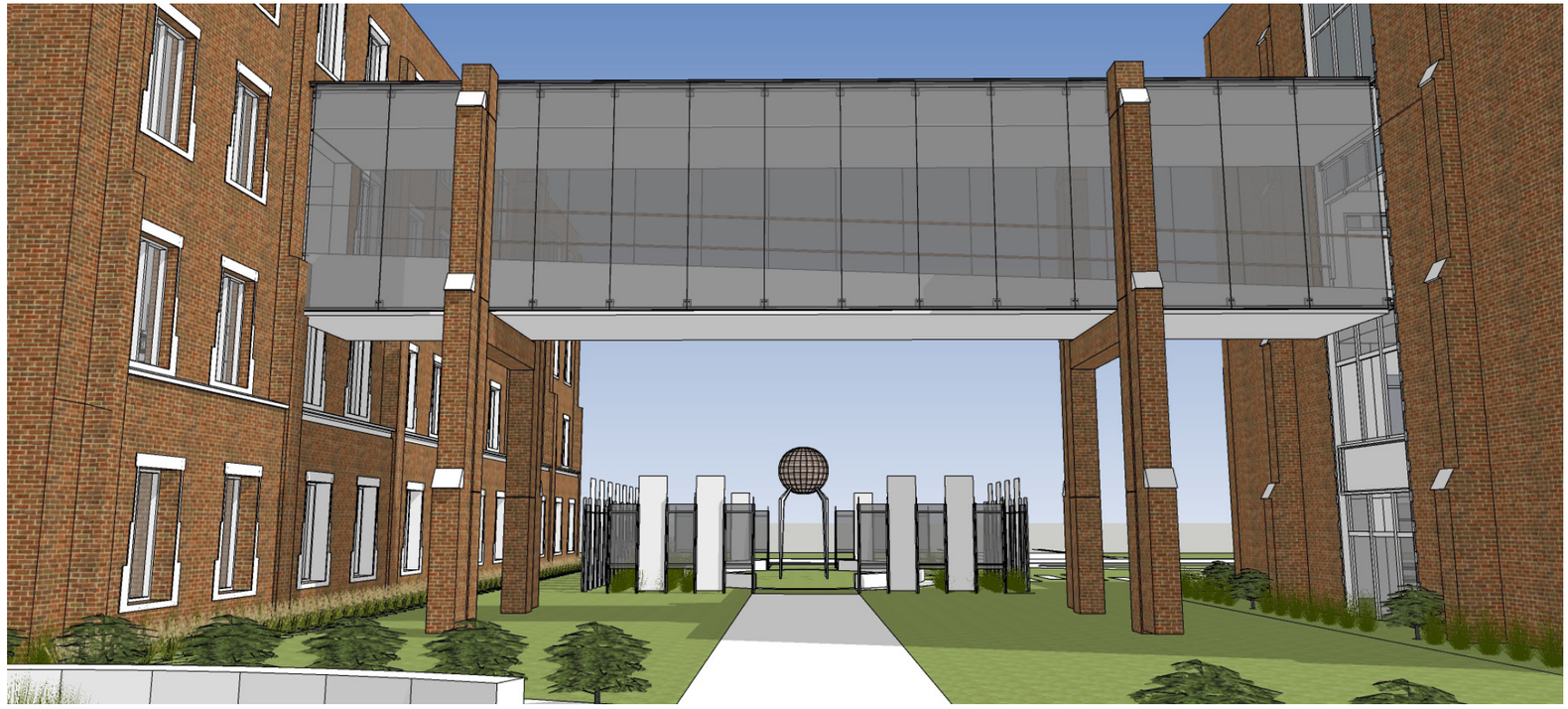
"To reinforce wayfinding and identity"

3.4.2 Twamley Quad Entry Update

While the priority for funding is to improve the learning environments within Merrifield, the design team has taken a holistic approach to re-envisioning the facade of Twamley in coordination with the development of the Sky Bridge as well. In order to be cost-effective, the team is proposing to create a minimal intervention to the main entry of Twamley on the Quad side in order to modernize the facade, tie the design into the updates happening at Merrifield, and create a new and welcoming face to the building.

This option is currently not within the proposed overall budget, but is a suggested design option to enhance the improvements along the face of the Quad and create a modern face for both Merrifield and Twamley.

"To create a new and welcoming face"

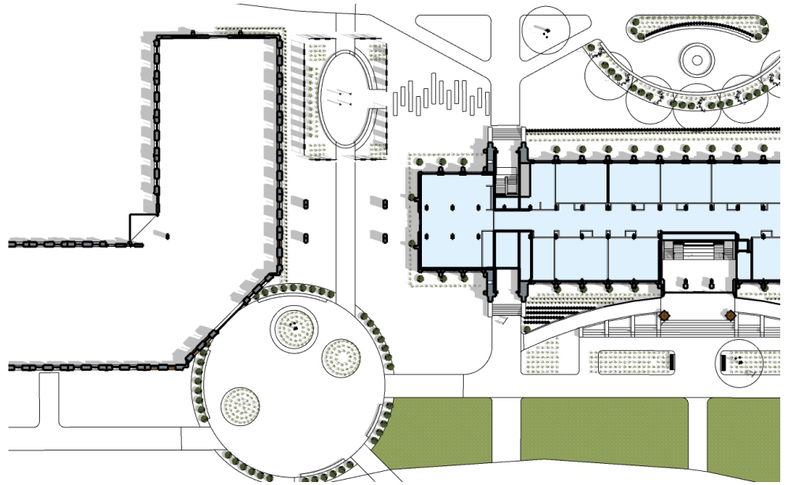


3.4.3 Exterior Bridge Connection

The learning ecosystem at UND is currently in flux, and accessibility between buildings is changing: the new College of Business building on the west corner of the Quad is currently being designed, and will incorporate bridges to connect to both Chester Fritz Library to the east and Merrifield Hall to the south. In a similar spirit, with a major renovation happening at both Merrifield and Twamley, a desire to create a physical interior connection between the buildings has driven the design team to create two studies of possibilites for a bridge connection between Level 2 of Merrifield and Level 3 in Twamley.

This physical connection in the future will help to maintain connections between the instructional spaces within Merrifield and the faculty and staff offices in Twamely, helping to reinforce the Four Building Ecosystem that is being created.

The design team discussed possibilities of exterior improvements with the Grand Forks Historical Preservation Commisssion, and has since studied two options for the bridge which we feel relate to the parameters discussed. In order to create a physical connection which is minimal and blends into the background as much as possible, the first option explores primarily a transparent and glassy addition which recedes into the background, while the second option seeks to relate more directly to the historic architectural tradition of the buildings on the Quad, while also standing as a separate design element.



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4.0

4.0

4.0 Systems Design & Criteria

4.1 APPLICABLE CODES

The following is a partial list of applicable codes governing the systems:

- International Building Code (IBC) 2018
- International Mechanical Code (IMC) 2018
- International Fire Code (IFC) 2018
- International Energy Conservation Code (IECC) 2018 Edition with Amendments Currently Adopted by the State of North Dakota.
- North Dakota State Plumbing Code, which has adopted the 2019 Uniform Plumbing Code with Amendments.
- NFPA 101 Life Safety Code
- NFPA 13 Installation of Fire Protection Systems
- NFPA 70 National Electrical Code.
- NFPA 72 National Fire Alarm and Signaling Code.
- Americans with Disabilities Act (ADA)
- ASHRAE 90.1

4.2 FIRE PROTECTION

4.2.1 SPRINKLER SERVICE

4.2.1.1 Merrifield & Twamley

The existing building does not currently have any wet system fire protection installed. A new dedicated 6" water line will be brought into the building to provide a fire protection service.

The building sprinkler riser will be situated in a lower level mechanical room. Building will be served with combination standpipe/wet system mains. Each floor will be zoned separately off the combination standpipe and shall be in accordance with NFPA 13. The combined standpipe will provide fire department hose connections at stairwell landings. The zone control valves will have control valve lockouts for the butterfly valves in stairwells to minimize the valves being tampered with. The service will have a double check valve to protect the potable water supply from the domestic water main.

A fire department connection will be located along the West side of the building (street access side) in a location coordinated with the local fire department

4.2.2 FIRE PUMP

4.2.2.1 Merrifield

A fire pump and jockey pump will be provided to accommodate the height of the building with the available water pressure and flow requirements. Pump sizes will be verified during design development, but it is assumed that the fire pump will be 950 GPM @ 30 PSI, 40 HP and the jockey pump will be 5 GPM @ 90 PSI, 1-1/2 HP (all flow rates and pressures will need to be verified during further design development).

A Firetrol fire pump controller and a jockey pump controller will be provided that will have a power transfer switch to work with the emergency generator and be solid state soft start.

A fire pump test connection similar to Potter-Romer No. 5862, polished chrome finish will be provided near the fire department connection on the North side of the building.

4.2.2.2 Twamley

A fire pump and jockey pump will be provided to accommodate the height of the building with the available water pressure and flow requirements. Pump sizes will be verified during design development, but it is assumed that the fire pump will be 725 GPM @ 30 PSI, 30 HP and the jockey pump will be 5 GPM @ 90 PSI, 1-1/2 HP (all flow rates and pressures will need to be verified during further design development).

A Firetrol fire pump controller and a jockey pump controller will be provided that will have a power transfer switch to work with the emergency generator and be solid state soft start.

A fire pump test connection similar to Potter-Romer No. 5862, polished chrome finish will be provided near the fire department connection on the North side of the building.

4.2.3 SPRINKLER PIPING

4.2.3.1 Merrifield & Twamley

Fire sprinkler system piping shall be a minimum wall thickness of Schedule 40 for pipe up to 8 inches in diameter. Where approved by NFPA, State Fire Marshall, and local authorities, Schedule 10 pipe may be used for main piping only. Plastic sprinkler piping is specifically prohibited.

4.2.4 SPRINKLER HEADS

4.2.4.1 Merrifield & Twamley

Sprinkler heads shall be upright in exposed spaces. All sprinkler heads where installed in a room with a ceiling shall be of the concealed type, with a cover plate colored to match the ceiling color. Sprinkler heads where located in lay-in ceilings shall be located in the center of the ceiling tile. An emergency sprinkler cabinet shall be provided that include heads of all types and rating installed as well as a sprinkler wrench for use to replace the heads.

4.2.5 ROOFTOP OUTLETS

4.2.5.1 Merrifield & Twamley

Rooftop outlets similar to Guardian model 6924 will be located at the roof level and have a shutoff valve located on the inside of the building to allow for fire department connection the roof level of the building in locations and quantities as required by the Grand Forks Fire Department.

4.2.6 PRE-ACTION SYSTEMS

4.2.6.1 Merrifield

The use of a pre-action or clean agent type systems for the critical IT room will be reviewed with the UND IT department during the design development stage to determine if pre-action systems are required, or if the spaces can be protected by standard wet sprinkler head systems. It is expected that a pre-action system will be used for the lower level critical IT room.

4.3 PLUMBING SYSTEMS

4.3.1 PLUMBING PIPING

4.3.1.1 Merrifield & Twamley

The water service piping from 5' outside the building to the final plumbing fixture is by this contractor. A new 6" water line will be brought into the building to provide a fire protection service. The existing water line in the building will be re-used for the domestic water service. Existing branch lines and existing fixtures will be removed throughout the building. New branch and distribution piping will be provided to new plumbing fixtures.

Above ground piping - Tubing 1-1/2" size and smaller shall be Type L hard drawn copper. Tubing 2" size and larger shall be Type M hard drawn copper. Soft drawn copper tubing in small sizes may be used adjacent to fixtures and equipment.

All water and condensate piping will be insulated with a minimum of 1" fiberglass insulation.

4.3.2 SANITARY AND STORM PIPING

4.3.2.1 Merrifield & Twamley

All sanitary and storm piping from a point 5' outside the building to the final plumbing fixture is by this contractor. It is anticipated that there will be limited storm sewer revisions in the building. Where required, existing storm piping will be removed and rerouted to accommodate floor plan changes. The existing underground sanitary system will be abandoned in place. A new 6" sanitary service will be brought to the building. New sanitary piping will be routed to new fixtures within the building.

All underground piping will be schedule 40 PVC or no hub cast. All above grade piping will be no hub cast iron pipe. It is assumed that above grade rain leader piping will be cast iron as it travels through return air plenum ceiling spaces.

4.3.3 STEAM DOMESTIC WATER HEATERS

4.3.3.1 Merrifield & Twamley

The existing electric hot water heaters will be disconnected and removed. One steam water heater will be installed in the lower level mechanical room for the domestic water heating in the building. The water heater will maintain a water temperature of 140°F. There will be an ASSE 1017 rated master mixer valve assembly provided with a recirculation loop set at 120°F to service the fixtures. The recirculating pump will have an ECM type motor and controlled based on return water temperature. An expansion tank will be provided on the hot water loop sized for the amount of service water heating volume.

4.3.4 SUMP PUMPS AND SEWAGE EJECTORS

4.3.4.1 Merrifield

The elevator is planned to be replaced/relocated during this project. The elevator pit will have a dedicated sump pump discharging into the storm sewer service. Drain tile for the elevator pit will be provided by the general contractor. Sump pumps will be duplex and provided with a lead-lag type control panel that has a high-water alarm that will have a local alarm as well as alarming to the building automation system.

Floor drains located in the lower level mechanical rooms will be routed to a sewage ejector pit containing duplex sewage ejector pumps that are rated for high temperature for a case where the sewage ejectors are receiving high temperature condensate from the heating system. The sewage ejector pumps will be provided with a lead-lag type control panel that has a high-water alarm that will have a local alarm as well as alarming to the building automation system.

4.3.4.2 Twamley

The existing elevator is planned to be replaced as part of this project and the pit will be modified. The elevator pit will have a dedicated sump pump discharging into the storm sewer service. Drain tile for the elevator pits will be provided by the general contractor. Sump pumps will be duplex and provided with a lead-lag type control panel that has a high-water alarm that will have a local alarm as well as alarming to the building automation system.

4.3.6 CONDENSATE DRAINS

4.3.6.1 Merrifield & Twamley

Condensate drains for air handling units, and split system units serving electrical/IT rooms will be piped to the nearest floor drain in type M copper.

4.3.7 PLUMBING FIXTURES

4.3.7.1 Merrifield & Twamley

Plumbing fixtures will be replaced throughout the building. All fixtures will be piped to allow for individual and room isolation valves for servicing.

Plumbing fixtures will be similar to the following

- Lavatories – under counter mount basins with battery operated motion sensors (Sloan Solis EAF-275 per UND standards).
- Urinals – wall hung china with battery operated flush valves
- Water Closets – wall hung china with battery operated flush valves will be used as the basis of design wherever possible when service clearance requirements can be met as per UND standards. Single user toilet rooms may end up being floor mounted toilets where service clearances cannot be obtained. These locations will be reviewed with UND in the DD/CD phase for final determination of floor mount or wall mount at the single user toilet room locations.
- Water coolers – dual height water coolers with a touch free water bottle filler
- Sinks – stainless steel of various sizes with gooseneck spouts and wrist blade handles
- Wall hydrants – wall hydrants will be located at various locations around the perimeter of the building to allow for hose connections every 100-150 feet. Hydrants similar to Woodford B67.
- Roof hydrants – Roof hydrants will be provided within proximity to the air-cooled chiller for maintenance requirements.
- Hose Bibbs – all mechanical rooms will have hot and cold-water hose bibbs for maintenance
- Mop basins – 2x2 fiberglass basin with wall mounted mop sink faucets

4.4 HVAC SYSTEMS

4.4.1 HEATING AND CHILLED WATER PIPING

4.4.1.1 Merrifield & Twamley

Existing heating piping will be removed and replaced. Existing heating and cooling equipment throughout the building will be removed and new equipment will be provided.

All piping for hot water and chilled water system shall be run level or pitch up toward the end of the piping so that air in the system will move in the direction of water flow. Pitch of mains, where possible, shall be at least 1/4" in 25 feet. Pitch of lines shall be uniform and shall be installed so that entire system can be drained. Eccentric reducers shall be installed wherever pipe size is reduced in direction of flow. Reducers shall be installed with openings up, on topside of pipe to allow air to pass through. Radiation branches and mains fed by overhead mains shall be connected at the supply side through a plugged tee in place of an elbow to permit draining of radiation, branches or mains. Up feed risers supplying radiators above the supply main shall come off main either from top or side. Down feed risers supplying radiation below the supply main shall come off the bottom of the supply main.

All piping for the hot water heating system shall be black mild steel pipe, ASA Schedule 40 thickness. Fittings shall be banded black cast iron 125-pound fittings. Grooved piping will be allowed. All hot and chilled water piping may be Type L hard drawn copper tubing at Contractor's option. Fittings for copper tubing shall be cast bronze or wrought copper solder fittings. All connections shall be made using 95-5 solder. Press fit fittings will be allowed.

The piping will be run in several reverse return loops in the building to allow for partial isolation of the system to keep the rest of the building operational during maintenance of specific equipment or spaces.

The entire hot water piping system will have 40% ethylene glycol installed in it for freeze protection. The entire chilled water piping system will have 40% ethylene glycol installed in it for freeze protection.

Exterior chilled water piping outside the building to air cooled chiller will be welded. The exterior piping will be insulated with rigid polyisocyanurate or extruded polystyrene pipe insulation in one-piece molded sections, 1.6 lb/ft3 nominal density, 1-1/2" thick insulation for piping 3" diameter and larger. The exterior of the piping will be insulated with a stucco aluminum jacket with stainless steel bands.

4.4.2 PERIMETER SUPPLEMENTAL HEATING EQUIPMENT

4.4.2.1 Merrifield & Twamley

Existing finned tube radiation will be removed throughout the building. New perimeter finned tube radiation will be installed in rooms with exterior exposures. Finned tube will be a combination of wall mounted sloped-top type, and pedestal type finned tube. Where there is space below windows, the wall mounted sloped-top will be used, and locations that have glass going down to the floor, pedestal type enclosures will be used.

Where finned tube radiation cannot be used for supplemental perimeter space heating, fan powered VAV boxes with duct heating coils will be used to satisfy the space heating loads during the unoccupied mode. Radiant ceiling panels will be used where finned tube, or a fan powered VAV box cannot be used for perimeter supplemental heating.

In stairwells and vestibules, hot water cabinet unit heaters will be installed. In mechanical rooms, hot water suspended unit heaters will be installed.

4.4.3 SITE UNDERGROUND STEAM AND CONDENSATE PIPING

4.4.3.1 Merrifield & Twamley

The existing low-pressure steam and condensate piping to the building will be disconnected and removed. New low-pressure steam and condensate piping will be routed from the existing vault location to the building. Steam and condensate pump discharge shall be installed in Ric-Wil Prefabricated Insulated Pipe Conduit, with all necessary fittings, anchors, and conduit accessories, as hereinafter specified.

Conduit shall be 10-gauge smooth wall hot dipped galvanized steel having all outside surfaces of the conduit machine-coated with high melting point asphalt to a minimum thickness of 3/16", with an interposed layer of fiberglass screen plus one final outer wrap of asphalt impregnated, fiberglass reinforced, asbestos pipe line felt applied spirally under tension.

Conduit closures shall be furnished with the conduit at a ratio of one closure for each fabricated item or length. Closures shall consist of 10-gauge steel suitably rust-proofed and in cylindrical form with a single horizontal split and shall be field welded over adjacent units. After test all exposed closures shall be covered in the field with the Rip-Coat coating and Rip-Coat Blanket. All materials and insulation required for complete field closure shall be furnished with the conduit.

All condensate piping shall be schedule 80 black steel. Pipe shall be tested at one and one-half times the design pressure. Hydrostatically test and hammer all pipe welds in accordance with specifications. Concealed pipe welds in prefabricated conduit fittings shall be factory tested the same as specified for field welds prior to assembly.

Piping shall be suitably spaced and supported in conduit by specially designed full round insulating support-guides and shall permit the pipe to expand and/or contract freely without stress or wear on the pipe or insulation as well as provide for drainage and free air circulation.

Terminal ends of conduits inside tunnel or building walls shall be equipped with end seals consisting of a steel bulkhead plate welded to the pipe and conduit. Where there is no anchor within five feet of a terminal end, conduits shall be equipped with gland seals consisting of a packed stuffing box and gland follower mounted on a steel plate welded to end of conduit. End seals or gland seals shall be equipped with drain and vent openings located diametrically opposite on the vertical center line of the mounting plate and shall be shipped to the job site with plugs in place. Terminate all conduits 2" beyond the inside face of walls to protect any exposed piping insulation from damp-wall condensation.

4.4.4 STEAM AND CONDENSATE PIPING

4.4.4.1 Merrifield & Twamley

Existing steam and condensate piping within the building will be disconnected and removed. New piping will be provided to new equipment.

Steam and return piping shall pitch at least 1/4" in 10 feet. Provide drip and trap assemblies at all rise locations where required. Eccentric reducers or eccentric fittings shall be used at all points where pipe sizes change.

Run outs of steam and condensate return to equipment shall pitch 1/2" to the foot. The runouts or sprig pieces shall be taken off the top of the main or at a 45-degree angle. Proper swing joints shall be provided for the expansion of all pipes.

Low pressure steam (15 psig and lower) supply piping shall be electric-resistance welded, Schedule 40, black steel. Threaded pipe shall use Class 125 cast-iron fittings. Flanged and welded pipe shall use Schedule 40 wrought-steel welding fittings and Class 150 wrought-steel flanges.

All condensate return piping shall be electric-resistance welded, Schedule 80, black steel. Threaded low pressure condensate pipe shall use Class 125 malleable-iron fittings. Threaded high pressure condensate pipe shall use Class 300 malleable-iron fittings. Flanged and welded pipe shall use Schedule 80 wrought-steel welding fittings and Class 250 wrought-steel flanges.

4.4.5 HOT WATER HEATING GENERATION

4.4.5.1 Merrifield & Twamley

The heating for the building shall be accomplished with the use of the campus steam. The low-pressure steam coming into the building will be fed to the heat exchangers and water heaters. All steam condensate will be pumped back to the central heating plant through the use of duplex electric condensate pumps with cast iron receivers. The condensate pumps will have an alternating control panel with combination starter/disconnect, inlet strainer and gauges, and an audible alarm for pump failure.

Existing heating equipment in the building including heat exchangers, pumps, hot water piping, steam piping, and condensate piping will be disconnected and removed.

Heating to the building will be accomplished with a glycol hot water heating system. The hot water shall be created by a pair parallel operating low pressure steam to glycol hot water shell and tube heat exchangers, with both heat exchangers sized for 100% redundancy. The design supply water temperature shall be 160°F with the highest differential temperature practical, with the expectation that the overall system will be operating at 30°F ΔT. Generally speaking, air handling units will operate at 40°F ΔT while terminal heating coils shall operate at 30°F ΔT and fin tube radiation and unit heaters will operate at 20°F ΔT. The heating system will be filled with a 40% solution of inhibited ethylene glycol solution.

The hot water will be circulated by redundant base mounted hot water heating pumps. The pump speed will be modulated with VFDs to maintain the required differential pressure set point.

A floor drain connected with cast iron piping shall be provided near the condensate pumps to allow for condensate to be dumped during a condensate pump failure

4.4.6 COOLING SYSTEMS

4.4.6.1 Merrifield Chilled Water Plant

Existing air-cooled condensing units will be removed. Cooling for the building will be generated from one (1) 200 Ton (sizes to be verified as design progresses) high efficiency rotary screw or scroll air cooled chiller located on the roof. The chillers will be piped to ensure minimum flow rate and cycle time provided by building air handling unit 3-way valve(s)

The building chilled water loop will distribute water from the chillers to the air-handling unit coils. The chilled water will be pumped by redundant base mounted pumps circulating pumps. The pumps shall be fitted with a VFD to provide a variable primary chilled water-pumping loop to maximize efficiency.

4.4.6.2 Twamley Air-Cooled Condensing Units

Cooling for the building will be generated from (2) 75 Ton (sizes to be verified as design progresses) high efficiency air cooled scroll condensing units located on the roof. Each condensing unit will serve a separate indoor air handling unit.

4.4.7 HEAT RECOVERY CHILLER

4.4.7.1 Merrifield

A heat recovery chiller (2-15 ton compressors for 30 tons total) will be used to provide the energy for the reheat water loop when the chilled water plant is in operation rather than consuming steam energy for the reheat water loop. The heat recovery chiller will be the first stage chiller and first stage heating device during chiller operation. The heat recovery chiller will reject heat to the reheat water loop, rather than rejecting the heat to the atmosphere similar to how the air-cooled chiller rejects heat. The heat recovery chiller will be sized based on the largest simultaneous reheat demand during the cooling mode and be based on a 2-compressor design utilizing scroll compressors. The heat recovery chiller will be similar to Multi-Stack.

4.4.8 ELECTRICAL AND SERVER ROOM COOLING

4.4.8.1 Merrifield

The existing Liebert split system unit serving the lower level main server room is in good condition and shall remain. All other new electrical and server rooms that will require cooling year-round will have mini-splits similar to Mitsubishi to provide cooling. The evaporator coils will be installed over the doors into the rooms, and the condensers will be located in adjacent large volume spaces where the heat will be rejected to the indoor space and be condition by the associated air handling unit serving that area. The units will be provided with BACnet cards to allow for BAS integration.

4.4.8.2 Twamley

Electrical and server rooms that will require cooling year-round will have mini-splits similar to Mitsubishi to provide cooling. The evaporator coils will be installed over the doors into the rooms, and the condensers will be located in adjacent large volume spaces where the heat will be rejected to the indoor space and be condition by the associated air handling unit serving that area. The units will be provided with BACnet cards to allow for BAS integration.

4.4.9 INDOOR AIR HANDLING UNITS

4.4.9.1 Merrifield

The two existing indoor air handling units will be disconnected and removed. Existing roof top air handling units and fans will also be removed.

The building will be served through two new 40,000 CFM units. The indoor air handling units, similar to Daikin Vision, will consist of at least the following; relief air fans, economizer section, minimum outside air connection, MERV 8 and MERV 13 filter sections, chilled water-cooling coil, hot water heating coil, and supply fans. Per ASHRAE standards, MERV 13 rated filters offer a high level of filtration and are effective at removing bacteria and virus carriers from the air stream. Roof hoods will be used wherever possible and louvers will be utilized where roof hoods cannot be used. Roof hoods will be painted a color to be selected by the architect.

Two separate 10,000 CFM energy recovery units, utilizing enthalpy wheels, will be used to transfer energy from the exhaust air stream to the fresh air stream and

will provide the code minimum ventilation rate to each air handling unit. Energy recovery units will consist of at least the following- exhaust air fan, energy recovery section, MERV 8 return air and outside air filters, hot water preheat coil for frost control, and supply fan. An airflow measuring station will be provided to measure outside air being provided to air handling units. This will be used to control fan speed and verify that the units are always supplying outside air into the building at a rate that meets the ASHRAE standards for ventilation.

All air handling units will have the outside air intake and relief air exhaust sized for 100% economizer. Air handling units will be serving VAV boxes with integral heating coils for individual space temperature control. Multiple rooms may be served by a single VAV box if they have similar loads (up to approximately 4 rooms based on conditions). VAV box sizes and airflow rates to spaces shall be determined by the cooling load and shall not be less than the ASHREA recommended air changes per hour.

4.4.9.2 Twamley

The existing indoor air handling units will be disconnected and removed. Existing roof top air handling units and fans will also be removed.

The building will be served through two new 30,000 CFM indoor air handling units. Air handling units, similar to Daikin Vision, will consist of at least the following; relief air fans, economizer section, minimum outside air connection, MERV 8 and MERV 13 filter sections, DX cooling coil, hot water heating coil, and supply fans. Per ASHRAE standards, MERV 13 rated filters offer a high level of filtration and are effective at removing bacteria and virus carriers from the air stream. Roof hoods will be used wherever possible and louvers will be utilized where roof hoods cannot be used. Roof hoods will be painted a color to be selected by the architect.

A separate 12,000 CFM energy recovery unit, utilizing an enthalpy wheel, will be used to transfer energy from the exhaust air stream to the fresh air stream and will provide the code minimum ventilation rate to both indoor air handling units. Energy recovery units will consist of at least the following- exhaust air fan, energy recovery section, MERV 8 return air and outside air filters, hot water preheat coil for frost control, and supply fan. An airflow measuring station will be provided to measure outside air being provided to air handling units. This will be used to control fan speed and verify that the units are always supplying outside air into the building at a rate that meets the ASHRAE standards for ventilation.

All air handling units will have the outside air intake and relief air exhaust sized for 100% economizer. Air handling units will be serving VAV boxes with integral heating coils for individual space temperature control. Multiple rooms may be served by a single VAV box if they have similar loads (up to approximately 4 rooms based on conditions). VAV box sizes and airflow rates to spaces shall be determined by the cooling load and shall not be less than the ASHREA recommended air changes per hour.

4.4.10 VARIABLE AIR VOLUME BOXES

4.4.10.1 Merrifield & Twamley

Variable air volume boxes to be shall be pressure independent variable air volume boxes with direct digital controls. VAV boxes will be constructed of standard construction with a hot water heating coil and metal controls cover.

4.4.11 DUCTWORK AND DISTRIBUTION

4.4.11.1 Merrifield & Twamley

All existing ductwork will be disconnected and removed from the building. New ductwork will be provided based on new floorplan.

Ductwork and fittings shall be constructed and supported in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, 1995 Edition with 1997 Addendum except as modified herein. Ductwork and fittings shall be fabricated from G60 galvanized steel sheets complying with ASTM A527. All ductwork shall be built to 4" pressure class prior to VAV boxes, and 2" pressure class in all other instances.

All supply ductwork in spaces with ceilings will be insulated with 2" fiberglass insulation. All supply and relief air ductwork located in mechanical rooms will be insulated with 2" rigid duct board insulation. All fresh air ductwork located in mechanical rooms will be insulated with 3" rigid duct board insulation.

Diffusers located in lay-in tile ceilings will be square plaque. Duct and wall mounted registers will be double deflection type. Linear slot diffusers will be used at perimeter locations and spaces with high ceilings. Return and exhaust grilles mounted in lay-in tile ceilings will be egg-crate type. Duct and wall mounted return & exhaust grilles will be single deflection type grilles.

4.4.12 TESTING AND BALANCING

4.4.12.1 Merrifield & Twamley

All water and air systems will be tested by a 3rd part Testing and Balancing (TAB) agency. The TAB contractor will be either NEBB or AABC certified for balancing commercial HVAC and Plumbing systems.

4.4.13 COMMISSIONING

4.4.13.1 Merrifield & Twamley

Per the requirements of the International Energy Conservation Code, section C408, new buildings are required to undergo commissioning for mechanical, electrical and power systems. Prior to the final inspections, a commissioning firm shall provide evidence of system commissioning and completion in accordance with the provisions of section C408 of the IECC.

UND will hire the services of a commissioning authority outside of the scope of this contract. The mechanical contractor shall coordinate as needed with the commissioning authority.

4.5 AUTOMATIC TEMPERATURE CONTROLS

4.5.1 AUTOMATIC TEMPERATURE CONTROLS

4.5.1.1 Merrifield & Twamley

A direct digital control (DDC) system will be installed on all HVAC equipment throughout the building. The approved vendors for the project include Johnson Controls and Honeywell.

The DDC system will control all heating and air conditioning equipment to allow for automatic temperature control, seasonal adjustments, and maximize HVAC system efficiencies. In addition to controlling HVAC equipment, monitoring of critical air and water temperatures and system operations (fan/pump status), the system shall also alarm all equipment, so maintenance personnel can maintain and troubleshoot all equipment.

Each equipment controller shall be provided with an uninterruptible power supply to keep control systems online between losses of power and generator startup.

Equipment to be controlled and monitored includes:

- Air Handling Units
- Variable Air Volume (VAV) Boxes
- All Pumps
- Steam to hot water heat exchanger system
- Chiller Plant
- Supplemental Perimeter Heating Equipment, cabinet unit heaters and suspended unit heaters
- HVAC Hot Water and Chilled Water Temperatures
- Fans
- Fire/smoke dampers
- All thermostats, humidity sensors, and CO2 sensors
- All VFD's for pumps and fans.
- Condensate meters
- Condensate pump monitoring
- Domestic steam to Hot Water Heaters
- Mini-Split systems serving electrical and server rooms via BACnet
- Occupancy sensors will be used for setback control where appropriate
- Sump Pumps
- Sewage Ejector
- Domestic water meter
- Generator(s)
- Electrical metering

4.6 ELECTRICAL SYSTEMS

4.6.1 ELECTRICAL GENERAL INFORMATION

4.6.1.1 Overview - Merrifield

Merrifield Hall and Twamley Hall, which are located on the campus of the University of North Dakota, will be completely renovated with all new electrical systems.

4.6.1.2 Scope

This narrative document summarizes the design concepts for the major electrical systems (Division 26), and Fire Alarm System (Division 28) to be included in the facility.

Electrical systems (Division 26) included in this document:

- Low voltage power distribution system.

- Medium voltage power distribution system.
- Emergency power system.
- Interior and exterior lighting systems.
- Lighting control systems.
- Emergency interior and exterior lighting systems and egress signage (exit signs).

Electronic safety and security systems (Division 28) included in this document:

- Fire alarm system.

4.6.2 DESCRIPTION OF ELECTRICAL SYSTEMS

4.6.2.1 Medium Voltage Power Distribution System - Merrifield

Merrifield Hall is currently supplied medium voltage power from a 12.47 kV to 208/120 volt, 750 KVA pad-mounted step-down transformer. This transformer is connected to primary switch B-7-A, which is on UND Circuit #3.

The existing medium voltage transformer shall be removed and replaced with a new 750kVA transformer.

Medium voltage cable will be 15 kV Okonite Okoguard-Okoseal Type MV-105 or General Cable equal. Conductor sizes will be 500 kcmil copper for sources and 1/0 copper for taps. Cable insulation will be 220 mil EPR, 133% insulation level with copper tape shield and overall PVC jacket.

Pad-mounted transformer will be Cooper or ABB, Oil to Air, with aluminum windings, standard impedances. Transformer will have loop capability with four position switches. Open B side will have lightning arrestors. It is anticipated that the facility will be served by one 2.5 MW transformer.

Load-Break Cable Terminators: Elbow-type units with 200-A-load make/break and continuous current rating; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.

4.6.2.2 Low Voltage Electrical Power Distribution - Merrifield

Underground primary service and pad mounted medium voltage transformers will be provided by the Electrical Contractor.

The low voltage electrical service will consist main service rated at 2,500 amps at 208/120 volt 3-phase, 4-wire. It is anticipated that one 2,500-amp service will be provided.

- Each main service section will be front assessable ANSI C37.20.1 metal-enclosed, low voltage power circuit breaker switchgear.
- Each main circuit breaker will be draw-out type in a separate compartment.
- Each feeder breaker will be provided fully adjustable electronic trip with ground fault protection giving the facility two levels of ground fault protection.
- Per NEC Code Section 230.95 Ground Fault Protection of Equipment (C) Performance Testing: The ground fault protection system shall be performance tested when first installed on site. This testing shall be conducted by a qualified person(s) using a test process of primary current injection in accordance with instructions that shall be provided with the equipment. A written record of this testing shall be made and shall be available to the authority having jurisdiction.

Electrical power will be distributed through the facility from distribution equipment at the main service electrical room at 208-volts.

Larger 208-volt distribution switchboards will be sectional NEMA Type I, free standing, indoor, dead front, low-voltage switchboards with copper bussing.

Distribution panelboards will generally be located on each floor to serve the branch panelboards on that floor. Panelboards will be located to suit the loads served.

- Distribution panelboards and panelboards will be sized for code minimum plus 20% space capacity.
- Recessed mounted panelboards will be provided with minimum of (5) ¾" empty conduits stubbed to the accessible ceiling space.

Surge protective devices will be provided at the electrical service equipment, distribution equipment, and branch circuit panel boards.

Automatic Transfer Switches (ATS)

- All ATS will be similar to ASCO 7000 Series, four pole, with manual bypass.
- Closed transition ATS will be 100 mSec rated and have paralleling timers, reverse power relays, and lock out relays.
- Switches shall have remote communication and control capability.
- Switch manufacturers must have a certified service technician within 100 miles of the facility.
- A dedicated ATS will be provided for the atrium smoke control system.

Transformers

- Transformers will be dry type, maximum 75 KVA, where possible.
- Isolation transformers pairs with phase off-set and zig-zag windings will be provided where feasible to reduce harmonic currents.

Panelboards

- Distribution panelboards will be circuit breaker type with copper bus and lugs, 100% neutral bus, and ground bus.
- Branch Circuit Panelboards will have bolt-on type branch circuit breakers, 20 ampere minimum, copper bus, 100% neutral bus, and hinged cover construction.

Raceways

- All wiring will be in metal conduit except for under floor raceway which will be Schedule 40 PVC. Metal conduit will generally be electrical metallic tubing (EMT) except where exposed to damage where it will be full-weight rigid galvanized steel conduit.
- Flexible metal conduit will be used at equipment connection where required by the application.

Wire and Cable

- All feeder and branch circuit wiring for power, lighting, and control will be copper, 98% conductivity, stranded in sizes #8 AWG and larger, with 600-volt THW or THWN-THHN thermoplastic insulation. The exception on insulation will be on VFD motor circuits where 1000 volt high-dielectric XHHW thermoset insulation will be used.
- MC cable shall be acceptable for use within walls and for lengths of up to 6' above accessible ceilings. All homeruns to panelboards will be in conduit.
- Minimum wire size will be #12 AWG except #14 AWG for control circuits.
- Feeders will be designed to limit voltage drop to 2% as noted in ASHRAE 90.1.
- Voltage drop will be designed to not exceed 3% on branch circuits, 5% overall.

Grounding systems shall be provided with 5 ohms maximum.

- All bonding and grounding wires will be copper. Terminations will be bronze.
- Grounding electrodes will be 10'-0", 3/4" copper clad steel.
- A main ground termination bar will be installed at each main service room and intersystem bonding and grounding termination bars will be provided in each telecommunications room.

Wiring Devices

- Duplex receptacles will be 125-volt grounding types with stainless steel cover plates.
- GFCI type receptacle will be provided where required by code.
- USB type receptacles will be used where appropriate.
- All cover plates will be labeled with panel and circuit origination.

The Division 25 Contractor will provide VFDs for pumps, and other HVAC equipment motors that require VFDs. Generally, across the line enclosed motor controllers will be provided for motors smaller than 3 HP by the Division 26 contractor. Fire alarm shut downs will be wired directly into the VFDs.

Identification: Wiring devices connected to UPS systems and optional standby branches will be identified by using unique colored devices.

4.6.2.3 Facility Electric Metering - Merrifield

Each electrical meter will need an IP address and network outlet.

Current Design Standards list Dent Power Scout metering: PS3037-E-D. Sub metering will be done with a similar Power Scout meter.

4.6.2.4 Back Up Power and Supply Distribution System - Merrifield

Merrifield Hall currently contains a 208/120V natural gas generator. Generator to be demolished with the rest of the electrical distribution system.

A new backup power supply will be provided for emergency, legally required standby loads, and optional standby loads. The power supply will be an engine generator located outdoors in a weatherproof walk-in style enclosure. It would need to be certified and rated for standby use.

Emergency power will be distributed throughout the facility to serve code required emergency loads including:

- Emergency lighting.
- Fire alarm system.

Optional standby loads are any other selected non-emergency or legally required load. Loads to be fed from this generator on an Optional Standby Branch include:

- IT equipment.
- Boilers and heating pumps. Enough to keep the facility from freezing.
- HVAC control system.

Each system will have a separate dedicated feeder from the engine generator and

four pole, open or closed transition, automatic transfer switch. From this automatic transfer switch, power will be distributed to a distribution panel and then to branch circuit panels throughout the facility.

The emergency power distribution system will be selectively coordinated with all supply side overcurrent protective devices.

The engine generator would be used for emergency / stand-by operation only.

The exact capacity requirement is unknown at this time; however, a reasonable assumption would be that the generator capacity would be about 150 KW.

- Fuel source will be natural gas.
- Fuel consumption meter will be provided.

4.6.2.5 Power outlets - Merrifield

Convenience Power

- Auditoriums, classrooms, and conference rooms will include power in the floor and at the perimeter walls.
- Student gathering areas will include power in the floor, at walls, and at seating areas.
- Offices will have double duplex receptacles at desk locations and a single USB-type duplex receptacle on each of the remaining three walls.
- Workstations will be provided with a double duplex receptacle.
- USB receptacles will be provided in all public seating areas.

Double duplex receptacle with GFCI protection will be provided for each drinking fountain.

GFCI receptacles will be provided for heat tape at roof drain overflow locations.

4.6.2.6 Lightning Protection System - Merrifield

At this time, lightning protection is not planned for either Merrifield Hall or Twamley Hall.

4.6.2.7 General Interior and Exterior Lighting Systems - Merrifield

Interior and Exterior Lighting systems will be designed in accordance with the recommendations of the Illuminating Engineering Society (IES) and the requirements of the ND Energy Code.

- IES and design team direction will be followed in regard to light level recommendations where appropriate. This is not a code requirement but a design guideline.
- NFPA 101 and IBC requirements for emergency lighting levels will be followed.
- The lighting power density requirements listed in the ND Energy Code for interior and exterior lighting will be followed.

Light sources for interior lighting are anticipated to be LED throughout.

Light fixtures will be located in such a way to facilitate ease of maintenance. Remote drivers will be used for fixtures in areas that are difficult to reach.

Anticipated lighting design.

- Light fixtures will be selected to match the aesthetics of the building's interior.
- Ceiling mounted light fixtures located near flat panel displays shall be positioned to reduce veiling glare.

Space	Horizontal Level	Vertical Level
Classrooms	Variable 30FC low to 50 FC high	15 FC
Walls with projectors/ screens	Dimmable to 3 FC	Dimmable to 3 FC
Conference/Board Rooms	Variable 30FC low to 50 FC high	30 FC
Office / Workstation	Variable 30FC low to 50 FC high	15 FC
Toilets	15 FC	5 FC
Service Spaces	10-20 FC	5 FC
Communica-tion and Electrical Rooms	50 FC	15 FC

- Lighting within all rooms shall have a common correlated color temperature with no more than 500 degrees Kelvin difference among all lighting sources.
- A proper contrast ratio between displayed images and adjacent viewing surfaces shall be maintained in order to present eyestrain and fatigue.

The following is a preliminary list of preliminary illumination levels:

1.2.8 Lighting Control Systems - Merrifield

Lighting control requirements listed in the ND Energy Code will be followed including automatic lighting shut-off, lighting reduction controls, and daylight control zones.

- In areas with ample access to natural daylight, automatic daylight harvesting will be used to control lighting.
- Occupancy sensors will be used to control lighting in the janitor closet and restrooms.
- Individual offices will be provided with dimming control and vacancy sensors. Sensors shall include auxiliary contacts to be monitored by the Building Automation System.
- Exterior lighting will be controlled via photo sensor to turn on at dusk to a predetermined time, then turn off for most of the night, and turn on again near sun-up until daylight.
    - Minimal lights will remain on all night long for security.
    - Photo sensor bypass switch shall be located at a readily accessible location to override photo sensor for maintenance of exterior lighting.

Mechanical rooms and electrical rooms will be controlled via manual switching.

Lighting Control System will be UND Campus standard Lutron Vive.

4.6.2.9 Emergency lighting and egress signage - Merrifield

LED type exit signs will be provided to mark paths of egress.

General use light fixtures connected to the emergency power generator will be used to provide emergency lighting at the building's interior and exterior.

In the corridors, and other selected areas, various light fixtures will be wired for 24/7 operation.

4.6.3 Electronic Safety and Security Systems

4.6.3.1 Fire Alarm System - Merrifield

An addressable fire alarm and detection system will be provided. The system will meet the requirements of NFPA 72 and ADA.

Audible notification will be via voice communication system.

Visual notification will include standard white fire alarm strobes along with amber "Alert" strobes.

Provide a separate price for consideration.

Microphone annunciator station will be provided at a constantly attended location within the facility.

Microphone annunciator station will be located at the fire fighter's entrance (in the vestibule).

Automatic detectors will be provided in mechanical and electrical rooms, storage rooms, janitor rooms, and similar areas including combustible storage areas.

Smoke detectors will be provided in supply and return air ductwork of air handling units rated 2,000 cfm or greater and within 5' of all fire-smoke dampers.

- Area smoke detection will be used to eliminate the need for duct smoke detectors where feasible.

CO Detection will be provided in public spaces with fuel burning appliances.

Addressable modules will be used for control of fire-smoke dampers, air handling equipment, and elevators.

Addressable modules will be used for supervision of fire sprinkler valves and switches.

A single manual fire alarm box will be provided at each floor and at select areas within the facility accessible to staff. (To be confirmed by UND)

Configuration for IDC and SLC will be Class B.

Notification appliances will be located throughout the facility. Appliances will be addressable, and circuits will be Class B.

UND currently has Simplex and FCI Gamewell systems elsewhere on campus. This system manufacturer shall be one these two.

Currently on campus, central monitoring of facility fire alarm systems is accomplished via the BAS system and campus energy management system. This facility will include this type of monitoring and a digital alarm communicator for off-site UL Listed monitoring station communication.

4.6.4 TECHNICAL CRITERIA

4.6.4.1 Codes and Standards

The following is a partial list of design and installation standards governing the systems described herein:

- IES Lighting Handbook, Tenth Edition.
- International Electrical Testing Association (NETA) Standards.
- National Electrical Contractors Association (NECA) Standards.
- UND Facilities Department Design Standards.

4.7 STRUCTURAL SYSTEM

The information listed below will be used as a guideline in the structural design of the UND Merrifield & Twamley Hall renovations. These guidelines are given to ensure that the buildings will be structurally sound, economical, and are constructed within all International Building Code (IBC) requirements.

Structural renovations to Merrifield will be designed to risk category III requirements per IBC 2018 Table 1604.5. Buildings and other structures containing educational occupancies for students above the 12th grade with and occupant load greater than 500.

Structural renovations to Twamley Hall will use risk category II requirements.

4.7.1 Minimum Building Code Requirements

Overall structural design design:

- 2018 IBC (International Building Code).

Concrete design:

- ACI 301 – "Specifications for Structural Concrete" (American Concrete Institute).
- ACI 318 – "Building Code Requirements for Reinforced Concrete" (American Concrete Institute).

Structural Steel design:

- New structural steel work will follow the AISC (American Institute of Steel Construction) ASD Specification, Fifteenth Edition material:
  - Wide Flange Shapes - ASTM A992
  - HSS Pipes - ASTM A500 Grade C
  - HSS Tubes - ASTM A500 Grade C
  - Channels, Angles & Plates - ASTM A36
  - Connection Bolts - ASTM A325
  - Anchor Bolts - ASTM F1554 Grade 55
  - Connection Nuts - ASTM A563
  - Welding Electrodes - AWS D1.1 98E70
  - Pipe Pile - ASTM A252 Grade 3

Masonry design:

- New concrete block masonry units shall conform to Grade "N" moisture controlled, Type 1 of the ASTM C-90.
- Mortar shall be as per ASTM C270.

4.7.2 Design Live Load Requirements

The live loads used will be as required in the 2018 IBC. They are as follows:

- Offices 50 psf (+ 15psf partition loading)
- Corridors Above 1st Floor 80 psf
- Exit Corridors & Stairs 100 psf
- Assembly Areas(Lobbies) 100 psf
- Green Roof 100psf (+dead load of green roof products)
- Storage Areas 125 psf
- Mechanical Rooms 150 psf
- Catwalks 40 psf
- Roof Snow Load (+ drift)* 46.2 psf (New construction)

*The roof snow load is dependent upon the ground snow load of 60 psf an importance factor of 1.1 and will be adjusted for snow drifted areas.

- Existing structure roof snow load 30psf

4.7.3 Design Dead Load Requirements

The dead loads used are those specified in the referenced codes and are as follows:

- Typical Concrete Floors & Roof Self Weight + 15psf
- Typical Masonry Walls 35-75 psf (Based on reinforcement)
- Typical Precast Walls 125 psf
- Typical Steel Roof 30-35 psf (includes steel joist and deck)

4.7.4 Design Wind Load Requirements

The minimum wind speed is 118 mph with an exposure "B".

Importance factor = 1.0

4.7.5 Design Seismic Load Requirements

The renovated buildings will be analyzed under Seismic Design Category "A" with the following factors:

- Seismic Use Group - I
- Importance Factor - 1.5
- Site Class - D
- Ss - 7.8% Gravity
- S1 - 2.1% Gravity
- Sds - 0.064
- Sd1 - 0.032

4.7.6 Geotechnical Engineering Requirements

Geotechnical exploration and engineering report will be required for any additions to the buildings. Based on this report, all new construction will require some degree of soil correction. The soil correction will allow the building to be supported by a spread footing foundation system. The required soil correction will be confirmed as the design progresses. Review of the final drawings by the Geotechnical Engineer is imperative to ensure that their recommendations and requirements are followed relative to excavation, backfilling, and drainage.

4.7.7 Structural System Component Selection

The following criteria is used for design of all new structural systems and component selection:

- Structural Requirements
- Durability
- Required fire assistance
- Economy
- Aesthetics and Architectural requirements

4.7.8 Existing Structural Systems

4.7.8.1 Twamley Hall

Based on structural construction documents for the building dated 5-25-1961. The building is founded on a conventional concrete spread footing foundation system. The first floor is a 4" concrete slab on grade. Second, third fourth and penthouse floors consist of a 4" slab on metal form deck supported by a steel frame. The roof is a steel frame with wide flange roof beams supporting a metal roof deck.

Structurally the planned renovations will not alter the current use of the building in regards to floor live load loading. New penetrations thru the floor or roof will be analyzed individually but will be relatively easy to accomplish and detail, due to existing framing system.

4.7.8.2 Merrifield

Based on Architectural construction documents for this building dated November, 1927. The building is founded on conventional concrete spread footings. The first, second, third floors and roof appear to be constructed with a concrete frame consisting of a flat slab and concrete beam and column system. The concrete beams, columns and slab were visible in the lower level mechanical rooms.

Structurally the planned renovations will not alter the current use of the building in regards to floor live load loading. New penetrations through the floor or roof of this building will be analyzed individually, but will be more difficult to accomplish and detail due to the cast in place concrete frame. The existing concrete beams and columns should remain unaltered.

UNIVERSITY OF NORTH DAKOTA

MERRIFIELD - TWAMLEY
TECHNOLOGY PROGRAM

Prepared By:

THE SEXTANT GROUP
AN NV5 COMPANY

April 10, 2020

CONTENTS

INTRODUCTION

The University of North Dakota is currently planning for the renovation of Merrifield and Twamley Halls on their campus in Grand Forks, North Dakota. The Sextant Group, Inc. is assisting with this programming endeavor relative to the technology systems within the building, specifically Audiovisual Technology and Telecommunications / Structured Cabling Systems.

To provide a foundation for decision-making over the course of the project, and to remind the design team of the program's intent, the technology systems and spaces within this facility will align with the guiding principles set forth for the project.

- Increase Student Education Outcomes
- Reduce Operational Costs

In addition to these overall project principles, the Technology Systems need to provide flexibility to the users so the environment can meet their immediate and changing requirements. This flexibility must be tempered by providing robust and stable technology solutions that are intuitive and have a low rate of failure for faculty and students. Further, the technology solutions used, whether provided by the University within the classroom or by the student should not be a distraction to either the student or the teacher. In addition to providing for the immediate needs, the facility must provide long-term flexibility to accommodate the University's users well into the future.

It is understood that multiple departments will be utilizing the instructional spaces and theses spaces must support various unique teaching styles. The spaces should accommodate contemporary pedagogies, focusing on engaging and active learning activities, such as small group collaboration and problem-based learning. Further, the learning environments must continue to support traditional methods of instruction that are not reliant on technology.

The facility will include a multiple types and styles of technology-enabled instructional spaces. This includes ~24-80 seat active learning classrooms, 30-90 seat lecture-style classrooms, and seminar rooms. Group work or study areas are also planned. These may be dedicated rooms, or within "found" space or niches. The Audiovisual Requirements within this program describe the recommended characteristics and capabilities of the audiovisual systems planned. Additionally, a robust wired and wireless network will be implemented to meet the telecommunications networking needs of the users.

To assist in budgeting and simplifying this process, we have captured the functional requirements for classrooms, seminar/meeting rooms and study rooms into three system modules:

- Base Presentation Module
- Collaboration Station Module
- Capture/Distance Learning Module

These modules are applied to rooms as required, in any combination. For example, a classroom has at a minimum the Base Presentation Module. However, our example classroom also has the requirement to break up into small groups for active learning; therefore, four collaboration stations are also added to the room. A key benefit to planning and designing these systems as modules is that if the infrastructure is provided as part of the base building construction, the University can add these system modules to the room at any time. Scalability, such as this, is a fundamental requirement in managing constantly evolving technologies and expectations.

The Owner Considerations section herein identifies unique technologies for consideration, technologies that require additional discussion, or other factors within the project that should be acknowledged. The IP-Based Audiovisual Transport sub-section requires close attention by the University's Audiovisual and IT staff. This is a key technology to enable the system module concept. IP-Based transport facilitates an additive model of design, which is a requirement in designing for future growth.

This document is the initial Technology Program. The recommendations herein are formulated specifically for this project and represent our understanding of the functional requirements based on our programming meeting from March 4, 2020, University standards, and drawn from our experience on similar projects. This program document is provided as a decision-making tool for planning and budgeting purposes and is not a substitute for further inquiry and complete system design.

The included Opinion of Probable Cost (OPC) does not recommend specific manufacturers, makes, or model numbers; it is a professional opinion of the pricing for fully installed, integrated, and commissioned technology systems for the defined functionality and product classes. A fully designed package of specifications and systems drawings will be required at a later stage of the project. As technology is constantly evolving, this process will need to be revisited prior to final design of the Audiovisual Systems. The Opinion of Probable Cost reflects installed Structured Cabling Systems that fall under the base building construction and Audiovisual Technology Systems that are generally included within the FF&E budget.

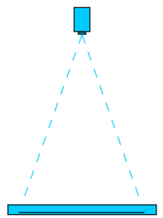
- Opinion of Probable Cost for audiovisual systems ***with base presentation modules*** included: **$1,795,400**
- Opinion of Probable Cost for audiovisual systems ***with all modules*** included is: **$3,867,300**
- Opinion of Probable Cost for installed IT Structured Cable system is: **$1,499,250**

We rely on feedback and commentary from the design team and user groups to confirm and finalize this document and allow us to move on to the next design phase of the project. If a full audiovisual system installation is not feasible, it is recommended that the infrastructure support the full program be included during construction.

AUDIOVISUAL EQUIPMENT PLANS

Audiovisual equipment plans representative of the layouts of the spaces have been included within each description as well as an image of a representative space. Not all spaces are included within the provided equipment plans. These equipment plans were developed based on documentation provided by JLG Architects and are typical of the spaces that are planned within the facility. Furniture that is shown on these plans is representative of the type of furniture planned within the space-type and should not be considered final. It is expected that over the course design, through meetings and feedback from the University that these layouts will be refined and changed.

Refer to the following legend when viewing the equipment plans within the audiovisual systems descriptions. Note that the projection screens and flat panel displays are shown indicating optimum viewing for Advanced Decision Making (green) and Basic Decision Making (yellow). These standards are utilized to properly size the screens within the space.



Front Projection System

Flat Panel Display

ER1 Equipment Rack

L Lectern / Instructor's Station

C Video Camera

M Table-Mounted Microphone

S Ceiling-Mounted Loudspeaker

RS Room Schedule Display

OWNER CONSIDERATIONS

For the audiovisual systems to be successful, a number of related factors will require input and decisions from the University and in some instances from those that will be providing support of these systems. A few areas are discussed briefly below, intending to encourage additional discussion.

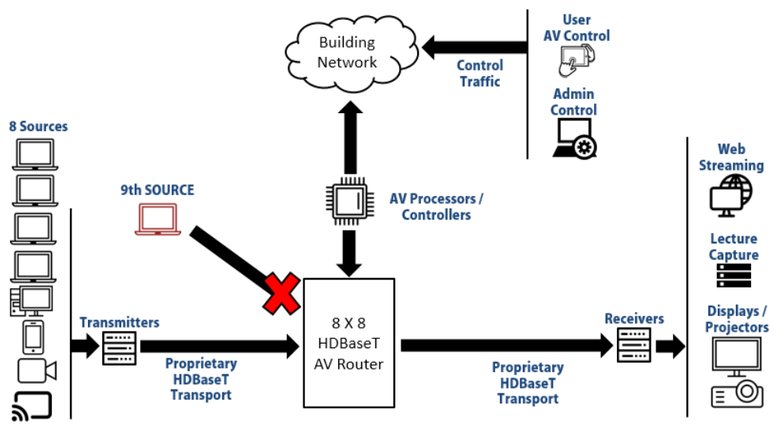
AUDIOVISUAL TECHNOLOGY STANDARDS

The University of North Dakota is currently in the process of reviewing and updating their classroom technology standards. This process is currently slated to be complete around June, 2020 and will be the basis for many of the audiovisual systems within this facility. After the University standards are revised this technology program will be updated to reflect any changes required to conform to the standards. It is expected that there will be spaces that do not conform to the University's standards, in instances such as this, the audiovisual system design will strive to utilize technologies or equipment that is within the standards.

AUDIOVISUAL SIGNAL TRANSPORT

Conventional audiovisual distribution/switching systems rely on frame-based architecture and commonly use a transport method called HDBaseT. All inputs and outputs connect to a transmitter/receiver, which in turn connect to a fixed or modular switching frame. Although HDBaseT systems are quite common in the audiovisual industry, there are several drawbacks that should be considered.

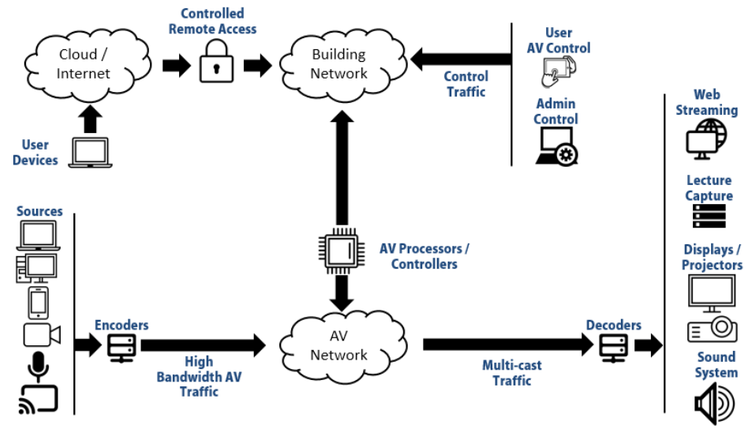
With HDBaseT systems, once a frame size is selected, the ability to add to that frame above the predetermined size is negated. For example, if there are eight sources and eight displays, an 8-input x 8-output frame will suffice. However, there is a need to add a ninth source, the entire 8 x 8 frame needs to be removed and replaced with a larger frame, such as a 16 x 16 out. An example of this is shown within the diagram below.



Audiovisual systems based around HDBaseT and other similar approaches have limited scalability. Also, HDBaseT products are only compatible with other HDBaseT products, and in many instances only products from the same manufacturer.

As advances in technology are made, newer options become available for audiovisual system signal routing and transport. Over the past three to five years, IP-based transport solutions have been introduced by numerous manufacturers and have been gaining widespread acceptance in the marketplace.

With IP-based audiovisual signal transport, and similar to HDBaseT, each source and display connects to a transmitter or receiver. The transmitters and receivers in this method are IP encoders and decoders. In this system architecture, each source's audio/video signal is converted to an IP Ethernet network stream, which is then decoded at each display. This is typical of a standard telecommunications network design in which all encoders and decoders connect to Ethernet switches located in centralized data or AV rooms. A central control system switches the source's audio/video signals to displays by routing the desired encoder's IP address to the display's decoder IP address.



The major benefit of IP-based transport is scalability. All processing and switching equipment is centralized, and only the encoders and decoders are in the individual rooms. If an extra source is needed, simply add another encoder and connect it to a switch on the network. Since networks are scalable by design, the system can grow along with changing needs in a way that is very familiar to the Information Technology team.

A significant benefit to a centralized IP system is it natively allows routing of "any source to any display" on the entire network, not just routing of the sources and displays to which the individual switch is connected, provided that the audiovisual signal transport network is designed for such use. This capability is a key functionality of the audiovisual systems. The use case for this is to allow for various "intersection points" within the learning environment, such as Room A can share with Rooms B and C, but not Room D. Content and source sharing between rooms should be carefully considered and defined prior to the final design of the audiovisual systems and IT networks.

It should be noted that there are various ways that this signal transport method can be implemented on the telecommunications network. If the telecommunications staff would prefer that audio and video signals not run on the telecommunications network, a parallel audiovisual network can be created that has limited connection points to building-wide telecommunications network. As the project progresses, further discussion with the IT team will be required to determine the network implementation and topography for the system.

Further discussion with the University is required as this may be a departure from signal transport standards that are currently implemented on campus.

CENTRALIZED EQUIPMENT ROOMS

Proper space provisions for all AV/IT equipment is critical and the design team will work to create proper space provisions per industry best practices. Centralizing most of the audiovisual processing and control equipment helps create learning spaces that are very flexible and open. A typical classroom has the instructor tethered to a large lectern or equipment rack in the corner of the room. These pieces of furniture are not easily movable and tend to get in the way. Through embracing an IP-Transport model and centralizing as much of the audiovisual equipment as possible, we are able to free up space and allow for very light a movable teaching stations, as seen to the right:

We recommend either combining the data rooms (IDFs) with the audiovisual equipment rooms if UND policy will allow this or providing dedicated AV equipment rooms that serve multiple spaces. An additional benefit of a centralized topography will be reduced audiovisual equipment costs since multiple spaces will be able to share equipment (control processors, audio DSP, and switches) rather than have this same equipment dedicated per space.

The Opinion of Probable Cost does not reflect centralized equipment rooms.

ASSISTIVE LISTENING

The requirements for assistive listening systems are provided within the current ADA Standards. Per the standard, assistive listening systems “shall be provided in assembly areas where audible communication is integral to the space.” The essence of this law is that any space where people gather must have an assistive listening system. Further, the coverage of the system must not be confined to a portion of the room or space, but within the entire space.

There are multiple options available for assistive listening and include:

- Radio Frequency (RF) Technology
- Infrared (IR) Technology
- Induction (Loop) Technology
- WiFi Technology.

RF and IR systems are very similar in that they utilize a transmitter (Radio Frequency or IR Radiator) to send the signal to a portable receiver with earphone that is provided to the guest. These technologies include options for a neck loop for use with T-coil hearing aids and Cochlear implants. This type of system is generally the lowest cost and can deliver content across multiple channels and a single receiver can be used within multiple spaces within the same facility.

Hearing Loop technology uses a magnetic field to wirelessly transmit audio to your ears using either a T-Coil equipped hearing aid with a built in “T” switch or with a Hearing Loop receiver with earphones. These systems use a wire, or flat copper tape of loop(s) that are typically installed within the floor or in the walls of the entire venue. Hearing Loop Systems are generally preferred by hearing impaired users as there is no need to check-out any hardware and are easy to service once installed. Current estimates are that 70% of hearing aids sold are T-coil enabled. Convenience of use and sound quality, because the T-coil is specifically tuned to the individual’s specific hearing loss contribute to this preference. The initial investment of this type of system can sometimes be seen as an impediment to implementation of this type of system, particularly within a multi-use classroom facility.

WiFi enabled systems provide high-quality streamed audio via low-latency transmission over an owner’s existing IT network infrastructure and takes advantage of a “bring your own device” and convenience for the guest. WiFi enabled receivers are still required for guests that don’t have their own devices. It should be noted that a WiFi system is dependent upon the facility’s WiFi Infrastructure and coverage within the space. If the coverage is not robust, there may be issues within the ability to transmit or receive audio or could inhibit users from connecting to the network. Further, this is also a relatively new technology and studies of acceptance, ease of use and performance over time are not yet available.

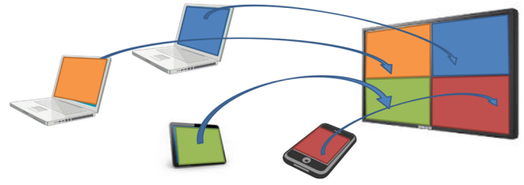
The ADA Standards provide further information on requirements and indicate the quantity of receivers for a space based on the seating capacity. We assume that the University’s Disability Services group will assist in determining the system type to implement within the classroom environment based on standards currently in place.

The following audiovisual program includes an allowance for an IR or RF assistive listening system within each space per the ADA Standards.

WIRELESS SCREEN SHARING

As people rely more on their personal and company devices (laptops, phones, tablets, etc.) for work and collaboration, easily connecting these devices together has become a core requirement. This has proven to be a challenge as these various devices have different connectivity requirements and operating systems. For this reason, wireless software-based connectivity has become more prevalent.

Devices such as Extron ShareLink, Mersive Solstice, or Crestron AirMedia allow users to connect their device wirelessly to the displays in a room. Users install (one time) a small application on their device, which allows them to connect to the display. These systems allow multiple people to connect to the display, which is often presented in a quad-screen view; as shown below.



Another approach for wireless screen sharing is to utilize consumer-level products such as AppleTV and MS Wireless Display Adapter. These tools work natively will Apple, Windows, and Android products. However, the major drawback with this approach is these tools are not “enterprise-friendly”, as they do not have a method for pushing software/firmware updates over the network, nor can they centrally monitor all activity/bandwidth utilization. In addition, the method for connecting to these systems can vary from device manufacture to manufacture, potentially creating confusion.

It should be noted that in spaces with wireless screen sharing technology, at this time, the ability to connect directly to the system via a cable will be provided.

The University currently utilized Crestron AirMedia for wireless screen sharing. This may change based on the aforementioned University review of technology standards.

RESEARCH AND STAFF DEVELOPMENT

Audiovisual Support Staff

Some of the audiovisual technologies that will be implemented in the renovated facility may be a departure from the standard audiovisual technologies that have been previously installed within the facility, and in some instance, the university campus in general. To meet the needs of the faculty, students, and staff, as well as the needs of the audiovisual systems, the school should carefully evaluate the complete audiovisual technology support environment.

This review should include the present technology staffing organization, service agreements for support from outside vendors, skill sets, and availability of the staff, expectations of the users, mission-critical nature of the instructional environments, as well as other factors deemed important. Through this review, the school will be able to determine appropriate staffing needs and support contracts that may need to be implemented as this project comes online.

If there are no plans to add audiovisual support staff to the facility, this should be balanced with the desire to have a world-class facility and technology environment that will serve the needs of the school for years to come. Ideally, the technology support staff will not be a limiting factor in the functionality available in the instructional spaces.

In addition to staffing, the current technical support staff is likely to face new challenges. The staff should understand the configuration, maintenance, and programming requirements for an IP-based audiovisual switching system if this type of signal transport is utilized. The campus should consider training for the technical staff, whether it be on-campus manufacturer specific training, or off-campus training such as at a manufacturer facility, industry conference or trade shows.

The Sextant Group recently co-sponsored an industry survey that seeks to determine some benchmarks and best practices of audiovisual support staff on higher education campuses. We polled numerous college and university campuses on topics such as the number of audiovisual-equipped spaces and the support staff levels needed to properly support those spaces and users.

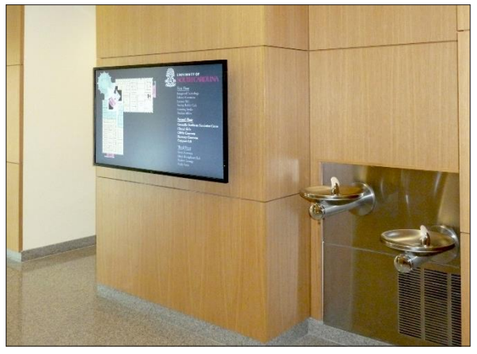
The most relevant outcome of the survey is the 47:1 average ratio of audiovisual-equipped rooms vs. full-time audiovisual support staff. Thus, the average number of audiovisual support staff is one person for every 47 audiovisual-equipped rooms. Like all survey results, this is a gross over-simplification and should not be used for decision-making without considering the unique factors of your environment. For example, many of the colleges and universities supplement their full-time staff with part-time student workers, service contracts with outside service providers who can quickly and easily enter nearly all campus buildings, and so on. Many institutions also classify those who work in studio environments that are producing instructional materials, recording audio/video recordings, editing, and similar tasks in different groups than true “audiovisual support.”

Faculty Development

The audiovisual systems may be a departure for the user and support staff. The Teaching Transformation and Development Academy (TTaDA) at the University of North Dakota is a well-established professional development organization on campus. Through the services offered, we expect that there will be opportunities for the instructors to obtain training for these new spaces as well as technologies that will be deployed within.

DIGITAL SIGNAGE CONTENT

In order to assure that the digital signage located throughout the facility does not become irrelevant or out of date, the school should identify individuals who will contribute and provide content to the digital signage system. The digital signage system will be configured to allow access by multiple users to the system through the network. Further, the system can be configured so that a single person or persons has authorization to publish content to the system supplied by the contributors.



AUDIOVISUAL SYSTEM MODULES

BASE PRESENTATION MODULE

Each audiovisual-equipped space will include a base presentation system. The base system is optimized for each room to which it is applied. There are variations between the spaces to adjust for type and size of display and sound system to ensure proper coverage. Additionally, the source device and control system interface may vary based upon users-group needs.

Display Devices

- Larger instructional spaces such as the 90-Seat Lecture and classrooms are planned include projection systems (projector/screen), with a confidence monitor located at the lectern.
- Smaller spaces such as the seminar rooms and small group rooms will be outfitted with a flat panel display(s).


Display System

Digital Ink

- A multi-touch display mounted to an articulating arm connects via USB to the local computer. This display is equipped with a digitized stylus, providing for high-fidelity digital inking over computer content.

Audiovisual Sources

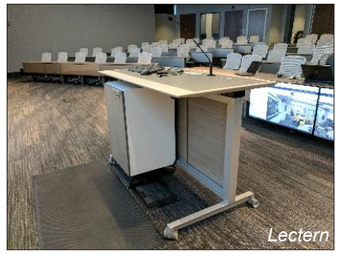
- All spaces are planned to include:
  - Wired auxiliary audiovisual digital input(s). The input(s) can be used for Laptops or other audiovisual devices such as a portable document camera or media player.
  - Wireless screen sharing device
- Spaces that include a lectern with integrated equipment rack or separate equipment rack may include many of the following source devices. This will be determined based on the users’ requirements for these spaces:
  - Dual output resident computer with wireless keyboard/mouse
  - Document camera
  - Others as needed


Display System


Touch Panel

Sound Reinforcement System

- All spaces are planned to include a sound reproduction system with an amplifier for program audio and speech reinforcement. Spaces may include any of the following loudspeaker types:
  - Wall-mounted loudspeakers flanking the display
  - Ceiling-mounted loudspeakers
  - Sound bar attached to the flat panel display
- Spaces that require speech reinforcement would include the following:
  - Wired microphone
  - Wireless microphone system to include a lavaliere and handheld microphone
  - Larger spaces such as the auditorium and the larger classrooms may include multiple microphones and microphone types.
- In spaces with more complicated audio requirements an audio DSP would be included for audio processing and mixing
- Assistive listening system per ADA Standards.


Lectern

Audiovisual Control/Transport System

- All audiovisual enabled rooms will include an intuitive user-interface to control the display, volume, source selection and so on. Classrooms are planned to include a touch panel controller located on the instructor station, table or wall. Smaller spaces that have fewer source devices and simpler control requirements are planned to be controlled via a wall-mounted push-button interface.
- Control may be extended to control the lighting and shade system.
- All control systems will have secondary analogous control available via software on a computer or tablet device.
- Audiovisual sources and displays are planned to be connected via an IP-Based transport system (AVoIP), with encoders/decoders in each room. This system may include a central audiovisual switching system to allow any source in any room to be displayed in any other location throughout the building provided it is on the AV network. As noted previously, this may be on the building telecommunications network as a separate LAN. If the system is not desired to have this type of topography, an AVoIP solution can still be employed, but would be done as a closed network per room. In this instance the audiovisual signals would be relegated to that room system only. In smaller spaces, an AVoIP solution may be more expensive than a traditional audiovisual signal transport system. Therefore, these spaces may utilize an HDBT solution or utilize the switcher integral to the display to route source devices.

Audiovisual Furnishings

- Instructional spaces will include an instructor's station. This may be small and portable with very minimal equipment or a larger lectern with space to house the audiovisual equipment. This program assumes the latter style of instructor station.
- In active learning spaces, a standard lectern as previously noted and a smaller portable wheeled lectern may be utilized.
- Spaces with more complex audiovisual system requirements will require a separate audiovisual equipment rack. This may be located within a space integral to the room, or multiple rooms may share an equipment rack based on their proximity.
- Smaller spaces such as conference rooms may require a credenza or small equipment rack cabinet. Many times this equipment can be located behind the display; however, more complex rooms generally require more equipment than can be located behind the display.

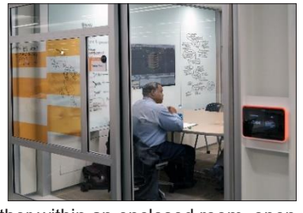
By applying the base presentation module to all instructional spaces, faculty can easily move from room to room without additional training on basic functionality.

COLLABORATION MODULE

A standard and consistent approach for group collaboration will be planned throughout the building. This will allow students to seamlessly utilize the same collaboration tools whether it be during class in an active learning classroom or work with fellow students in a small group room. Ultimately the style utilized within this facility will mimic other spaces on campus.

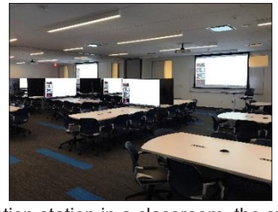
Example space types:

Huddle/Small Group Rooms



Open Collaboration Areas

Active Learning Classrooms



Whether within an enclosed room, open area, or cart/wall-mounted collaboration station in a classroom, the systems will support groups of students connecting to a local display for digital collaboration. The University will need to confirm that groups of six is the ideal quantity of students utilizing a collaboration system within an active learning classroom.

Display Devices

- In smaller group study rooms, a flat panel display will be mounted to the wall. In classrooms that include collaboration groups there may be a combination of wall mounted display and portable displays on carts. Mounting style of the display will be dependent upon room geometry. The mounting style (wall or cart) is based on room type and space requirements, with no technical or functional differences.

Audiovisual Sources

- Students will be provided with the ability to wirelessly share content from their personal device(s) to the display and through a wired connection (HDMI). The ability to share wirelessly allows for multiple displays to be shown simultaneously through the wireless connection. Further, when another group member would like to share their device, the cable does not need to be disconnected from one user's device and connected to another.

Sound Reinforcement System

- The display speakers are planned to provide program audio for the content that is displayed.
  - If the instructor desires to show one of the group table displays to all displays, the audio DSP will route the audio from that group to the audio system within the space.
- Within larger active learning classroom spaces, a microphone system at each table is planned. This will include two push to talk microphones. With the addition of this microphone system, the audio DSP system will be enhanced to accommodate the additional microphones and audio mixing required.

Audiovisual Control/Transport System

- In active learning classrooms, each collaboration group display requires at a minimum an audio/video encoder and decoder. These devices enable local audiovisual sources to be encoded so that they will be able to be displayed on the local collaboration display and then routed to any other display within the system. The decoder allows any encoded audio/video stream to be shown on the local display. An example of this is the instructor pushing content from their display to select or all of the collaboration displays.
  - Within huddle/small group rooms and open collaboration areas, a small video input switcher or switcher integral to the display will be utilized to route source devices to the display system.
- A push button control system will be associated with each display to control source selection, as well as volume control. The touch panel controller at the instructor's station will be able to override the local push button control system
  - In larger spaces with multiple collaboration groups, the push-button controller associated with each group will allow use of the collaboration group display by student groups after hours without the necessity of turning the entire audiovisual system on. In an after-hours mode, the push button controller will also be able

to turn the display on/off and control audio volume. In this mode, the microphones associated with each table will not function.

Audiovisual Furnishings

- A portable cart will be provided for spaces that are not able to have all displays mounted to a wall surface.
- In standard instruction that will support active learning, the furniture will need to be flexible and support multiple layouts and/or configurations. If the room is purpose-built for active learning, the furniture can be fixed, but will need to support an active and collaborative group dynamic.

CAPTURE / CONFERENCE / STREAMING MODULE

The proliferation of web-conferencing services such as Teams, Zoom, and WebEx has greatly changed expectations in contemporary education buildings. The requirement for connecting remote students or presenters synchronously and asynchronously to classes and small group spaces is on the rise and is becoming an expected technology of today's student. Further, these services can be indispensable to educators in the event that world-events require a suspension of in-class learning activities.

Traditional methods of videoconferencing/capture have utilized purpose-built CODECs. Systems from manufacturers such as Cisco and Polycom were commonplace in the classroom environment. These systems are largely point-to-point solutions and provide the optimal results when each side of the conference employs the same device or device from the same manufacturer.

The aforementioned web-conferencing services are enterprise focused and are quickly replacing traditional CODECS due to their scalability, flexibility, and mobility.

The Capture/Conference module may be applied to Base Presentation spaces.

Capture / Conference / Streaming Device

- Owner-furnished web-conferencing / software is planned to be provided on a dedicated computer within the space. The University currently utilizes the following software for this application: Blackboard Collaborate Ultra, Skype for Business, and Zoom (see https://und.edu/academics/ttada/academic-technologies/online-collaboration.html). As outlined within the link noted above, each of these all has varying levels of interactivity, user management, recording, and accessibility. Any of or all of these may be made available to the users within the space.
- While the web-conferencing applications previously noted can provide recording capabilities, an appliance-based recording system will be included within classroom spaces. These systems are specifically designed for classroom capture to include video, audio and content. The University currently utilizes YuJa for this application and integrates captured sessions into their Blackboard course management system.
- The space will include a camera. In select spaces multiple cameras may be required.
  - The classroom spaces may utilize a software-driven facial recognition auto-tracking software to track the instructor as they move around the instructional space. The camera will connect to the audiovisual system via the IP Transport system allowing IT faculty to monitor and (if needed) control the camera from a central location.
  - Smaller spaces such as conference rooms and seminar rooms would include a fixed focal or self-framing camera.
- A USB bridging device connects the audiovisual system (sources and audio) to the resident computer via USB. This allows the faculty to not only route the camera to far-end but also any source in the room, such as the document camera or laptop input.

Sound System

- The wireless lavaliere or gooseneck microphone utilized by the instructor will be used to capture their speech. When required, a ceiling microphone system is planned to be utilized to capture the students. The use of these microphones is necessary to keep the remote participants engaged by enabling them to hear questions and discussion as it happens. The instructor may mute the microphones via the audiovisual control system when desired. The microphones do not provide local amplified speech reinforcement unless the size of the space dictates this requirement. In smaller conference-style spaces, the microphone integral to the camera will be utilized for audio transmission.

AUDIOVISUAL REQUIREMENTS PER SPACE TYPE

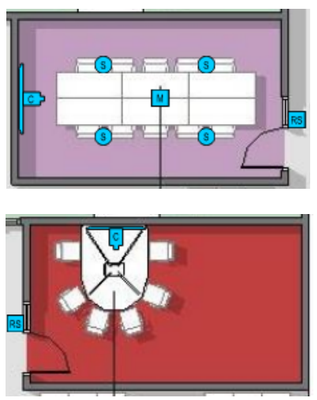
10-SEAT CONFERENCE (QUANTITY 6)
6-SEAT CONFERENCE (QUANTITY 11)

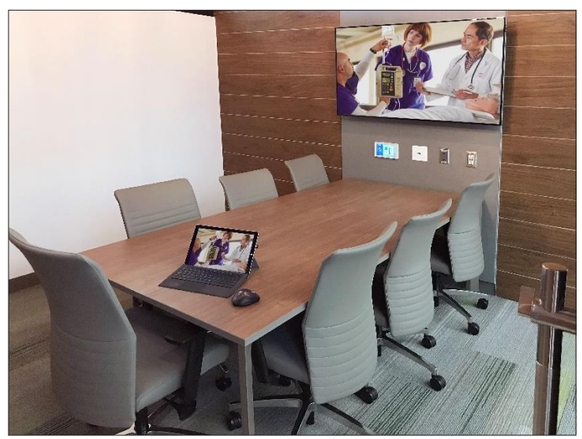
The Conference Rooms are planned to function as a meeting or work room environment for small groups. This space will include audiovisual equipment like that within the Collaboration or Base Presentation Module. These spaces will feature a single flat panel display presentation system and video camera with integral microphone for web conferencing applications.

System Modules	
Base Presentation	• **Displays:** Flat Panel Display • **Sources:** Dedicated Computer, Auxiliary Digital Inputs, Wireless Connection to Display System • **Sound:** Ceiling-mounted Loudspeakers (10-Seat Conference), Sound Bar attached to flat panel display (6-Seat Conference) • **Control/Transport:** Push Button Control System, App-based control, Audiovisual Signal Transport • **Furniture:** Equipment Rack
Collaboration	• Not Applicable
Capture / Conference / Streaming	• Self-Framing Camera with Integral Microphone (integral microphone will be used in the 6-Seat Conference Room) • Ceiling or table mounted microphones (10-Seat Conference only) • Assistive listening system

Design Considerations:

- A location for an equipment rack will be required.
- Coordination of the location for the display will be required to ensure optimal viewing for the most seats.





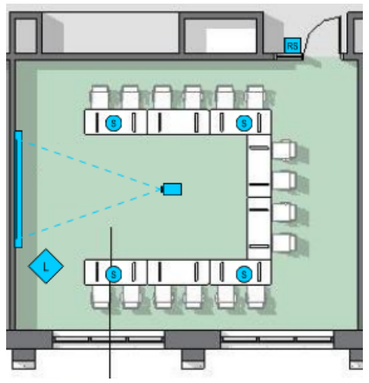
12-SEAT SEMINAR (QUANTITY 2)
16-SEAT SEMINAR (QUANTITY 4)

The Seminar Rooms may be utilized for larger meeting or small classes. The space is planned to include audiovisual equipment like that within the Base Presentation Module. The main display will be a front projection system.

System Modules	
Base Presentation	• **Displays:** Ceiling mounted fixed projector with motorized projection screen • **Sources:** Dedicated computer, Auxiliary Digital Inputs, Wireless Connection to Display System • **Sound:** Ceiling-mounted Loudspeakers, Assistive Listening System • **Control/Transport:** Touch Panel Control System, App-based control, Audiovisual Signal Transport • **Furniture:** Lectern with integrated audiovisual equipment rack
Collaboration	• Not Applicable
Capture / Conference / Streaming	• Pan-Tilt-Zoom Camera, Capture Appliance, Auto-tracking Software, Ceiling Microphone Array

Design Considerations:

- If the Capture/Conference/Streaming module is not initially required for the space, it is recommended that the infrastructure to support this is provided.



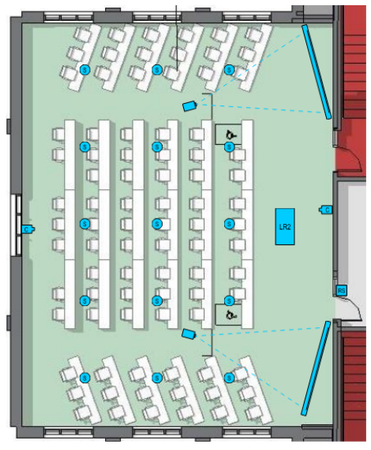
90-SEAT LECTURE (QUANTITY 1)

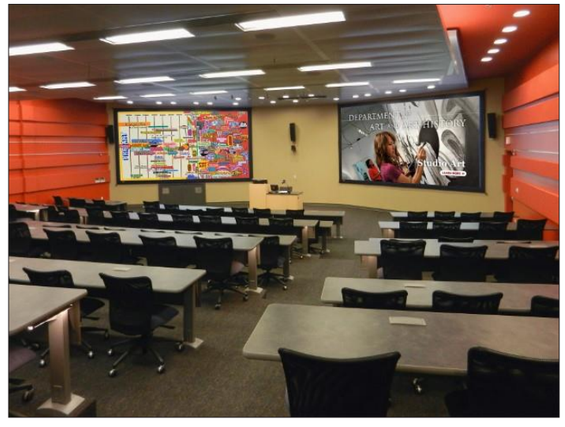
The 90-Seat Lecture Hall is planned to provide standard lecture style instruction with fixed furniture. The tiering within the space will enable group collaboration between the two rows on each tier. The space will feature a dual projection presentation system that will be capable of showing independent and redundant imagery.

System Modules	
Base Presentation	• **Displays:** Two Projection Systems, Confidence Monitor/Digital Ink at Lectern • **Sources:** Dedicated Computer, Auxiliary Digital Inputs, Wireless Connection to Display System, Document Camera • **Sound:** Wired/Wireless Microphones, Audio DSP, Ceiling-Mounted Loudspeakers, Assistive Listening System • **Control/Transport:** Touch Panel Control System, App-based control, IP Audiovisual Signal Transport • **Furniture:** Presenter's Station with integral AV equipment rack
Collaboration	• Not Applicable
Capture / Conference / Streaming	• Two Pan-Tilt-Zoom Camera (s), Capture Appliance, Auto-tracking Software, Ceiling Microphone Arrays

Design Considerations:

- Coordination of instructor's location will be required
- Shades should be utilized to reduce the amount of ambient sunlight within the space. Lighting should be coordinated with the audiovisual design to prevent direct light on the projection screen.
- A location to house an equipment rack may be required.





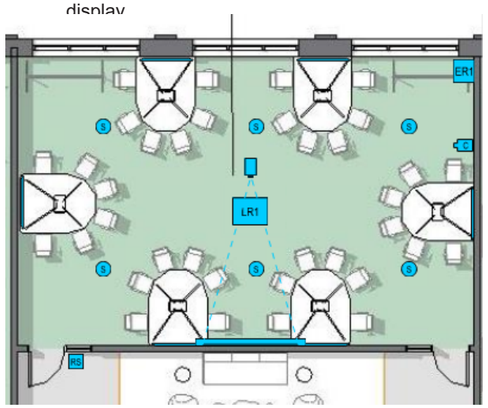
24-SEAT ACTIVE LEARNING CLASSROOM (QUANTITY 4)
30-SEAT ACTIVE LEARNING CLASSROOM (QUANTITY 5)
36-SEAT ACTIVE LEARNING CLASSROOM (QUANTITY 4)
42-SEAT ACTIVE LEARNING CLASSROOM (QUANTITY 2)

The Active Learning Classrooms are planned to support an active learning environment with University provided technology during classroom instruction. The spaces are planned to have a fixed seated configuration. While the fixed seating is optimized for active learning, a projection screen will be provided to allow for standard lecture-style instruction.

System Modules	
Base Presentation	• **Displays:** Projection System, Confidence Monitor/Digital Ink at Lectern • **Sources:** Dedicated Computer, Auxiliary Digital Inputs, Wireless Connection to Display System, Document Camera • **Sound:** Wired/Wireless Microphones (36 and 42 seat rooms), Ceiling-Mounted Loudspeakers, Assistive Listening System • **Control/Transport:** Touch Panel Control System, App-based control, IP Audiovisual Signal Transport • **Furniture:** Presenter's Station, Equipment Rack
Collaboration	• **Quantity of modules is based on the quantity of groups of six:** Wall or cart-mounted flat panel display, wired and wireless connection to display, wired microphones, push button panel
Capture / Conference / Streaming	• Pan-Tilt-Zoom Camera, Capture Appliance, Ceiling-mounted Microphone array(s), Audio DSP, USB Bridge

Design Considerations:

- Confirmation the spaces will or will not be reconfigurable is required.
- Coordination of instructor's location(s) will be required
- Shades should be utilized to reduce the amount of ambient sunlight within the space. Lighting should be coordinated with the audiovisual design to prevent direct light on the projection screen.
- A location to house an equipment rack will be required.
- Space between the end of the table and the display is required to provide optimal viewing for those closest to the display.



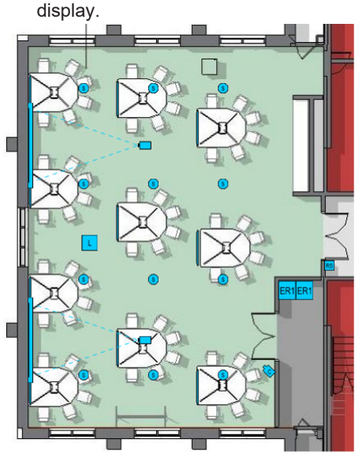
54-SEAT ACTIVE LEARNING CLASSROOM (QUANTITY 1)
60-SEAT ACTIVE LEARNING CLASSROOM (QUANTITY 1)
78-SEAT ACTIVE LEARNING CLASSROOM (QUANTITY 2)

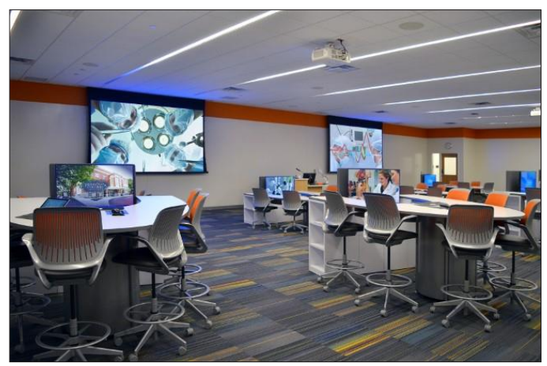
The Active Learning Classrooms are planned to support an active learning environment with University provided technology during classroom instruction. The spaces are planned to have a fixed seated configuration. While the fixed seating is optimized for active learning, a dual projection system will be provided to allow for standard lecture-style instruction.

System Modules	
Base Presentation	• **Displays:** Two Projection Systems, Confidence Monitor/Digital Ink at Lectern • **Sources:** Dedicated Computer, Auxiliary Digital Inputs, Wireless Connection to Display System, Document Camera • **Sound:** Wired/Wireless Microphones, Ceiling-Mounted Loudspeakers, Assistive Listening System • **Control/Transport:** Touch Panel Control System, App-based control, IP Audiovisual Signal Transport • **Furniture:** Presenter's Station, Equipment Rack
Collaboration	• **Quantity of modules is based on the quantity of groups of six:** Wall or cart-mounted flat panel display, wired and wireless connection to display, wired microphones, push button panel
Capture / Conference / Streaming	• Pan-Tilt-Zoom Camera, Capture Appliance, Ceiling-mounted Microphone array(s), Audio DSP, USB Bridge

Design Considerations:

- Confirmation the spaces will or will not be reconfigurable is required.
- Coordination of instructor's location(s) will be required
- Shades should be utilized to reduce the amount of ambient sunlight within the space. Lighting should be coordinated with the audiovisual design to prevent direct light on the projection screen.
- A location to house an equipment rack will be required.
- Space between the end of the table and the display is required to provide optimal viewing for those closest to the display.





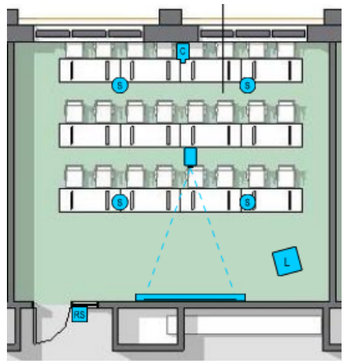
20-SEAT LECTURE CLASSROOM (QUANTITY 2)
24-SEAT LECTURE CLASSROOM (QUANTITY 2)
34-SEAT LECTURE CLASSROOM (QUANTITY 1)
36-SEAT LECTURE CLASSROOM (QUANTITY 1)

The Lecture Classrooms are planned to be flexible seating environments that will allow for multiple seating arrangements during instruction. The space is planned to feature a single projection presentation system.

System Modules	
Base Presentation	• **Displays:** One Projection System, Confidence Monitor/Digital Ink at Lectern • **Sources:** Dedicated Computer, Auxiliary Digital Inputs, Wireless Connection to Display System • **Sound:** Ceiling-Mounted Loudspeakers, Assistive Listening System • **Control/Transport:** Touch Panel Control System, App-based control, Audiovisual Signal Transport • **Furniture:** Presenter's Station, Equipment Rack
Collaboration	• Not applicable
Capture / Conference / Streaming	• Pan-Tilt-Zoom Camera, Capture Appliance, Ceiling-mounted Microphone array(s), Audio DSP, USB Bridge

Design Considerations:

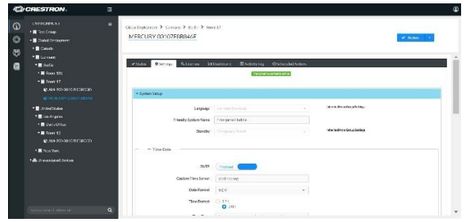
- Shades should be utilized to reduce the amount of ambient sunlight within the space. Lighting should be coordinated with the audiovisual design to prevent direct light on the projection screen.
- A location to house an equipment rack may be required. This will be dependent upon the size of the instructor station and the inclusion of the collaboration module within the space.

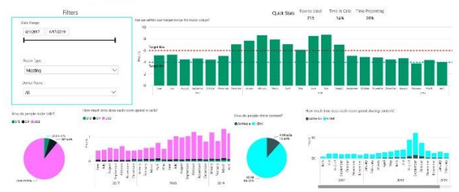


Audiovisual Metacontrol System

Each room-specific audiovisual system described above will contain a control system with a standard user interface to facilitate ease of use. While this equipment is assigned to each room-specific system, all control system processors will be connected to the building LAN and thus will have Internet Protocol (IP) capabilities. The information carried by the LAN is low-bandwidth control command only and does not include high-bandwidth audio or video signal. All push-button and touchpanel control functions for each system should be replicated on HTML-based web pages and be capable of being controlled via an APP on a tablet.

This Audiovisual Program and Opinion of Probable Cost assumes that the University has a meta-control system on campus and monitoring of this building will be an extension of the system.





Graphics provide courtesy of Crestron Electronics

Public Information Display and Digital Signage System

The building will contain flat panel displays strategically located for the display of information, schedules, video, event advertising and other content.

The digital signage system will be capable of displaying computer graphics, embedded digital video, and any associated program audio. Each flat panel display will be connected to the system head-end via the building LAN, and would contain an IP-based hard disk media player. Content will be delivered to, and stored on, each individual media player through the use of a content server. Each display will be individually assignable, so programming can be displayed on any or all of the displays independently. The head-end equipment will include content creation, play-list, and scheduling software to establish the playback schedule for each display.

An allowance for eleven digital signage display locations between the two buildings is included. Final locations for these displays will be coordinated as the design progresses.

Room Schedule Displays

Touch-sensitive room scheduling displays will be located outside of selected rooms for the presentation of real-time schedule information. The displays will be powered via POE and individually assignable. The displays will include dual color, side-mounted LED's to indicate the availability of a room from a distance.

Users will have the ability to review room availability, and schedule selected spaces at the room scheduling display.

A schedule display is currently planned to be located on the exterior of classrooms, seminar rooms and conference rooms.

Portable Equipment Pool

Included is a budgetary allowance for a pool of portable equipment: The exact contents of this pool needs to be determined through further discussions with faculty and staff, but could likely include any of the following:

- Document Cameras
- Portable projectors
- AVoIP Encoders and Decoders
- Carts to transport audiovisual equipment around the building
- iPads/ Tablet PCs as backup control interfaces
- Spare components to facilitate service
- Portable power monitor

Additional Audiovisual Technologies

The following audiovisual technologies are *not* planned:

- Rich-media streaming storage/management
  - It is assumed that the University already has this type of system on campus.
- Television distribution system (CATV/Satellite)
- Sound masking system
- Paging / Background Music System

INFORMATION TECHNOLOGY

COMMUNICATIONS INFRASTRUCTURE

Modern communication has evolved to encompass all aspects of our lives from voice to video. Information technology's prime objective is to facilitate communication and collaboration, and the transfer of information. The communication infrastructure for the Merrifield-Twamley project will include items such as:

- Pathways and Spaces
- Telecommunication Rooms
- Structured Cabling throughout building
- The connection points to the Campus Wide Network.
  - The connections to the campus WAN will be defined with University of North Dakota IT personnel as the project progresses through design.

The following documentation incorporates information provided through the **University of North Dakota Communications Standards For Cabling, Pathways, and Space** revised *01/2020*. If this documentation has been updated since the revision date noted herein, new standards will need to be provided for review and incorporation.

STRUCTURED CABLING MATERIAL STANDARDS

The following is an abbreviated list of the materials standards provided by the University.

- 19" x 7' 2 post Equipment Rack – **Newton (0040100230) or Chatsworth (66353-703)**
- Category 6 and 6A Cable – **SYSTIMAX**
- Faceplates and Jacks – **SYSTIMAX**
- 48 Port CAT 6 angled Patch Panel and CAT 6A patch panel – **SYSTIMAX**
- 210 Block, 110/100 pair block with legs – **Siemens**
- SM Fiber – **CommScope TeraSPEED**
- MM Fiber – **CommScope LazrSPEED**
- Fiber Connectors and Distribution Panel – **Panduit**
- Category 3 Multi-pair Copper (25 or 100) – **CommScope**
- TV Distribution – **Belden**

PATHWAYS AND SPACES

Information technologies require dedicated rooms on each floor to house equipment racks, network switches, optical fiber terminations, copper cabling patch panels, and so on. These spaces are known as Equipment Room (ER) and Telecommunications Rooms (TR). ERs & TRs provide for the organized and logical distribution of low voltage communications signals within a building and are specifically designed to be flexible and scalable. TRs provide value over an extended period of time as a distinct asset to the building and have an anticipated life cycle of up to 25 years. All TRs are designed following ANSI/TIA/EIA and BICSI standards along with recommendations and standards provided by the University.

Telecommunications Rooms

It is recommended that multiple TRs should be provided on the same floor if usable floor space exceeds 10,000 sq ft. or the conduit length between the horizontal cross-connect in the TR and any Telecommunication outlets being served would exceed 250 total feet. Maximum allowed length of horizontal cable installed to outlets must not exceed 295 feet. Pathway length should be kept to a maximum of 250 feet to accommodate proper cable length including vertical changes and cable slack.

To minimize the horizontal cable lengths within a maximum of 250 feet, locate the TR on each floor as close as possible to the center of the area it is to serve. The location on each floor should be consistent so they stack vertically for ease of cable pathway between each room.

The TRs are dedicated to communications functions and related support and should contain only communications equipment. Additional equipment should not be located within these rooms unless review and authorized by University of North Dakota IT representatives.

Per UND standards, the minimum size of communication rooms is 90 sq feet, sized 9’ x 10’ and is sized to hold two telecommunications equipment racks with clearances of 36” to the front, rear and one side of the racks. The telecom room size is based on a serving area of 10,000 SF. The quantity of racks required may vary depending upon the density of network outlets within the serving zone. If additional racks are required, the size of the space will need to increase to accommodate the additional racks with clearances.

The communications rooms will include cable management hardware on the wall, between the wall and the rack and within the rack. This will facilitate neat/efficient jumper and patch cord routing.

Personnel entry to MTR / TRs will be through a locked door with electronic access control at least 36 inches wide, 80 inches high. The door should open outward unless building codes prohibit and be from a common hallway. The door threshold should include a sealed door bottom sweep.

All walls will be finished, i.e. sheetrock/painted, and the interior will be lined with 3/4 inch thick, A/C Grade Plywood backboard with fire retardant grey paint on a minimum of three walls. Plywood orientation will be 8 feet wide by 4 feet high with the bottom at 2 feet above finished floor. Plywood locations will be shown on the Technology Drawings.

The floor should be finished with VCT or sealed concrete.

Locate light fixtures a minimum of 8 ft. 6 in. above the finished floor. A light intensity level of 70 foot candles minimum should be provided measured at 3.3 feet from the finished floor. Lights should not be located above the equipment racks but instead are located over the areas where a service technician would be working on the rack. This will provide ample light on both sides of the rack without causing shadows or interfering with overhead cable pathways.

To permit maximum flexibility and accessibility, false ceilings (drop ceilings) are not required in MTR or TRs. Overhead clearances should be at least 8 feet (i.e. HVAC duct work, sprinkler heads, etc).

Each rack location will include two 120VAC double duplex (non-switchable) 20 amp outlets mounted to the cable ladder. These receptacles should be on UPS and building emergency power. Each wall will include one dedicated 120 VAC 20 amp (non-switchable) quad receptacle below the plywood. All power receptacles located in the MTR and TRs should be fed from dedicated telecommunications panels located in the MTR or TRs. Ensure proper clearances are maintained per code in front of these panels for servicing. The Electrical Engineer on the project will be required to assist with this.

Heating, ventilation and air conditioning that will maintain continuous and dedicated environmental control 24 hours per day, 365 days per year will be provided. Since the MTR and TRs house sensitive equipment, the normal temperature range should be 68 to 75 degrees with 30% to 55% relative humidity. All MTR and TRs should maintain a positive air pressure to assist in reducing dust in these rooms.

HVAC Duct other than that serving the room, electrical conduits for other areas, sprinkler system piping, drain pipes, clean outs, steam pipes, chilled water pipes, or any other systems should not be routed through the interior of the MTR or TRs. The TRs shall not be located below potential sources of flooding like restrooms, roof drains or kitchens.

Due to RFI and EMI the MTR/TRs shall not house any electrical equipment (i.e. - step down or step up transformers, breaker panels, etc). The equipment room shall be in a location where electromagnetic interference is minimal.

Based on the preliminary plans provided for review, a minimum of one centrally located TR is required per floor.

Primary Components

- Multiple sleeves connecting telecommunications rooms
- Fiber and copper connections between Telecom Rooms
- Connection to the current campus network
- Floor mounted 19” two post equipment racks, secured to the floor, equipped with both vertical and horizontal wire management.
- Overhead racking system for management of flexible connection cabling and providing additional structural support for the racks, cabinets, and systems.
- Patch panels for all horizontal cabling
- Adequate floor space and growth potential
- Independent telecommunications grounding system
- Dedicated power circuits supported by building generator and UPS
- Dedicated HVAC systems – 24/7/365
- A minimum of one TR is required per floor if it will be centrally located

STRUCTURED CABLING

Wired building network systems are known as structured cabling systems. Structured cabling systems originate in the Telecom Rooms and extend throughout the building from MTR to TR (backbone) and from TR to the end users (horizontal). The backbone cabling system between Telecom Rooms consists of fiber and copper cables and connects each TR via home-run cables to a Main TR within the building. The horizontal cabling system consists of twisted pair cables such as CAT 6 or CAT 6A and is visible to the end user in the form of wall faceplates. All horizontal cabling routes to the Telecom Rooms should be through cable baskets located in corridors and other approved support systems as required.

The wired building network system uses a common cable that supports all communications needs for various independent systems such as computer networks, voice system, surveillance, video, and building automation system. These diverse systems run on the same cable infrastructure, which offers ultimate flexibility; the same cabling supports all network requirements indifferent of the system.

Horizontal Pathways

All horizontal cabling routes to the Telecom Rooms should be through cable baskets located in corridors and other approved support systems and are not permitted to lay on the finished ceiling.

EMT Conduit for outlets will be sized at a minimum of 1” (although the University standard currently reads ¾”) and will extend to the closest cable tray or will stub into the accessible ceiling above each work area communications outlet. In instances where cable is in conduit, total distance of the conduit run cannot be greater than 100’ between two pull points. A pull box will be required immediately before or after any conduit run section containing two 90 degree turns. Pull boxes will be positioned so that the conduit ends align with each other, and shall be so located where they will be readily accessible and indicated on the as-builts. All installed conduit will include a pull cord capable of 200 pounds of pulling tension and will be clearly labeled at both ends.

All conduit runs shall be labeled at both ends. In the communications room the conduit shall be labeled with the destination work area room number and conduit number. At the work area outlet the conduit shall be labeled in the outlet box indicating the communications room number where the conduit ends.

Cabling within ceiling spaces will be within cable tray. If cable tray cannot be utilized, it will be properly supported with proper cable support attachments (J-Hooks) spaced no farther than three feet apart.

Proper firestopping will be provided to comply with applicable codes.

Backbone / Riser Cable

Within Merrifield and Twamley Halls, it is planned that the Main Telecom Room (MTR) in each building will be connected to all other TRs via fiber and copper cables in a star topology. All fiber cabling will be terminated in rack mounted housings in order to provide complete flexibility for cross-connecting of various networks and equipment and to provide redundancy. All copper cabling will terminate at the rack on patch panels. This methodology permits cross-

connection for devices requiring analog phone lines (like fax machines) by using simple patch cords instead of specialized tools. Copper tie-lines from rack patch panels to wall-mounted 110 blocks may also be incorporated into the backbone.

The backbone will include the following UND approved cabling as required to support the telecommunication requirements of the facility.

- 50/125 micron OM3 & OM4 laser optimized multimode fiber optic cable
- 8.3/125 micron single-mode fiber optic cable
- Category 3 multi-pair copper cable
- 75-ohm coaxial cable for video shall be RG-6 or RG-11, depending on distance and loss requirements and shall have a minimum of 95% braid
- #6 AWG Copper Wire for bonding the communications and power grounds

The final backbone cables required from the Main TR to the respective floor TR's will be reviewed and finalized during the design phases of the project.

Horizontal Cable

All horizontal cabling will be Category 6A for all standard telecommunications outlets including wireless access points. All areas of the building will follow similar design standards regarding the number of cables per workspace as established by UND standards along with industry codes, standards, and best practices. A typical standard outlet location consists of 3 data ports. This aspect of the horizontal cabling design will be reviewed and confirmed as the design progresses.

The horizontal cabling infrastructure will include the following UND approved cabling as required to support the telecommunication requirements of the facility.

- SYSTIMAX 1071/2071 Category 6 unshielded twisted pair (UTP) cable
- SYSTIMAX 1091/2091 Category 6A
- 75-ohm coaxial cable for video shall be RG-6 or RG-11, depending on distance and loss requirements and shall have a minimum of 95% braid

Horizontal cabling is planned to:

- Utilize CAT 6A cabling including all cabling, patch panels, patch cables, termination modules, and wiring blocks.
- Utilize CAT6A cabling for all wireless access points, 2-ports each location.
- Terminate on rack-mounted patch panels regardless of the application using the cable – email, phone, fax, video, etc.
- Utilize the same cable regardless of the device using the cable – computer, telephone, surveillance camera, etc.

Outlet Configurations

The outlet faceplate utilized in most locations is a three position plate. All faceplates will be labeled with the room number and alpha indicator, if used, the outlet number and jack position.

Preliminary definitions for the recommended work area outlet configurations are as follows and will be finalized as the design progresses:

- The "Data-Only" or "Voice-Only" Outlet consists of one (1) Category 6 cable. This outlet type will be used less frequently than a "Triple" Outlet and will support such specialty applications as stand-alone wall-mounted telephones and surveillance cameras. These outlet types are typically characterized by specialty mounting heights and locations. Examples of required "Voice-Only" outlets will include:
    - Emergency Blue-light or Code Blue phones provided inside or outside of the facility
    - Wall telephones
- The "Dual" Outlet consists of two (2) Category 6 cables on a single-gang faceplate. These will be utilized primarily for projector and digital signage locations.
- Wireless Access Points (WAP) cabling will be CAT 6A and will include two cables to each location.
- Additional outlet configurations as required per design requirements.

Connecting Hardware / Patch Cable Assemblies

Effective patch "flow" is an integral part of the Structured Cabling System design to be planned according to the specific rack and wire management layouts.

- Patch panels are used to terminate UTP cabling in communications rooms. SYSTIMAX CAT6A patch panels will be installed
- UTP cable termination at the work area outlet will be SYSTIMAX MGS600.
- 50/125 Micron Fiber Optic Cable will terminate with LC type connectors
- 8.3/125 Single-mode Fiber Optic Cable will be terminated with SC type connectors.
- Patch cable assemblies will be provided and warranted as a part of the Structured Cabling System based upon a quantity twice that of the installed and available horizontal cabling channels plus an additional 5% to provide for varying needs at both cable ends.
- Patch cables will be color-coded according to UND standards.

The University will need to provide direction on whether the patch cables will be provided as part of the base building build-out and whom will be performing the patch cable installation.

WIRELESS NETWORK

Wireless technologies have been embedded into modern society. Some wireless technologies are used every day such as radios, cellular phones, smart phones, tablet PCs and laptop computers.

Today's campus buildings must accommodate a wide range of user needs and expectations in order to foster free flowing access to various formats of information. Many campuses struggle with a desire to support the ever-evolving BYOD (Bring Your Own Device) environment that is now expected by students, faculty, and staff.

A building-wide wireless network will be designed into Merrifield and Twamley Halls to augment the traditional wired network. UND currently plans for 25 devices per wireless access point. Access points will be located below finished ceilings or within recess mounted assemblies and will be activated as needed to provide full building-wide coverage. The wireless infrastructure design will include CAT 6A cabling and will be based on the latest IEEE-802.11 standard (802.11ac). The wireless network will be capable of adapting to and supporting recent standards such as 802.11ax Wi-Fi 6 and future standards such as 802.11be Extremely High Throughput (EHT).

Power over Ethernet (PoE) technology is deployed to simplify installation and increase system flexibility by centrally locating all power requirements for wireless access points. This design methodology greatly increases the availability of network bandwidth by adding the capability of connecting to the network via multiple frequencies and channels. The ultimate goal of the wireless system design is to allow for wireless coverage for the entire facility and may include adjacent exterior areas, utilizing high density and dynamic load balancing wireless network standards. It is anticipated that high density spaces such as the active learning classrooms and lecture hall will have multiple, dedicated access points.

Wireless network design and equipment procurement will be provided by the University. The Sextant Group will indicate two data ports at wireless network locations on plans.

NETWORK ELECTRONICS

The data network systems provide transport and communications for a multitude of applications. Ideally, there should be a single, common data network system for all applications as opposed to individual data network systems that are single application based. A common data network allows for cost savings of equipment and supporting infrastructure (space, power, cooling, etc.) while also providing better utilization of network equipment. By using network protocols

such as virtual local area networks (VLANs), applications such as voice can share a common network switch with applications such as email or video surveillance yet still ensure proper quality of service (QoS).

The structured cabling systems described in the previous section make up the passive components of the data network systems. The active data network electronics will include the following:

- 1RU stackable switches
- All switches to support Power over Ethernet (PoE) for all ports
- Switches will be provided for active ports only
- Provide 20% growth above current active port requirements
- All switches will be based on 1RU models per the University's standards
- Common network switches across all departments and applications utilizing VLANs for QoS and security

Network electronics design and equipment procurement will be provided by the University.

At this early stage of design, an allowance has been provided for network switching electronics. This may vary depending upon the standards and requirements of the University.

TELEPHONE SYSTEM AND HANDSETS

While email, texting, and messaging applications have become ingrained in our society, speech is still the primary means of communication for most people. Speech is more personal and offers details not offered via other means (voice inflections, pauses, volume). Voice telephone systems are still required at the University.

In Merrifield and Twamley Halls, it is expected that the telephone system will deploy the latest Voice over Internet Protocol (VoIP) technology. VoIP systems utilize the same cabling and switching equipment as the data network. VoIP offers the following advantages:

- Reduced Operational Costs
- Common cabling – data and voice networks use the same type of cable
- Flexibility – every network cable can be voice, data, or both
- Portability – phone number moves with the phone, not the location
- Handset not always required – phones can be software on a computer
- Unified Communications – users can access email from the phone and voicemail from the computer

Telephone handsets and other telephony equipment procurement will be provided by the University.

DISTRIBUTED ANTENNA SYSTEM (DAS)

The technical definition of a Distributed Antenna System, or DAS, is a network of spatially separated antenna nodes connected to a common source via a transport medium that provides wireless service within a geographic area or structure. In more general terms, a DAS is a system used to distribute various RF signals throughout an area or building.

Though often overlooked, adequate cellular phone service is now vital for many buildings. Delivery of course content and other information to cell phones is a logical extension to podcasting and webcasting and is sure to be utilized by students. DAS systems are most commonly deployed to support cellular services within a building that may otherwise not have sufficient coverage. These Cellular DAS systems do not require a user to connect their cellular device to the system similar to a tower that is part of a cellular network.

In addition to cellular networks, a DAS can support diverse radio systems such as 400 MHz, 700 MHz, 800 MHz, UHF, and VHF radios, etc. all at the same time.

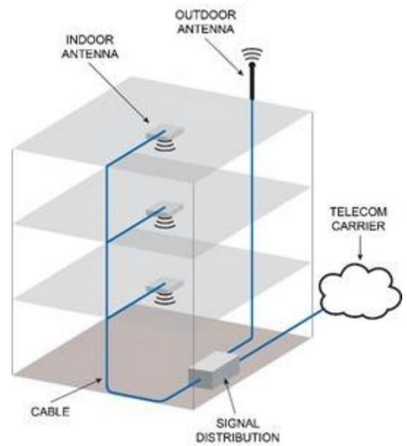
It should be noted that NFPA 72: National Fire Alarm and Signaling Code requires the use of a Public Safety DAS where first responder radio coverage is not sufficient to enable first responders within the building to communicate during an emergency. Critical areas as defined by the NFPA and the Authority Having Jurisdiction require 99% floor area coverage. General areas of the building must be provided with 90% floor area coverage. Depending on building construction and final site conditions, these levels may not be achievable without the installation of a Public Safety DAS.

DAS System Primary Components

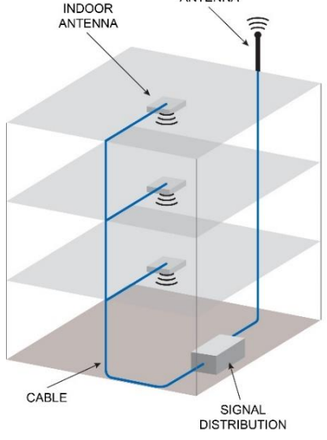
- Tuned antennas on the roof of the building
- Cabling from the uplink antennae to the DAS system Head-End
- Head-End equipment – usually housed in the Main TR
- Cabling from the Head-End equipment to antennas distributed throughout the building

The Public Safety DAS and/or a Cellular DAS may currently be included within this project but is not part of The Sextant Group's scope of work.

Cellular Distributed Antenna System



Public Safety Distributed Antenna System



It is recommended that further investigation of the cellular and public safety coverage within the building be explored. This should include an active RF site survey to determine the strength of the cellular network for all carriers within the facility as well as the various first responder frequencies required by the local authority having jurisdiction. The outcome of these surveys will assist in determining the requirements for a Cellular DAS and Public Safety DAS within the building.

DESIGN TEAM CONSIDERATIONS

The following is a brief discussion of several facility-related factors that impact the effectiveness of the technology systems within the building. Coordination with the appropriate designers for each area will occur as the project progresses.

NATURAL AND ARTIFICIAL LIGHTING

Numerous studies have shown that day-lighting increases productivity and are preferred by students, employees, faculty and virtually all users of the facility. Unfortunately, uncontrolled natural light can degrade or possibly ruin the contrast ratio of projected images and cause misleading or unflattering colorimetry effects for video cameras. While this creates some challenges for the audiovisual system and lighting designers, the benefits of day-lighting far outweigh the disadvantages.

Window treatments will be required for any spaces that use a screen to display video projector images, particularly those that allow natural light into the room. Although true “blackout” shades are often not required, the degree of opacity must be balanced with the performance of the projection systems and lighting systems. Control window treatments may be coupled with the audiovisual system.

The lighting system should also be coordinated with the audiovisual systems. Careful attention must be paid to the balance of natural and artificial light, color temperature, interaction with various displays, heat generation, and noise generated by dimmers and ballasts, operational costs and so on.

It is recommended that specialized lighting fixtures be utilized in any spaces that will be used for video recording or videoconferencing to prevent the participants from appearing two-dimensional and flat. With the use of video cameras, this specialized lighting will provide the lumen levels and color temperature necessary to produce clear images of the instructor.

A document has been released under separate cover to the project’s lighting designer, discussing lighting requirements and recommendations related to the audiovisual systems.

TECHNICAL POWER

Due to the sensitive nature of electronic equipment that is being used, a clean source of power is required. Clean power requires that there are no equipment loads, such as those with transformers that generate electrical noise on the power lines shared with sensitive technologies. This would include, for example, air conditioning equipment, large motors that stop and start regularly, uninterruptible power supplies, air compressors, welding or other heavy industrial equipment, or dimmed lighting loads; all of which create transients, harmonics, surges, and spikes.

To ensure power quality, dedicated “technical power" distribution panels should be provided. Where concentrations of sensitive electronic equipment occur, a dedicated technical power circuit may also be specified. All technical power circuits for equipment within a room should be in the same phase to ensure proper equipment timing within the system. For additional power quality, transient voltage surge suppression devices must be installed on the panels serving technical power circuits.

While the Electrical Engineer for the project is responsible for the design of the electrical systems, this work should be done in coordination with the technology designer.

A document has been released under separate cover to the project’s Electrical Engineer with recommendations for technical power for the technology systems.

INTERFACE WITH EMERGENCY COMMUNICATIONS

Audiovisual components such as digital signage displays, paging loudspeakers, and even projectors can be interfaced with the building’s emergency communications systems. If desired, this should only be considered to be a supplement to required emergency communications systems designed by others and cannot be relied upon for life safety.

APPENDIX A: OPINION OF PROBABLE COST

The following Opinion of Probable Cost (OPC) represents a preliminary cost analysis for the systems required to satisfy the functional requirements of the project program. This information is for use as a decision-making tool for planning and budgeting purposes and has been prepared to support the set of functional requirements described earlier at a practical level. Audiovisual system design and specification will be required at a future date.

Structured Cabling System OPC includes:

- Cable
- Network Outlets
- Telecommunications Room Fit Out including:
    - Patch panels
    - Equipment racks
    - Cable managers

Audiovisual Systems OPC includes:

- Projection Screens
- Audiovisual equipment, cabling, and installation hardware
- Audiovisual control system programming and installation labor
- Specialty mounting hardware for audiovisual equipment
- Dedicated instructor PC’s in classrooms and dedicated PC’s in conference style spaces
- Custom lecterns, millwork, and/or technical furniture associated with audiovisual systems

The following items are not included:

- Cable pathways (junction boxes, floor boxes, conduit, cable tray/ladder, etc.)
- Outside Plant (OSP) pathways and cabling
- Distributed antenna systems
- Intelligent building monitoring systems
- Data electronics such as network switching and routing
- Standard whiteboards/marker boards or furniture
- General use desktop and laptop computers such as those within office or computer labs
- Copiers, fax machines, office equipment
- Telephone system or handsets
- Physical Security Systems

General administration costs and a contingency are included but sales tax is not with the assumption that the campus is tax-exempt.

For the purpose of this document, all estimated equipment costs are based on the latest MSRP (Manufacturer’s Suggested Retail Price) with considerations made for increases in cost over the duration of the project. It should be noted that the University will most likely be able to purchase the equipment at a discounted rate under a competitive bidding process. To account for this, a conservative discount has been applied to the cost opinion. This estimate is based on historical data, our experience with similar projects, and our professional opinion. These reductions will depend on a variety of factors, including project delivery method, market conditions at the time of bid, the need to acquire subsets of the program over time due to available funding, and others.

The following Opinion of Probable Cost is based on the full implementation of the systems as described above. If a full system installation is not feasible based on the available budget, it is recommended that the infrastructure support the full system be included during construction.

This Technology Program prepared for: **The University of North Dakota / JLG Architects**

Prepared by:

Matthew LeFeber, CTS
Aaron P. Barber, CTS

The Sextant Group, Inc.
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University of North Dakota
Merrifield-Twamley

Planning & Programming
Technology Systems Opinion of Probable Cost

Space Description	Qty	Unit	Extended with Presentation Only	Extended with Modules Included
Room Specific Audiovisual Systems: FF&E				
10-Seat Conference	6	$ 23,800	$ 142,800	$ -
Webconference Module	6	$ 6,800		$ 40,800
Sub total:				**$ 183,600**
6-Seat Conference	11	$ 9,400	$ 103,400	$ -
Webconference Module	11	$ 3,200		$ 35,200
Sub total:				**$ 138,600**
12-Seat Seminar	2	$ 28,300	$ 56,600	$ -
Capture/Stream and Webconference Module	2	$ 20,500		$ 41,000
Sub total:				**$ 97,600**
16 Seat Seminar	4	$ 28,300	$ 113,200	$ -
Capture/Stream and Webconference Module	4	$ 20,500		$ 82,000
Sub total:				**$ 195,200**
90-Seat Lecture	1	$ 106,900	$ 106,900	$ -
Capture/Stream and Webconference Module	1	$ 31,900		$ 31,900
Sub total:				**$ 138,800**
24-Seat Active Learning Classroom	4	$ 38,400	$ 153,600	$ -
Collaboration Module	16	$ 13,700		$ 219,200
Capture/Stream and Webconference Module	4	$ 17,300		$ 69,200
Sub total:				**$ 442,000**
30-Seat Active Learning Classroom	5	$ 39,400	$ 197,000	$ -
Collaboration Module	25	$ 13,300		$ 332,500
Capture/Stream and Webconference Module	5	$ 17,300		$ 86,500
Sub total:				**$ 616,000**
36-Seat Active Learning Classroom	4	$ 39,300	$ 157,200	$ -
Collaboration Module	24	$ 13,200		$ 316,800
Capture/Stream and Webconference Module	4	$ 17,300		$ 69,200
Sub total:				**$ 543,200**
42-Seat Active Learning Classroom	2	$ 45,900	$ 91,800	$ -
Collaboration Module	14	$ 13,200		$ 184,800
Capture/Stream and Webconference Module	2	$ 17,300		$ 34,600
Sub total:				**$ 311,200**
54-Seat Active Learning Classroom	1	$ 74,700	$ 74,700	$ -
Collaboration Module	9	$ 13,200		$ 118,800
Capture/Stream and Webconference Module	1	$ 17,300		$ 17,300
Sub total:				**$ 210,800**
60-Seat Active Learning Classroom	1	$ 74,700	$ 74,700	$ -
Collaboration Module	10	$ 13,200		$ 132,000
Capture/Stream and Webconference Module	1	$ 17,300		$ 17,300
Sub total:				**$ 224,000**

University of North Dakota
Merrifield-Twamley

Planning & Programming
Technology Systems Opinion of Probable Cost

Space Description	Qty	Unit	Extended with Presentation Only	Extended with Modules Included
78-Seat Active Learning Classroom	2	$ 116,600	$ 233,200	$ -
Collaboration Module	26	$ 12,100		$ 314,600
Capture/Stream and Webconference Module	2	$ 17,300		$ 34,600
Sub total:				**$ 582,400**
20-Seat Lecture Classroom	2	$ 34,400	$ 68,800	$ -
Capture/Stream and Webconference Module	2	$ 24,800		$ 49,600
Sub total:				**$ 118,400**
24-Seat Lecture Classroom	2	$ 34,400	$ 68,800	$ -
Capture/Stream and Webconference Module	2	$ 24,800		$ 49,600
Sub total:				**$ 118,400**
34-Seat Lecture Classroom	1	$ 38,800	$ 38,800	$ -
Capture/Stream and Webconference Module	1	$ 24,800		$ 24,800
Sub total:				**$ 63,600**
36-Seat Lecture Classroom	1	$ 38,800	$ 38,800	$ -
Capture/Stream and Webconference Module	1	$ 24,800		$ 24,800
Sub total:				**$ 63,600**
Building-Wide and Special Systems: FF&E				
Paging System	0	$ -	$ -	$ -
Lecture Capture Software / License	0	$ -	$ -	$ -
Rich Media Streaming Storage / Playout / Manage	0	$ -	$ -	$ -
Public Information / Digital Signage (FF&E)	11	$ 2,500	$ 27,500	$ 27,500
Room Scheduling & Display System	49	$ 1,300	$ 63,700	$ 63,700
Television Distribution System	0	$ -	$ -	$ -
Audiovisual Metacontrol Systems	0	$ -	$ -	$ -
Portable Equipment Pool	1	$ 15,000	$ 15,000	$ 15,000
Control System and Audio DSP Software Develop	1	$ 87,400	$ 87,400	$ 87,400
Research and Staff Development: FF&E				
Beta / Pilot Study Space	0	$ -	$ -	$ -
Faculty Development	0	$ -	$ -	$ -
Technology Staff Development	0	$ -	$ -	$ -
SUBTOTALS:			$ 1,913,900	$ 4,122,600
Freight & General Administration at 4%			**$ 76,600**	**$ 164,900**
Anticipated Discount at 18%			**$ (358,300)**	**$ (771,800)**
State & Local Taxes at 0%			**$ -**	**$ -**
Contingency at 10%			**$ 163,200**	**$ 351,600**
Total Audiovisual Systems OPC:			**$ 1,795,400**	**$ 3,867,300**

University of North Dakota
Merrifield-Twamley

Planning & Programming
Technology Systems Opinion of Probable Cost

Space Description	Qty	Unit	Extended with Presentation Only	Extended with Modules Included

Notes:

1. All estimates above represent complete systems, including equipment, installation materials, installation labor and general user training.
2. Cost opinions shown above have been determined using Manufacturer's Suggested Retail Price or other published prices for equipment. The Owner should expect to receive a discount for both equipment and labor during competitive bidding. The amount of this discount will be dependent on factors such as market conditions at the time of bidding, final product selections, schedule of the installation and provision of a third-party consultant bid. An estimated discount for the complete package has been applied.
3. Typical infrastructure items such as back boxes, conduit, cable pathways, AC power, etc. which are provided by the General Contractor or Electrical Contractor are not included.
4. Related items not included are: Structured cabling, Outside Plant, voice/data electronics, access control, surveillance systems, specialty lighting fixtures and dimmer controls, traditional white boards, standard computers and Intelligent Building Systems.

4.9 ACOUSTICS

University of North Dakota
Merrifield-Twamley

Planning & Programming
Technology Systems Opinion of Probable Cost

MERRIFIELD

Space Description	Qty	Structured Cabling			
		Unit Range		Extended Range	
		Low	High	Low	High
Telecommunications Network: Base-Building					
Structured Cabling System	1	$ 536,500	$ 605,700	$ 536,500	$ 605,700
Network Switches	1	$ 328,300	$ 362,900	$ 328,300	$ 362,900
Peripheral Equipment (PCs/Printers)	0	$ -	$ -	$ -	$ -
Telephone System / Handsets	0	$ -	$ -	$ -	$ -
Wireless Access Points / Mgmt. Software	0	$ -	$ -	$ -	$ -
Public Safety Distributed Antenna System (DAS)	0	$ -	$ -	$ -	$ -
Cellular Distributed Antenna System (DAS)	0	$ -	$ -	$ -	$ -
Outside Plant	0	$ -	$ -	$ -	$ -
SUBTOTALS:				$ 864,800	$ 968,600
Freight & General Administration at 4%				**$ 34,600**	**$ 38,700**
Anticipated Discount at 18%				**$ (161,900)**	**$ (181,300)**
State & Local Taxes at 0%				**$ -**	**$ -**
Contingency at 10%				**$ 73,800**	**$ 82,600**
Total Structured Cabling OPC Merrifield Hall:				**$ 811,300**	**$ 908,600**

Notes:

1. All estimates above represent complete systems, including equipment, installation materials, installation labor and general user training.
2. Cost opinions shown above have been determined using Manufacturer's Suggested Retail Price or other published prices for equipment. The Owner should expect to receive a discount for both equipment and labor during competitive bidding. The amount of this discount will be dependent on factors such as market conditions at the time of bidding, final product selections, schedule of the installation and provision of a third-party consultant bid. An estimated discount for the complete package has been applied.
3. Typical infrastructure items such as back boxes, conduit, cable pathways, AC power, etc. which are provided by the General Contractor or Electrical Contractor are not included.
4. Related items not included are: Outside Plant, voice/data electronics, access control, surveillance systems, specialty lighting fixtures and dimmer controls, traditional white boards, standard computers and Intelligent Building Systems.
5. The Opinion of Probable Cost includes network switches as a courtesy at this early stage of the project to assist the University with budgeting. This cost is calculated based on the quantity of netwrok outlets planned through the strucutred cabling system. It is expected that all network switches and other active network electronics will be provided by the University as part of this project. This cost will not be included in future iterations of this document.

UNIVERSITY OF NORTH DAKOTA

MERRIFIELD - TWAMLEY

ACOUSTICAL DESIGN NARRATIVE

Prepared By:

THE SEXTANT GROUP
AN NV5 COMPANY

April 10, 2020

ACOUSTIC DESIGN NARRATIVE

The renovation of Merrifield & Twamley Halls will house a variety of spaces including a Lecture Hall, Active Classrooms, Seminar Rooms, Conference Rooms, several offices, and open areas such as the Lobby, collaboration spaces, and open offices. These spaces will require an appropriate combination of specialty acoustical interior finishes, sound isolation separation from adjacent spaces, and suitable background noise levels based on the programmed functions of each space. The concepts presented in this narrative should be viewed as a starting point to the development of acoustical solutions that satisfy the project's functional, aesthetic, and budgetary goals. The information presented in this document should also be included in pricing exercises so that important budget estimates incorporate acoustically-related materials and assemblies. The acoustical design will be developed in more detail as the design progresses.

1.1 ACOUSTIC DESIGN STANDARDS

As applicable, the acoustical design will be developed in accordance with the following standards:

- Chapter 49 'Noise and Vibration Control' from the 2019 ASHRAE Applications Handbook
- ANSI-ASA s12.60-2010 "Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools"

1.2 INTERIOR FINISHES (DIVISION 09)

Applying appropriate finishes will create acoustical environments that best serve the intended programming of each space. Special acoustic materials are needed to control unwanted sound reflections and enhance speech intelligibility in the Lecture Hall. Interior finish schemes for these types of spaces typically consist on acoustical ceiling tile, ceiling reflector panels, sound-absorptive wall panels (e.g. fabric, wood, metal), specialty sound-diffusive wood products, and carpet. Nonetheless, alternate finish options can be presented based on the desired and aesthetic goal.

In other occupied building areas such as Classrooms, Private Offices, Open Offices, Seminar Rooms, Conference Rooms, and the Lobby, sound-absorptive finished ceilings (e.g. acoustical ceiling tile, fabric-wrapped clouds, wood or metal systems, etc.), carpet, and sound-absorptive wall panels will be sufficient to control unwanted reflections, reduce reverberant noise build-up, and generate speech intelligibility.

Specialty acoustical products are marked in ***Bold Italics*** and are defined at the end of this section.

Active Classroom	
Ceiling:	***Omni-Directional Ceiling Diffusers*** evenly dispersed throughout 25% of ceiling area. ***NRC 0.90 Acoustical Ceiling Tile*** in remaining areas.
Walls:	2"-thick ***Fabric-Wrapped Absorptive Panels*** covering 50% of a 3'-tall band across the room's upper walls.
Floors:	Carpet

Atrium / Lobby	
Ceiling:	To be determined. Ideally treatment will cover at least 80% of the ceiling with a 0.85 NRC or greater acoustical material. Options include: • ***Vinyl-Wrapped Absorptive Clouds*** • ***Acoustical Ceiling Tile*** • ***Absorptive Wood Panels*** • ***Spaced Wood Slats*** • ***Absorptive Metal Deck***
Walls:	To be determined. Ideally treatment will cover at least 30% of the available wall surfaces with a 0.85 NRC or greater acoustical material. Options include: • ***Wood Absorptive Panels*** • ***Spaced Wood Slats*** • ***Metal Absorptive Panels*** • ***Vinyl-Wrapped Absorptive Panels***
Floors:	-

Classroom	
Ceiling:	***NRC 0.90 Acoustical Ceiling Tile*** in remaining areas.
Walls:	Rear and Back Side Walls: 2"-thick ***Fabric-Wrapped Absorptive Panels*** covering 75% of the area between 4' AFF and 7' AFF.
Floors:	Carpet

Conference / Seminar Rooms	
Ceiling:	Painted Gypsum Wallboard or ***Omni-Directional Ceiling Diffusers*** over the conference table. ***NRC 0.90 Acoustical Ceiling Tile*** in remaining areas.
Walls:	2"-thick ***Fabric-Wrapped Absorptive Panels*** covering 50% of the area between 4'AFF and 7'AFF on two perpendicular walls.
Floors:	Carpet

Lecture Hall	
Ceiling:	Painted Gypsum Wallboard, ***Omni-Directional Ceiling Diffusers***, or Convex Hardwood Panels at the front and central portions of the room ***NRC 0.90 Acoustical Ceiling Tile*** in remaining areas.
Walls:	*Side Walls*: ***Diffusive Wood Plank System*** install between chair rail height and 7' AFF. 2"-thick ***Fabric-Wrapped Absorptive Panels*** install between 7' AFF and the finished ceiling. *Rear Walls*: 2"-thick ***Fabric-Wrapped Absorptive Panels*** install between 4' AFF and the finished ceiling.
Floors:	Carpet

Private Office	
Ceiling:	***0.7 NRC & CAC 35 Acoustic Ceiling Tile***
Walls:	-
Floor:	Carpet

Shared/Open Office	
Ceiling:	***0.9 Acoustic Ceiling Tile***
Walls:	-
Floor:	Carpet
Workstation Furniture	To achieve Minimal Speech Privacy, workstation dividers must fully enclose workers and have the following features: • At least 60" tall • STC rating of at least 25, with no gaps around the perimeter • NRC rating of at least 0.75 • Stagger workstation entries to avoid direct line of sight between occupants of adjacent workstations and offices • Maintain at least 10' between adjacent workers

1.2.1 NRC 0.7 & CAC 35 Acoustic Ceiling Tile

Standard acoustical ceiling tile with a minimum 0.70 NRC and a CAC 35 ratings

Acceptable products include Armstrong – *Ultima* or equivalent

1.2.2 NRC 0.9 Acoustical Ceiling Tile

Standard acoustical ceiling tile with a minimum 0.9 NRC rating

Acceptable products include Armstrong – *Optima* or equivalent

1.2.3 Fabric-Wrapped Absorptive Panels

Product shall consist of a 6-7 pcf (density) rigid fiberglass board, with a minimum NRC rating of 1.0. The board shall be 1", 2", or 4"-thick and wrapped with an acoustically transparent fabric. Install the board with manufacturer approved z-clips and construction adhesive.

Acceptable products include Kinetics Noise Control – *Hardside Panels,* or SoundSeal – *S2000 Panels*, SkyAcoustic – *Nexus Acoustical Panels*

1.2.4 Omnidirectional Diffusive Ceiling Panels

Product shall consist of 2' x 2' fiberglass reinforced gypsum ceiling diffusion units. The units shall be based on a two dimensional quadratic residue diffuser sequence. The product shall be shaped for installation into a standard ceiling tile grid. Standard diffuser units protrude 4" below the t-grid. If desired, this product can be ordered in a flush-mount configuration and covered with acoustically transparent fabric.

Representative products include: RPG, Inc. – *FRG Omniffusor*

1.2.5 Absorptive Plaster

System is comprised of manufactured semi-rigid fiberglass or mineral wool panels faced with several layers of an acoustically transparent plaster-like finish. Final finish layers are applied to the product in the field. Install the system according to the manufacturer's instructions. After installation, certain finishes may be painted a limited number of times with a special non-bridging paint. Subsequent damage may be repaired with additional acoustical plaster. The finished system shall maintain a 0.70 NRC rating.

Acceptable products include Baswa – *BASWA Phon*; Pyrok – *StarSilent* or *Acoustement 20*, or Fellert USA – *Even Better Silk with fiberglass backing*

1.2.6 Vinyl Wrapped Absorptive Clouds & Panels

Product shall consist of a 6.0 to 7.0 pcf (density) rigid fiberglass board, with a minimum NRC rating of 1.0. The board shall be 2"-thick and wrapped with an acoustically transparent web-core vinyl facing. Clouds shall be suspended horizontally below the exposed ceiling using braided steel cable. Panels will be directly applied to walls.

Acceptable products include Kinetics Noise Control – *Hardside Acoustical Clouds and Panels,* or SoundSeal – *C2000 Ceiling Cloud*

1.3 SOUND ISOLATION (DIVISION 08 & 13)

Sound Isolation is a critical design element in the renovation of Merrifield & Twamley Halls. Classrooms and conference rooms will require a high level of sound isolation to limit disruptions from activities in adjacent areas of the building and vice-versa. Private offices will have similar requirements, though the required acoustical treatments are more modest. Anticipate the following sound isolation provisions:

1.3.1 Building Layout

Building massing should try to ensure that noise sensitive spaces are located away from, or with appropriate consideration to noise generating spaces. Some examples of different spaces and their category are listed below:

Noise Sensitive Spaces	Noise Generating Spaces	Buffer/Neutral Spaces
Classrooms	Bathrooms	Main Lobby
Offices	Elevators	Corridors / Lounges
Conference Rooms	Mechanical Rooms	Storage
	Mechanical Shafts	IT Closets

1.3.2 Floor/Ceiling Constructions

Typical commercial floor / ceiling constructions, consisting of an acoustical tile ceiling suspended below a normal weight concrete slab (minimum weight of 150 lbs/ft^2), should be sufficient for the majority of the building. However, enclosed ceilings and carpeted floors should be used above and below occupied spaces, wherever practical, to prevent transmission of footfall noise through the concrete slab. Acoustically enhanced ceiling constructions may be necessary in a few cases for noise sensitive spaces or noise producing noise spaces.

1.3.3 Classrooms and Conference Rooms

Classrooms, and Conference Rooms will require full-height walls with multiple layers of drywall and batt insulation.

Entry doors will be solid-core wood or hollow-metal and outfitted with full-perimeter acoustical gaskets.

Storefront glazing is to be avoided, though side-lights are acceptable. Glazing shall use insulated units with one laminated pane.

1.3.4 Offices

Offices will require full-height walls with batt insulation.

For normal levels of speech privacy between offices and their adjacent corridor, entry doors will be solid-core wood or hollow-metal and outfitted with full-perimeter acoustical gaskets.

Storefront glazing is to be avoided, though side-lights are acceptable in an area less than 10ft^2. Glazing shall use insulated units with one laminated pane.

1.3.5 Mechanical Equipment Rooms

Mechanical equipment rooms may require partial “Box-in-Box” construction, CMU partitions, and acoustical doors, pending their proximity to noise sensitive spaces and other occupied areas of the building.

1.4 MECHANICAL SYSTEM NOISE CONTROL (DIVISION 23)

Unwanted mechanical system noise and vibration needs to be controlled in the building. Noise of this nature can be detrimental to speech communication and can also pose considerable annoyance to occupants. Specific airflow velocities should be adhered to in order to control airflow generated noise. Appropriate vibration isolation treatments are necessary to control the transmission of mechanical equipment vibration into the building.

1.4.1 Background Noise Levels

The building’s mechanical system should be designed to achieve the following background noise levels:

Space Name	Maximum Design RC(N) Rating	Maximum Field RC(N) Rating
Active Classrooms	20	25
Classrooms	25	30
Conference Rooms	30	35
Lecture Hall	25	30
Open Offices	35	40
Private Offices	30	35
Seminars	30	35
Remaining Occupied Areas	35	40
Corridors	40	45

1.4.2 HVAC System

- Airflow Velocities: In order to achieve the background noise levels listed above, size the duct system in order to maintain the following airflow velocities with minimal balancing.

Duct Condition	Noise Level RC(N)	Maximum Air Velocity (fpm)					
		Rectangular Duct			Circular Duct		
		Main Duct	Branch Duct	Final Run-out	Main Duct	Branch Duct	Final Run-out
In shaft or above Gypsum Wallboard or Below Access Flooring	40	*2950*	*2375*	*1475*	*4150*	*3325*	*2075*
	35	*2500*	*2000*	*1250*	*3500*	*2800*	*1750*
	30	*2050*	*1650*	*1025*	*2960*	*2400*	*1475*
	25	*1700*	*1360*	*850*	*2500*	*2000*	*1250*
	20	*1400*	*1125*	*725*	*2075*	*1625*	*1075*
Above Acoustical Ceiling Tile	40	*2100*	*1675*	*1050*	*3650*	*2900*	*1850*
	35	*1750*	*1400*	*875*	*3000*	*2400*	*1500*
	30	*1450*	*1150*	*725*	*2475*	*1975*	*1225*
	25	*1200*	*950*	*600*	*2000*	*1600*	*1000*
	20	*1000*	*800*	*500*	*1550*	*1300*	*825*
Exposed	40	*1725*	*1375*	*850*	*3175*	*2550*	*1600*
	35	*1450*	*1175*	*725*	*2600*	*2075*	*1300*
	30	*1175*	*950*	*600*	*2150*	*1675*	*1050*
	25	*950*	*775*	*475*	*1700*	*1350*	*850*
	20	*775*	*625*	*400*	*1300*	*1100*	*700*

- Air Diffusers, Grilles, and Terminal Units: Air diffusers and return air grilles must be chosen such that noise levels do not exceed the specified background noise limits. Select devices so that they perform at least 10 points below the room's RC requirement.
- Duct Lining: Anticipate 1"-thick internal duct lining in all supply and return ducts serving spaces with background noise requirements of RC-25 or below. As required, use an anti-microbial fiber-free duct liner in lieu of fiberglass.
- Duct Routing: High velocity main ducts may not pass over spaces with background noise requirements of RC-30 or below. Supply and return air shall be brought into occupied rooms via long branches from main air ducts in the corridors. Ducts should not be run directly between noise-sensitive spaces. Avoiding direct penetrations between rooms will maximize the sound isolation capabilities of their common partitions.
- Duct Silencers: Anticipate 5'-7' duct silencers on the intake and discharge of any air handling unit that serves a space with a noise requirement of RC-30 or below. Secondary silencers may be necessary downstream of terminal units serving spaces with background noise requirements of RC-25 or below.
- Resilient Hanger: Anticipate that some duct and pipe sections in the noise sensitive areas of the building will be suspended from neoprene and spring vibration isolation hangers.

1.4.3 Vibration Isolation

Air Handlers, Chillers, Cooling Towers, Fans, Pumps, Transformers, and Elevators typically require vibration isolation to prevent the sound and vibration they produce from traveling to other parts of the building. Typical equipment treatments include bases, vibration isolators, and flexible infrastructure connections. These elements should be selected according to Chapter 49 'Sound and Vibration Control' from the 2019 ASHRAE Applications Handbook. Isolator selection will be reviewed as the project progresses.

This concludes the acoustical programming narrative for the renovation of Merrifield & Twamley Hall Renovation at the University of North Dakota. Please feel free to contact me at jcottrell@thesextantgroup.com or 402.408.4107 if you have any questions.

Sincerely,

THE SEXTANT GROUP, INC.

James Cottrell

Acoustical Consultant

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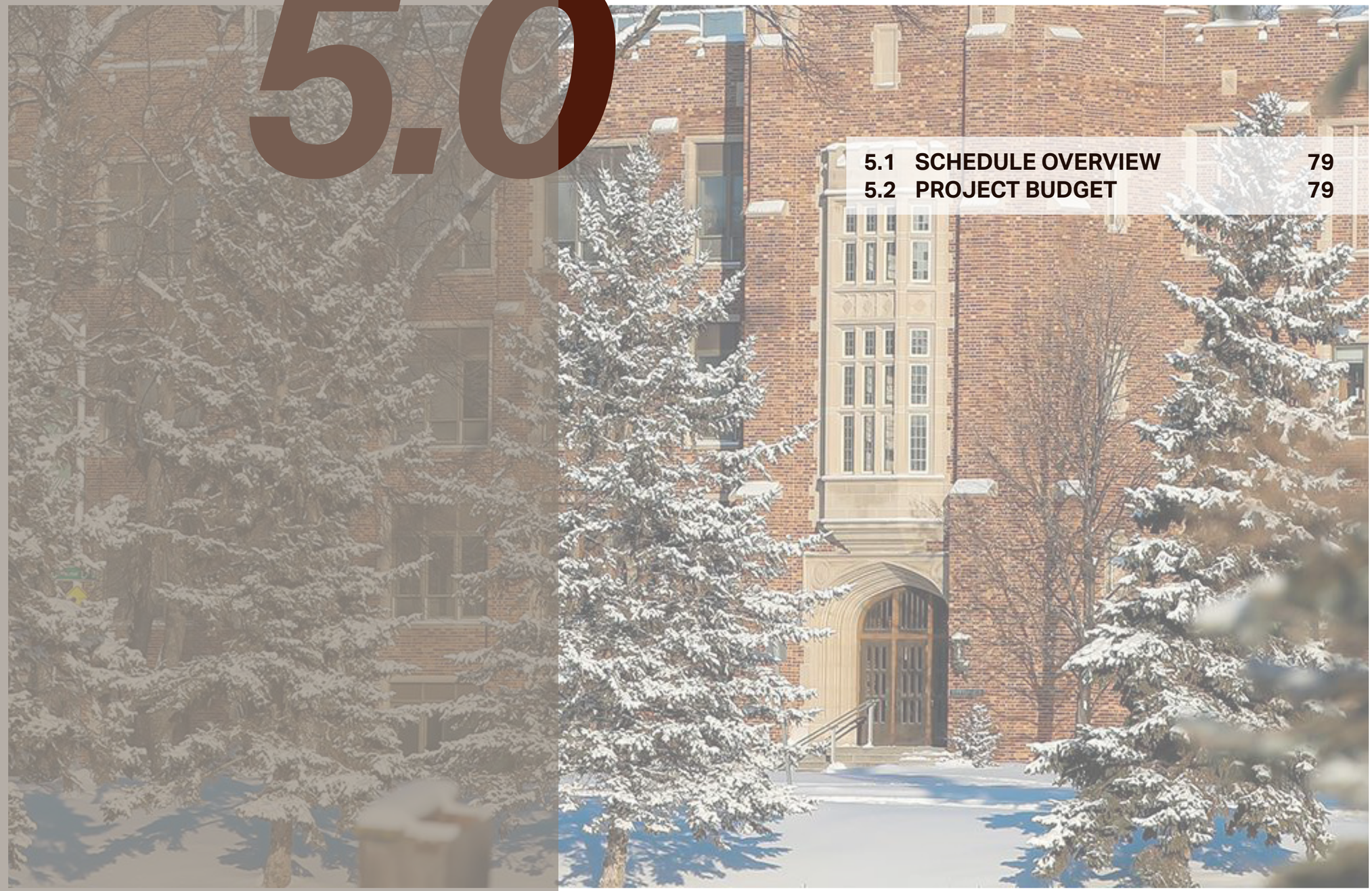

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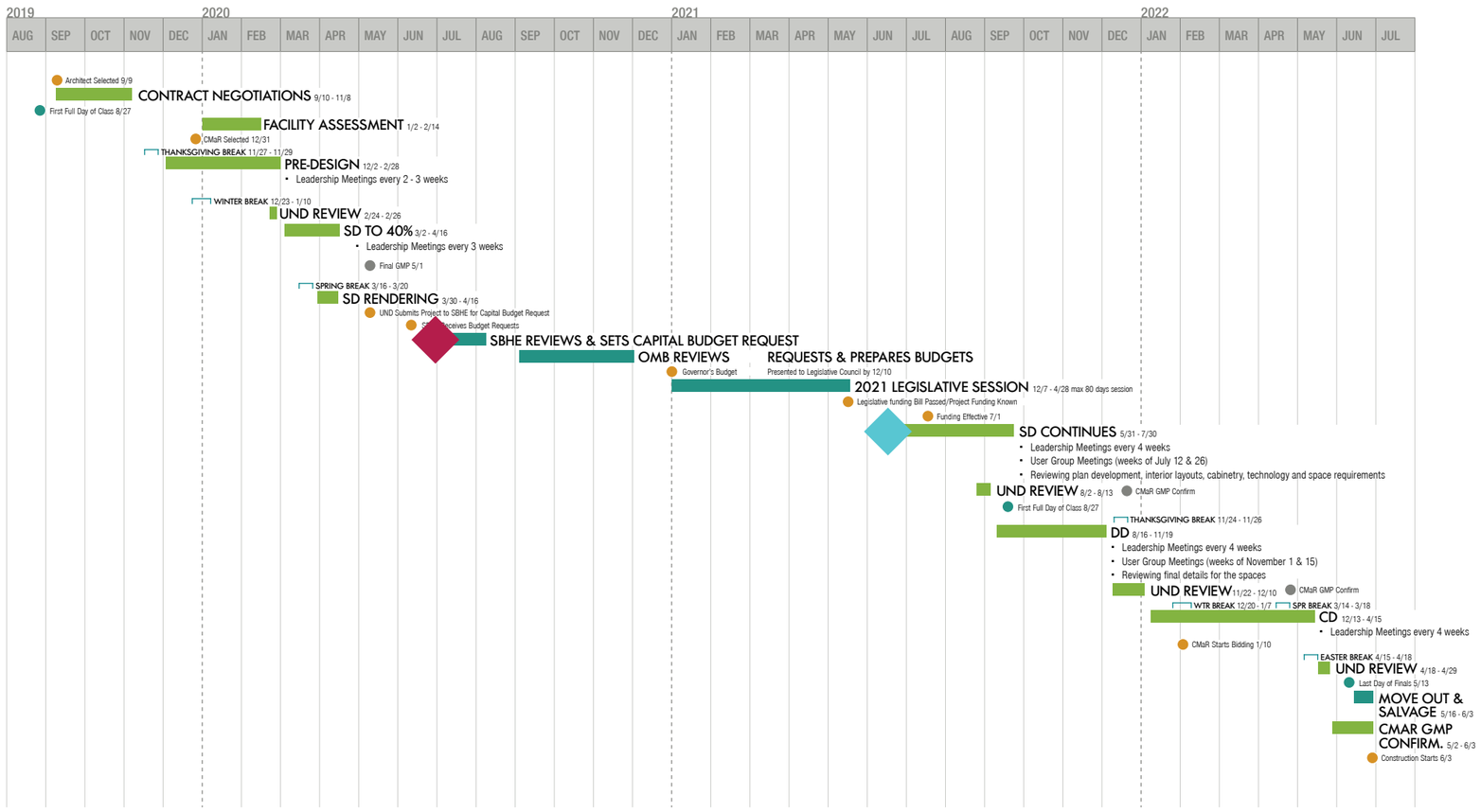
5.0 Schedule & Budget

Project Schedule Merrifield/Twamley



5.1 SCHEDULE OVERVIEW

The scope of work outlined in this document is envisioned as a single phase of work, to be executed at once in order to efficiently use time and budget. Upon approval of the funding, the design team will continue to validate the program and develop the design of the project in order to quickly execute the vision for the renovations of Merrifield and Twamley.

The project schedule at left illustrates this process, which is flexible enough to accommodate changes and deviations as we go through the process, which ensuring a timely delivery. The magenta diamond shows where our team left off in supporting UND's submittal to the SBHE, and the light blue diamond shows where we will pick back up again to complete our design process and development of the GMP.

5.2 PROJECT BUDGET

The cost estimates contained here are broken out into separate scopes related to each building or site area so that scope and cost are clearly delineated. Alternates have been evaluated separately that are desired to be included in this funding request.

5.2.1 PROJECT BUDGET SUMMARY

MERRIFIELD & TWAMLEY FULL RENOVATIONS*	$67,590,133
GAMBLE DEMOLITION & PARKING LOT	$5,367,188
COLUMBIA ANNEX MECHANICAL IMPROVEMENTS	$2,885,532
TOTAL - FULL SCOPE	$75,842,853

**INCLUDING FOUNDATION FEE.*

5.2.2 PROJECT BUDGET DETAIL

UNIVERSITY OF NORTH DAKOTA
FACILITIES MANAGEMENT ESTIMATE

Budget Year: 2019/20

Project Schedule			**Duration**	
Project Started	@	May-19	TBD	
Schematics Approval	@	Jun-21	776	
DD Completed	@	Oct-21	122	
Construction Drawings Completed	@	Feb-22	123	
Construction Started (NTP)	@	May-22	90	**Gross Area**
Construction Completed (NOC)	@	Jul-23	430	
Total Project Duration (Calendar Days)			1541	

Project: Merrifield / Twamley
Arch/Engr: JLG/AECOM
Contractor: PCL/Community Contractors
Delivery Type: CM @ RISK
Phase: Concept

New Construction	**Reno**
121,231	

		BUDGET ESTIMATE	**RND TOTAL**	**$/sq.ft.**
1		**CONSTRUCTION MANAGER AT RISK CONSTRUCTION COSTS**		
	A	**Building Construction Cost Subtotal**	$ 37,627,677	$310.38
	B	**Misc. Construction Cost Subtotal**	$ 770,825	$6.36
	C	**Fees and Contingencies Construction Cost Subtotal**	$ 6,028,468	$49.73
		Total Construction Manager Guaranteed Maximum Price	$ 44,426,969	**$366.47**
2		**CONSTRUCTION PROJECT ALLOWANCES**		
	A.1	**Hazardous Material Abatement (Merrifield)**	$ 110,000	$0.91
	A.2	**Hazardous Material Abatement (Twamley)**	$ 320,000	$2.64
	B	**NDUS Telecomm and Wireless Equipment**	$ 400,000	$3.30
	C	**Landscape/Site work Allowance beyond the landscape cost within 44M above**	$ 250,000	$2.06
	D	**Merrifield / Twamley Skywalk Allowance**	$ 800,000	$6.60
	E	**Institutional Work**	$ 50,000	$0.41
	F	**Moving Costs Merrifield**	$ 600,000	$4.95
	G	**Moving Costs Twamley**	$ 400,000	$3.30
		Total Construction Project Allowances	$ 2,930,000	**$24.17**
3		**DESIGN AND CONSULTING COSTS**		
	A	**Master Planning and Space Programming (not required contained in 3B)**	$ 0	$0.00
	B	**Architectural and Engineering Services**	$ 4,266,000	$35.19
	C	**Geotechnical Services (not needed?)**	$ 0	$0.00
	D	**Design (completed under separate project) and Construction Survey Services (limited scope)**	$ 15,000	$0.12
	E	**Hazardous Material Survey (completed under separate project)**	$ 0	$0.00
	F	**Branding Consultant (limited to Merrifield current displays and others)**	$ 400,000	$3.30
	G	**Building Commissioning Services (both buildings)**	$ 235,000	$1.94
	H	**3rd Party Materials Testing Services (limited due to renovation scope)**	$ 35,000	$0.29
	I	**Design Contingency (Merrifield)**	$ 2,758,954	$22.76
	J	**Design Contingency (Twamley)**	$ 1,673,743	$13.81
		Total Design and Consulting Costs	$ 9,383,697	**$77.40**
4		**OWNER PURCHASED FURNITURE, FIXTURES, and EQUIPMENT**		
	A	**Furniture ($25/SF)**	$ 3,030,775	$25.00
	B	**Audio Visual Equipment ($12.50/SF)**	$ 1,515,388	$12.50
	C	**Interior Signage, Donor Recognition**	$ 150,000	$1.24
	D	**Exterior Building Signage**	$ 60,000	$0.49
	E	**Art Purchase and Installation (1% of project budget) (OPTIONAL)**	$ 660,901	$5.45
	F	**FFE Escalation (3% annual to end of project)**	$ 191,452	$1.58
		Total Owner Purchased FFE Costs	$ 5,608,516	**$46.26**
5		**PROJECT MANAGEMENT AND OWNERS CONTINGENCY COSTS**		
	A	**UND Project Management Costs**	$ 1,246,984	$10.29
	B	**Owners Contingency (4%)**	$ 2,493,967	$20.57
		Total PM and Owners Contingency Costs	$ 3,740,951	**$30.86**
6		**GRAND TOTAL COST**		
		Grand Total Cost to Construct Project (does not include financing or fundraising costs)	$ 66,090,133	$ 545.16

Does not include fundraising costs

UNIVERSITY OF NORTH DAKOTA
FACILITIES MANAGEMENT ESTIMATE

Budget Year: 2019/20

Project Schedule			Duration
Project Started	@	May-21	TBD
Schematics Approval	@	Jun-22	410
DD Completed	@	Oct-22	122
Construction Drawings Completed	@	Feb-23	123
Construction Started (NTP)	@	Jul-23	156
Construction Completed (NOC)	@	Aug-24	396
Total Project Duration (Calendar Days)			1207

Project: Gamble Demo/Parking Lot Build
Arch/Engr: TBD
Contractor: TBD
Delivery Type: General Contractor - Multi Prime
Phase: Concept

Gross Area — New Construction: N/A; Reno:

BUDGET ESTIMATE

		RND TOTAL	$/sq.ft.
1	**CONSTRUCTION MANAGER AT RISK CONSTRUCTION COSTS**		
A	Building Construction Cost Subtotal	$ 3,109,583	N/A
B	Misc. Construction Cost Subtotal	$ 50,000	N/A
C	Fees and Contingencies Construction Cost Subtotal	$ 721,423	N/A
			N/A
	Total Construction Budget	$ 3,881,006	N/A
			N/A
2	**CONSTRUCTION PROJECT ALLOWANCES**		N/A
A	Landscape/Site work Allowance	$ 250,000	N/A
B	Gamble Hall Abatement	$ 400,000	N/A
	Total Construction Project Allowances	$ 650,000	N/A
			N/A
3	**DESIGN AND CONSULTING COSTS**		N/A
A	Master Planning and Space Programming (not required contained in 3B)	$ 0	N/A
B	Architectural and Engineering Services	$ 388,101	N/A
C	Geotechnical Services	$ 10,000	N/A
D	Design (completed under separate project) and Construction Survey Services (limited scope)	$ 0	N/A
E	Hazardous Material Survey	$ 10,000	N/A
F	Branding Consultant	$ 0	N/A
G	Building Commissioning Services	$ 0	N/A
H	3rd Party Materials Testing Services	$ 10,000	N/A
I	Design Contingency	$ 42,000	N/A
	Total Design and Consulting Costs	$ 460,101	N/A
			N/A
4	**OWNER PURCHASED FURNITURE, FIXTURES, and EQUIPMENT**		N/A
A	Site Furnishings	$ 40,000	N/A
B	Audio Visual Equipment/Security Camera's	$ 10,000	N/A
C	Interior Signage, Donor Recognition	$ 0	N/A
D	Parking Lot Signage and Banners	$ 20,000	N/A
E	Art Purchase and Installation (1% of project budget) (OPTIONAL)	$ 0	N/A
F	FFE Escalation (3% annual to end of project)	$ 2,278	N/A
	Total Owner Purchased FFE Costs	$ 72,278	N/A
			N/A
5	**PROJECT MANAGEMENT AND OWNERS CONTINGENCY COSTS**		N/A
A	UND Project Management Costs	$ 101,268	N/A
B	Owners Contingency (4%)	$ 202,535	N/A
			N/A
	Total PM and Owners Contingency Costs	$ 303,803	N/A
			N/A
6	**GRAND TOTAL COST**		N/A
			N/A
	Grand Total Cost to Construct Project (does not include financing or fundraising costs)	$ 5,367,188	N/A

UNIVERSITY OF NORTH DAKOTA
FACILITIES MANAGEMENT ESTIMATE

Budget Year: 2019/20

Project Schedule			Duration
Project Started	@	May-20	TBD
Schematics Approval	@	Jun-20	45
DD Completed	@	Oct-20	122
Construction Drawings Completed	@	Feb-21	123
Construction Started (NTP)	@	Jul-21	156
Construction Completed (NOC)	@	Jul-22	364
Total Project Duration (Calendar Days)			810

Project: Columbia Hall Annex Utility Improvements
Arch/Engr: TBD
Contractor: TBD
Delivery Type: General Contractor - Multi Prime
Phase: Concept

Gross Area — New Construction: N/A; Reno:

BUDGET ESTIMATE

		RND TOTAL	$/sq.ft.
1	**CONSTRUCTION MANAGER AT RISK CONSTRUCTION COSTS**		
A	Building Construction Cost Subtotal	$ 2,000,000	N/A
B	Misc. Construction Cost Subtotal	$ 20,000	N/A
C	Fees and Contingencies Construction Cost Subtotal	$ 332,000	N/A
			N/A
	Total Construction Budget	$ 2,352,000	N/A
			N/A
2	**CONSTRUCTION PROJECT ALLOWANCES**		N/A
A	Landscape/Site work Allowance	$ 100,000	N/A
	Total Construction Project Allowances	$ 100,000	N/A
			N/A
3	**DESIGN AND CONSULTING COSTS**		N/A
A	Master Planning and Space Programming (not required contained in 3B)	$ 0	N/A
B	Architectural and Engineering Services	$ 235,200	N/A
C	Geotechnical Services	$ 5,000	N/A
D	Design (completed under separate project) and Construction Survey Services (limited scope)	$ 0	N/A
E	Hazardous Material Survey	$ 0	N/A
F	Branding Consultant	$ 0	N/A
G	Building Commissioning Services	$ 0	N/A
H	3rd Party Materials Testing Services	$ 5,000	N/A
I	Design Contingency	$ 25,000	N/A
	Total Design and Consulting Costs	$ 270,200	N/A
			N/A
4	**OWNER PURCHASED FURNITURE, FIXTURES, and EQUIPMENT**		N/A
A	Site Furnishings	$ 0	N/A
B	Audio Visual Equipment/Security Camera's	$ 0	N/A
C	Interior Signage, Donor Recognition	$ 0	N/A
D	Parking Lot Signage and Banners	$ 0	N/A
E	Art Purchase and Installation (1% of project budget) (OPTIONAL)	$ 0	N/A
F	FFE Escalation (3% annual to end of project)	$ 0	N/A
	Total Owner Purchased FFE Costs	$ 0	N/A
			N/A
5	**PROJECT MANAGEMENT AND OWNERS CONTINGENCY COSTS**		N/A
A	UND Project Management Costs	$ 54,444	N/A
B	Owners Contingency (4%)	$ 108,888	N/A
			N/A
	Total PM and Owners Contingency Costs	$ 163,332	N/A
			N/A
6	**GRAND TOTAL COST**		N/A
			N/A
	Grand Total Cost to Construct Project (does not include financing or fundraising costs)	$ 2,885,532	N/A

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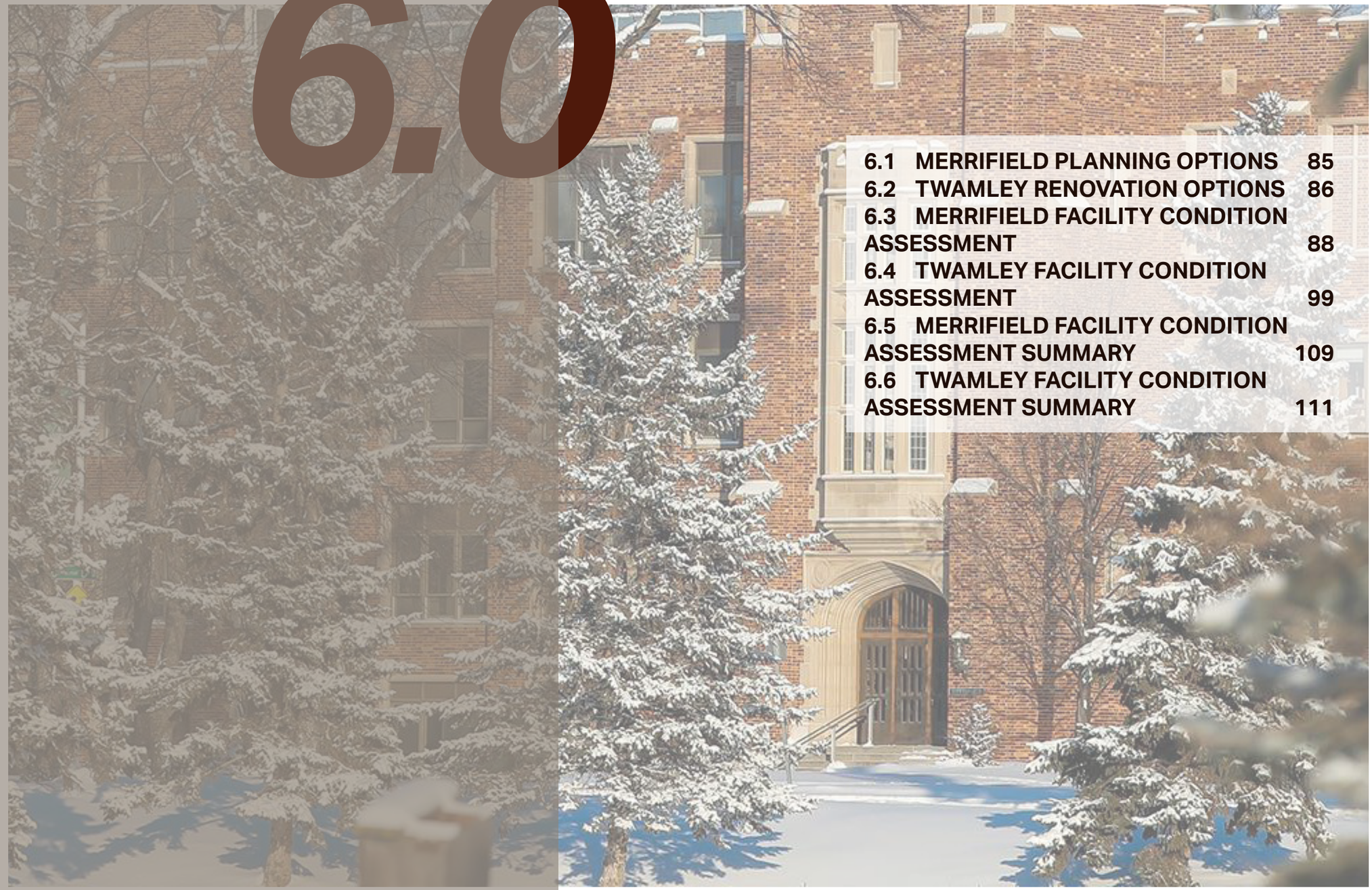

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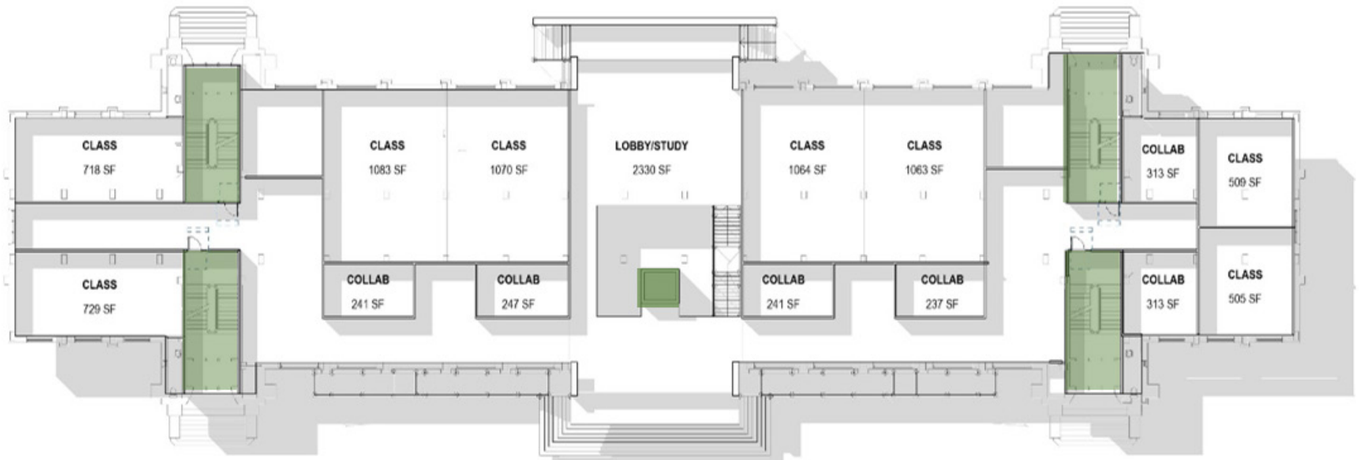
6.0 Appendices



GROUND LEVEL VIEW OF LARGE CLASSROOM OPTION WITH OFFSET CIRCULATION AND CENTRAL LOBBY.

GROUND LEVEL VIEW OF SMALL CLASSROOM OPTION WITH CENTRALIZED CENTRAL LOBBY.

6.1 MERRIFIELD PLANNING OPTIONS

The planning for Merrifield was established after several studies. In going through these studies, several items were discovered or uncovered:

- The existing elevator was initially assumed to remain in the same location, however given that it is beyond its useable life and is not in an accessible configuation, the decision was made to remove and replace it in a more ideal location.

- The initial planning studies looked at two separate options; one that prioritized all larger classrooms, and one that retained more smaller classrooms.

- In coordination with the programming studies that were completed, it was determined that a combination of these approaches created the best fit for the campus need.

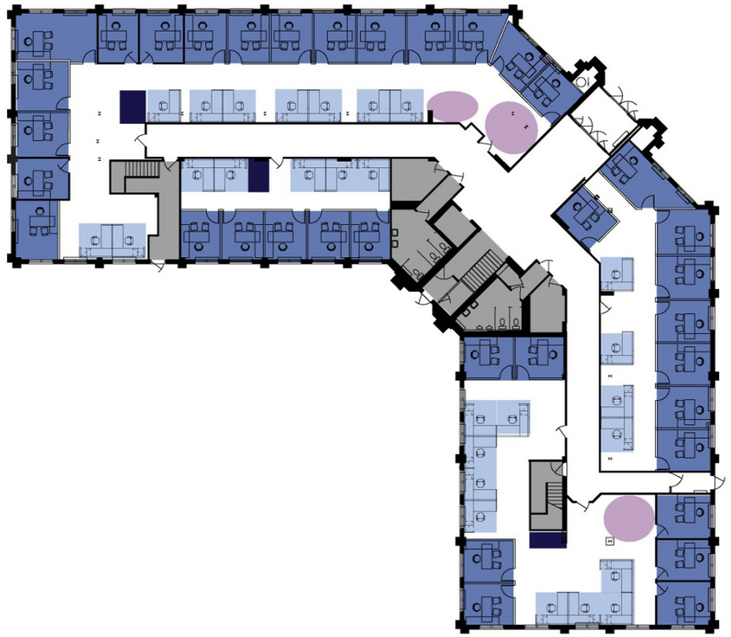
The flexibility of these options allows for the opportunity to make modifications as the program is validated in the next phase of work,

6.2 TWAMLEY RENOVATION OPTIONS

As the cost estimates were assessed for the overall project, the design ream evaluated multiple options for the renovation of Twamley, from a simple refresh of FF&E, to retaining some of the existing interiors, to the full renovation that is proposed in the budget request. In analyzing the best scenario for the renovation of Twamley, it became clear that the efficiencies that could be had in clearing the entire first 3 levels of the building would be much greater as compared with leaving the existing offices in place, by gaining not only a standardization of offices and workstations, but also in increasing transparency visibility, and the amount of shared amenities.

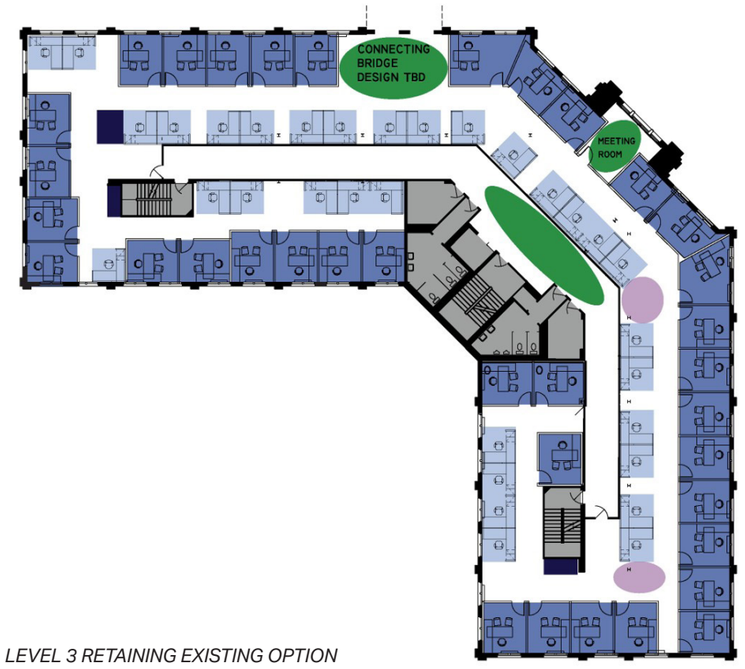
In addition, the cost estimates suggested that in trying to keep some of the existing interior walls and infrastructure it might actually cost the project more as compared with a full renovation, as the amount of space being modified would still require a full code and accessibility upgrade to the building. As an alternative to the full renovation, a simple refresh is possible for the building, it just results in a much more siloed environment for faculty and staff and less open collaborative amenities.

Finally, as moving faculty and staff is always challenging, part of the incentive for moving the associated seats in Merrifield and Columbia into a single facility would be to improve the existing working environment for all faculty and staff housed in Twamley. In order to do so, the groud prioritized a mix of offices and workstations that would allow for daylight to penetrate into the interior spaces on each floor, improved and amount and types of shared collaboration spaces and amenities, and overall created a more open and transparent workplace. The two options shown here do not achieve these goals and it was agreed by both the Steering Committee and the design team that pushing faculty to move their offices into a sub-par working environment would present additional challenges to gaining their consensus.



LEVEL 1 RETAINING EXISTING OPTION

LEVEL 2 RETAINING EXISTING OPTION



LEVEL 3 RETAINING EXISTING OPTION

OPTION 1: RETAINING EXISTING CORRIDORS & INFRASTRUCTURE

LEVEL 1 REFRESH OPTION

LEVEL 2 REFRESH OPTION

Program Comparison: Twamley	Option 1	Option 2
LEVEL 1		
WORKSTATIONS	27	35
PRIVATE OFFICES	36	24
LEVEL 2		
WORKSTATIONS	27	26
PRIVATE OFFICES	41	37
LEVEL 3		
WORKSTATIONS	32	15
PRIVATE OFFICES	36	26
Total Head Count - Seats:	**199**	**163**

LEVEL 3 REFRESH OPTION

OPTION 2: REFRESH OF FF&E ONLY

6.3 MERRIFIELD FACILITY CONDITION ASSESSMENT

FACILITY ASSESSMENT

CONDITION ASSESSMENT

DESIGN FOR LIFE

BUILDING INFORMATION

BUILDING NAME	GROSS SF	YEAR BUILT	EXISTING DRAWINGS	PAST RENOVATIONS/ADDITIONS
Merrifield Hall	94,138 SF	1929	X N	Some interior finishes.
BUILDING OWNER/DIRECTOR	**BUILDING CONTACT**	**BUILDING ADDRESS**		**COMMENTS**
State Board of Higher Education (DBA UND)	NAME: Les Bjore P. 701.777.2252 E. leslie.bjore@UND.edu	Centennial Drive - UND Campus Grand Fork, ND 58202		Part of UND's Historic District

RATING LEGEND

5 System condition is in new or near new condition.
4 System is generally suitable for intended use. Minor improvements are needed to improve building performance & longevity.
3 System is suitable, but requires specific upgrades to meet performance and operational objectives.
2 System has serious deficiencies.
1 System is unsuitable for intended use.

CATEGORY	SYSTEMS	RATINGS: EXCELLENT	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	POOR	COMMENTS
Site	Pavement	5	●	3	2	1	No lighting along sidewalks or street in back.
	Parking	5	●	●	2	1	
	Drainage	5	4	●	2	1	
	Signage	5	4	●	2	1	
	Lighting	5	4	3	●	1	
	Accessibility	5	4	3	●	1	
	Landscaping	5	4	●	2	1	
	Outdoor Program Space	5	4	●	2	1	
		5	4	3	2	1	Shares programmable space with Twamley.
		5	4	3	2	1	

CATEGORY	SYSTEMS	RATINGS: EXCELLENT	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	POOR	COMMENTS
Roof	General Condition	5	4	●	2	1	
	Roof Edge	5	4	●	2	1	
	Gutter/Scupper	5	4	●	2	1	
		5	4	3	2	1	
		5	4	3	2	1	
		5	4	3	2	1	
		5	4	3	2	1	

FACILITY ASSESSMENT

CONDITION ASSESSMENT

DESIGN FOR LIFE

EXTERIOR BUILDING CONDITION

CATEGORY	SYSTEMS	RATINGS: EXCELLENT	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	POOR	COMMENTS
North	Foundation	5	●	3	2	1	
	Walls	5	●	3	2	1	
	Windows/Doors	5	4	3	●	1	Some chipped paint on window frames and trim.
	Trim	5	●	3	2	1	
		5	4	3	2	1	
		5	4	3	2	1	
		5	4	3	2	1	
East	Foundation	5	●	3	2	1	Some cracking by entrances.
	Walls	5	●	3	2	1	
	Windows/Doors	5	4	3	●	1	Some chipped paint on window frames and trim.
	Trim	5	●	3	2	1	
		5	4	3	2	1	
		5	4	3	2	1	
		5	4	3	2	1	
South	Foundation	5	●	3	2	1	
	Walls	5	●	3	2	1	
	Windows/Doors	5	4	3	●	1	Some chipped paint on window frames and trim.
	Trim	5	●	3	2	1	
		5	4	3	2	1	
		5	4	3	2	1	
		5	4	3	2	1	
West	Foundation	5	●	3	2	1	Some cracking by entrances.
	Walls	5	●	3	2	1	
	Windows/Doors	5	4	3	●	1	Some chipped paint on window frames and trim.
	Trim	5	●	3	2	1	
		5	4	3	2	1	
		5	4	3	2	1	
		5	4	3	2	1	

FACILITY ASSESSMENT
CONDITION ASSESSMENT

DESIGN FOR LIFE

RATING LEGEND

5 System condition is in new or near new condition.
4 System is generally suitable for intended use. Minor improvements are needed to improve building performance & longevity.
3 System is suitable, but requires specific upgrades to meet performance and operational objectives.
2 System has serious deficiencies.
1 System is unsuitable for intended use.

	SYSTEMS	RATINGS: EXCELLENT	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	POOR	COMMENTS
SPACE REVIEWED **Ground Floor**	Floors	5	4	●	2	1	**Minor cracking in terrazzo tile. Worn carpet in classrooms.**
	Walls	5	4	●	2	1	**Minor chipping and cracking.**
	Ceilings	5	4	3	●	1	**Worn ceiling tiles in hallways.**
	Casework	5	4	3	●	1	**Worn finishes.**
	Window(s)	5	4	●	2	1	**Some chipped paint.**
	Door(s)	5	4	3	●	1	**Chipped and scratched paint.**
	Accessibility	5	4	3	●	1	**No ADA pull clearances on interior doors.**
	Signage	5	4	3	●	1	**Good, but outdated.**

OVERALL COMMENTS

old and worn finished.

Historic art work on this floor.

FACILITY ASSESSMENT
CONDITION ASSESSMENT

DESIGN FOR LIFE

RATING LEGEND

5 System condition is in new or near new condition.
4 System is generally suitable for intended use. Minor improvements are needed to improve building performance & longevity.
3 System is suitable, but requires specific upgrades to meet performance and operational objectives.
2 System has serious deficiencies.
1 System is unsuitable for intended use.

	SYSTEMS	RATINGS: EXCELLENT	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	POOR	COMMENTS
SPACE REVIEWED **1st Floor**	Floors	5	4	●	2	1	**Minor cracking in terrazzo tile. Worn carpet in classrooms.**
	Walls	5	4	●	2	1	**Minor chipping and cracking.**
	Ceilings	5	4	3	●	1	**Worn ceiling tiles in hallways.**
	Casework	5	4	●	2	1	**Worn finishes in classrooms. Faded display cases in hallway.**
	Window(s)	5	4	●	2	1	**Some chipped paint.**
	Door(s)	5	4	3	●	1	**Chipped and scratched paint.**
	Accessibility	5	4	3	●	1	**No ADA pull clearances on interior doors.**
	Signage	5	4	3	●	1	**Good, but outdated.**

OVERALL COMMENTS

Worn/outdated finishes.

FACILITY ASSESSMENT

CONDITION ASSESSMENT

DESIGN FOR LIFE

RATING LEGEND

5 System condition is in new or near new condition.
4 System is generally suitable for intended use. Minor improvements are needed to improve building performance & longevity.
3 System is suitable, but requires specific upgrades to meet performance and operational objectives.
2 System has serious deficiencies.
1 System is unsuitable for intended use.

SPACE REVIEWED	SYSTEMS	RATINGS: EXCELLENT	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	POOR	COMMENTS
2nd Floor	Floors	5	4	●	2	1	**Minor cracking in terrazzo tile. Worn carpet in classrooms.**
	Walls	5	4	●	2	1	**Minor chipping and cracking.**
	Ceilings	5	4	3	●	1	**Worn ceiling tiles in hallways.**
	Casework	5	4	3	●	1	**Worn finishes.**
	Window(s)	5	4	●	2	1	**Some chipped paint.**
	Door(s)	5	4	3	●	1	**Chipped and scratched paint.**
	Accessibility	5	4	3	●	1	**No ADA pull clearances on interior doors.**
	Signage	5	4	3	●	1	**Good, but outdated.**

OVERALL COMMENTS

Worn/outdated finishes.

FACILITY ASSESSMENT

CONDITION ASSESSMENT

DESIGN FOR LIFE

RATING LEGEND

5 System condition is in new or near new condition.
4 System is generally suitable for intended use. Minor improvements are needed to improve building performance & longevity.
3 System is suitable, but requires specific upgrades to meet performance and operational objectives.
2 System has serious deficiencies.
1 System is unsuitable for intended use.

SPACE REVIEWED	SYSTEMS	RATINGS: EXCELLENT	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	POOR	COMMENTS
3rd Floor	Floors	5	4	●	2	1	**Minor cracking in terrazzo tile.**
	Walls	5	4	●	2	1	**Minor chipping and cracking.**
	Ceilings	5	4	3	●	1	**Worn ceiling tiles in hallways.**
	Casework	5	4	3	●	1	**Worn finishes.**
	Window(s)	5	4	●	2	1	**Some chipped paint.**
	Door(s)	5	4	3	●	1	**Chipped and scratched paint.**
	Accessibility	5	4	3	●	1	**No ADA pull clearances on interior doors.**
	Signage	5	4	3	●	1	**Good, but outdated.**

OVERALL COMMENTS

Newer finishes in some classrooms (Rooms 304, 306A, and 313.)

Worn/outdated finishes in other classrooms.

FACILITY ASSESSMENT
CONDITION ASSESSMENT
DESIGN FOR LIFE

CATEGORY	SYSTEMS	RATINGS: EXCELLENT	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	POOR	COMMENTS
Building Code Compliance	Entry Access	5	4	3	2	●	Only accessible entrance is in back. interior classroom doors don't have ADA pull clearance.
	Protrusions	5	●	3	2	1	
	Guardrail Heights	5	4	3	2	●	No Guardrails on any stairs.
	Restrooms	5	4	●	2	1	Stairwell and elevators open into the main hallway. To meet code compliance stairwells and elevators need to be enclosed.
	Elevator and Stairwell Lobby	5	4	3	2	●	

OVERALL CODE COMMENTS

No fire sprinklers in building
No Guardrails on stairs.
No fire ratings on stairs or elevators
Poor wheel chair accessibility into building.

OVERALL COMMENTS

Interior doors don't have pull clearances. Poor acceptability through main entrances. Railings don't have guardrails.

FACILITY ASSESSMENT
CONDITION ASSESSMENT
DESIGN FOR LIFE

NOTE: East Elevation

NOTE: East Elevation

FACILITY ASSESSMENT
CONDITION ASSESSMENT

DESIGN FOR LIFE

NOTE: East Elevation

NOTE: South Elevation

FACILITY ASSESSMENT
CONDITION ASSESSMENT

DESIGN FOR LIFE

NOTE: South/West Entrance.

NOTE: North/West Entrance.

FACILITY ASSESSMENT
CONDITION ASSESSMENT

DESIGN FOR LIFE

NOTE: Cracking at North/East Entrance.

NOTE: Cracking at South/West Entrance.

FACILITY ASSESSMENT
CONDITION ASSESSMENT

DESIGN FOR LIFE

NOTE: Existing Art work on ground floor.

NOTE: Existing Terrazzo and Casework on First Floor.

Site Condition Assessment

For

Merrifield Hall
University of North Dakota
Grand Forks, ND

January 22, 2020

1. **Location**
   Merrifield Hall is located on a site of approximately 1.8 acres in the main academic core of the University of North Dakota Campus. It is located on the east side of the westerly loop of Centennial Drive, with Montgomery Hall immediately to the north and Twamley Hall to the South.

2. **Site Features**

a. West Yard: The two signature entrances and the primary visual façade of Merrifield Hall face west toward Centennial Drive. The large west yard maintains a setback of over 100 feet from Centennial Drive. The yard contains grass turf and a large landscape planting. The two main entrances have several steps and are not ADA accessible. Concrete sidewalks provide pedestrian connection from the two entrances west to a sidewalk along Centennial Drive which runs continuously from University Ave. to Twamley Hall and beyond. The sidewalks are in generally good condition, but should be reviewed in detail for any appropriate pedestrian safety improvements.

b. South Yard: The south "side" yard provides about 70 feet of separation to Twamley Hall. This yard area contains a visually attractive plaza surrounding the "Eternal Flame", an often-photographed Campus signature feature. The south yard also provides a pedestrian and utility corridor between buildings.

c. East Yard: The east yard is the main Campus "Quad", which provides a large area of mature trees, grassed areas, and pedestrian paths. A 12-foot wide north-south sidewalk 50 feet from the building provides primary pedestrian and emergency vehicle access. The east side of the building is accessed by two stairway entrances symmetrical with those on the west side. The center of the east face of the building is also served by an ADA accessible entrance. The sidewalks are in generally good condition, but we understand condition will be reviewed in detail for any necessary improvements in conjunction with upcoming landscape improvements to the Quad.

d. North Yard: The north "side" yard provides about 90 feet of separation to existing Montgomery Hall. This yard currently functions as a service area containing ADA and service vehicle parking spaces, as well as solid waste containers. We understand the area north of Merrifield Hall is planned as the future site of the Nistler College of Business and Public Administration. A separation of at least 60 feet will be maintained between the two buildings. The "2nd Ave. Pedestrian Promenade" will pass through this corridor providing excellent pedestrian and emergency vehicle access in an east-west route through Campus.

3. **Utility Services**
   All major utility services are functional and meet the needs of Merrifield Hall in its current condition. However, most of the utility services are owned by UND and several are of significant age. If a renovation project is undertaken, the utilities should be evaluated in detail for appropriate upgrade.
   Specific descriptions of existing conditions are as follows:

a. Steam: Steam and condensate lines enter Merrifield Hall from the south. Capacity and condition will be evaluated by mechanical engineer during design of future improvements.

b. Potable Water: Potable water enters the building through a 3-inch service from the east. Water service for fire protection is provided to fire hydrants by a 6-inch water main east of the building and an 8-inch water main west of Centennial Drive. Both of these water mains are cast iron pipe of significant age and should be evaluated for condition and adequacy of fire flow.

c. Sanitary Sewer: The sanitary sewer exits the north end of the building and is connected to a UND-owned sewer main flowing to the west. The capacity and condition are adequate for present conditions, but the aging main and service line should be evaluated in conjunction with any renovation project.

d. Electrical Power: An underground electrical service enters Merrifield Hall from a transformer near the west wall about 80 feet north of the southwest building corner.

e. Communications: Telecommunications duct lines enter at the northwest and northeast corners of Merrifield Hall. Underground telecommunications lines also are routed directly between Merrifield and Twamley Halls.

f. Natural Gas: An Xcel Energy natural gas service line enters near the southwest corner of the building. We assume this is a small diameter service used for a lunch room or similar purpose. Xcel Energy may be contacted to check necessity of upgrade when future natural gas needs are known.

g. Landscape Irrigation: Landscape irrigation systems were not visible at the time of field review. We are unaware whether landscape sprinkler systems are served from Merrifield Hall.

h. Storm Sewer: A system of underground storm sewer pipes provides drainage of site areas north and east of the building. We didn't note any piped roof drain leaders connecting to the underground storm sewer system.

END

Prepared by:

Mark Lambrecht, PE
AE2S
Jan. 22, 2020

HEYER ENGINEERING
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Sioux Falls, SD 57108
P: 605-370-6139

Twamley Hall Structural Assessment

A walk through was conducted on January 10, 2020 none of the structure was visible, and there was no sign of any structural issues. Not a single crack was observed.

We did obtain structural construction documents for the building. The plans are dated 5-25-1961.
The building is founded on a conventional concrete spread footing foundation system. The first floor is a 4" concrete slab on grade. Second, third fourth and penthouse floors consist of a 4" slab on metal form deck supported by a steel frame. The roof is a steel frame with wide flange roof beams supporting a metal roof deck.

Merrifield Hall Structural Assessment

A walk through was conducted on January 10, 2020 a portion of the structure was visible in the mechanical boiler rooms and the floor of the hallways.

The concrete floors of first , second and third levels have a somewhat uniform pattern of 11 to 12 cracks across the corridor. It is undetermined if these crack extend to the concrete floor below the terrazo floor finish. The only other structural item to note is the brick at each entrance stair, is in need of repair. The mortar at the bottom of the brick at the top of the stair is in very poor condition or gone.

We obtained Architectural construction documents for this building dated November, 1927. The building is founded on conventional concrete spread footings. The first, second, third floors and roof appear to be constructed with a concrete frame consisting of a flat slab and concrete beam and column system. The concrete beams, columns and slab were visible in the lower level mechanical rooms.

UND MERRIFIELD
EXISTING CONDITIONS REPORT

MECHANCIAL SYSTEMS

FIRE PROTECTION

The existing building is currently not protected by a wet sprinkler system. During any significant remodel of any portion of the building, the entire building will need to be sprinkled to brought up to current life safety code requirements.

PLUMBING

The plumbing fixtures throughout the building are inconsistent in model and age as fixtures appear to have been replaced at different times. Most plumbing fixtures appear to be in working order. Existing public fixtures do not have code required ASSE 1070 scald protection mixing valves to keep hot water within acceptable limits. ADA access to plumbing fixtures needs to be verified. Trap guards are also missing from ADA height lavatories for protection of wheelchair access. The existing electric water heaters are past their useful life and are in need of replacement. There is an insufficient hot water recirculation system present within the building requiring water to be ran for extended periods of time before hot water gets to the fixture needing hot water.

HVAC PIPING

There is an existing low-pressure steam and condensate line servicing the building. Existing air handling units have steam coils for heating. Heat exchangers in mechanical rooms convert steam to hot water serving finned tube radiation throughout the perimeter of the building and supply air terminal heating coils. Hot water pumps extended past their useful life and are in need of replacement.

VENTILATION & AIR CONDITIONING

There are two air handling units original to the building construction which are past their useful life located in the lower level mechanical room serving the majority of the building. There is also a rooftop air handling unit serving an auditorium. Each indoor air handling unit has a dedicated condensing unit located on the roof of the building that appear to be out of working order. The fresh air is currently ducted to the existing unit but does no have airflow measuring stations to confirm they meet code minimum ventilation rates. Variable air volume boxes were added to existing ductwork during a recent project for zone control. Two exhaust fans on the roof serve bathrooms throughout the building. Typical classroom air distribution consists of a single high sidewall supply grille and two low sidewall return grilles on the corridor side of the space. There corridors are not being served with any code required ventilation air.

AUTOMATIC TEMPERATURE CONTROLS

The existing temperature control system consists of a pneumatic system controlling pneumatic valve actuators and dampers. The system is aged and out of date without any means of updating. Variable frequency drives were retrofitted to existing fans in a 2012 project and are in good condition. The automatic temperature controls do not follow current University standards which are DDC controls which also provide a means for monitoring the systems within the building and for providing alarms if there are any spaces or systems that would be too far out of set point, or if a piece of equipment was in alarm.

UND Merrifield/Twamley
GRAND FORKS, ND

UND, MERRIFIELD
EXISTING CONDITIONS REPORT

ELECTRICAL SYSTEMS

MEDIUM VOLTAGE POWER SUPPLY

Merrifield is supplied medium voltage power from a 12.47 kV to 208/120 volt, 750 KVA pad-mounted step-down transformer. This transformer is connected to primary switch B-7-A, which is on UND Circuit #3.

LOW VOLTAGE POWER DISTRIBUTION

The existing service for Merrifield consists of a 2000-amp, 208/120 volt, distribution switchboard on the ground floor which is an ITE FC-20 that appears to have been installed in 1976.

All building loads are supplied by breakers in the main distribution panel or breakers in sub-panels. There are various subpanels on all floor of the building.

The majority of electrical distribution equipment appears to be original to the building.

There is a 120/208V 50kW natural gas emergency generator located within the ground floor of the building that feeds two subpanels in the building. Loads fed by the emergency panels are mostly IT racks and equipment within the main lower level IT room.

Uninterruptible power supplies are also utilized for various equipment within the main lower level IT room.

LIGHTING & CONTROL

Light Fixtures
Light fixtures within public spaces, such as corridors and stairways, consist primarily of recessed 2x4 fluorescent troffers. Various areas utilize suspended 2x4 fluorescent fixtures.

Light fixtures within classrooms primarily consist of 4’ suspended linear fluorescent fixtures. Along with recessed 2x4 fluorescent troffers and incandescent can lights in a few classrooms.

Back of house areas, such as mechanical spaces, IT rooms, etc. consist of 4’ suspended and surface mount fluorescent light fixtures. A few spaces are utilizing incandescent light bulbs.

Exit signs are primarily LED.

All emergency egress lighting is supplied via battery pack fixtures. Emergency lighting coverage was not tested during this walkthrough.

Lighting Control
Lighting within the entire building is primarily controlled via toggle switches in every space. Corridor lighting is controlled via occupancy sensor only.

UND Merrifield/Twamley
GRAND FORKS, ND

TECHNOLOGY

It was stated by UND that this building is used as a central hub for all data services throughout a large portion of campus. A large IT room in the ground level of the building houses several pieces of equipment for the distribution of information via fiber, copper cabling, and coaxial CATV. This includes servers, switches, patch panels, punchdown blocks, UPS’s, and several other pieces of important equipment.

New horizontal cabling and outlets should be provided with any new project. New cabling and devices should meet the current UND standards at that time.

Wireless access points seemed to be appropriately placed throughout the building to provide adequate service. However, higher bandwidth networks and Wi-Fi should be considered for any new project.

Typical classroom technology includes projectors, sound reinforcement, and dedicated wireless access points.

SAFETY & SECURITY

Fire Alarm
Current fire alarm system appears to have been updated within the past 10 years.

System consists of Simplex 4100U Fire Alarm Control Panel and is completely addressable.

Adequate spacing and location of fire alarm activation was observed for a building with no fire sprinkler system. This includes manual fire alarm pull stations and smoke detection.

Adequate spacing of notification, including horns and strobes, was noted throughout all spaces observed.

An assessment of every space within the building would be required to assess complete Code compliance.

Fire alarm system is backed up by battery.

Only electronic door card access was observed on doors to server room.

No video surveillance system was observed.

UND Merrifield/Twamley
GRAND FORKS, ND

TECHNOLOGY

The building has fiber optic, copper telecommunications, and coaxial CATV services. All network equipment is housed within data closets on the third and fourth floors. Services for the entire building are fed from these two rooms.

New horizontal cabling and outlets should be provided with any new project. New cabling and devices should meet the current UND standards at that time.

Wireless access points seemed to be appropriately placed throughout the building to provide adequate service. However, higher bandwidth networks and Wi-Fi should be considered for any new project.

Networked scheduling system was observed outside of conference rooms.

SAFETY & SECURITY

Fire Alarm

Current zoned fire alarm system consists of Simplex 4100 Fire Alarm Control Panel. Panel is now obsolete and entire system should be replaced with new addressable system.

For the majority of the building, adequate fire alarm activation spacing and locations was observed for a building with no fire sprinkler system. This includes manual fire alarm pull stations and smoke detection. Adequate smoke detection was not observed within various larger spaces. All pull stations should be replaced with new addressable pull stations. Various newer smoke detection were observed. All older smoke detection should be replaced with new addressable devices.

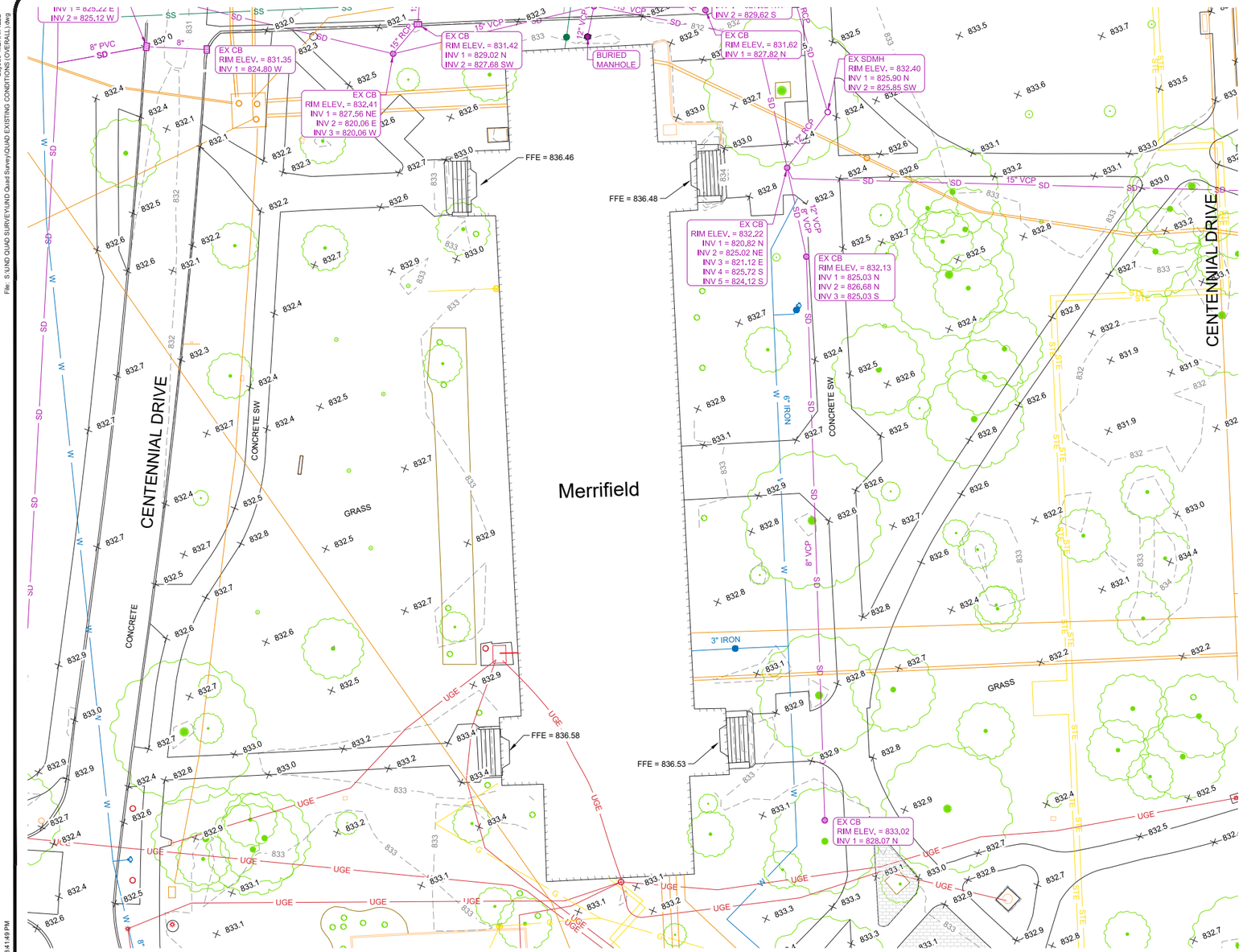
For the majority of the building, adequate notification spacing, including horns and strobes, was noted throughout all spaces observed. Notification devices are required within 15’ of the end of each corridor. This requirement was not observed at all locations. Various spaces of egress were noted to not contain any notification. It is also suggested that all non-addressable devices be replaced with new addressable devices.

Fire alarm system contains battery backup.

An assessment of every space within the building would be required to assess complete Code compliance.

Only electronic door card access was observed on southwest exterior door.

No video surveillance system was observed.



LEGEND

- BUILDING
- EXISTING WATER MAIN
- EXISTING SANITARY SEWER
- EXISTING STORM SEWER
- COMMUNICATIONS DUCTBANK
- COMMUNICATIONS
- EXISTING GAS LINE
- EXISTING STEAM LINE
- CHAIN LINK FENCE
- OVERHEAD ELECTRIC
- UNDERGROUND ELECTRIC
- CURB AND GUTTER
- MAJOR CONTOUR
- MINOR CONTOUR
- BOUNDARY
- PROPERTY LINE
- SIGN
- EXISTING STORM MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING GATE VALVE
- EXSISTING HYDRANT
- EXISTING STORM CATCH BASIN
- CONTROL POINT
- DECIDUOUS TREE
- CONIFEROUS TREE
- SHRUB
- ELECTRICAL PEDESTAL
- EXISTING IRON MONUMENT
- SET 5/8" REBAR WITH CAP MARKED LS-4185
- COMMUNICATION MANHOLE
- CATCH BASIN AREA INLET
- TRAFFIC SIGNAL WITH ARM
- LIGHT POLE
- GAS VALVE
- GAS METER
- SANITARY SEWER VALVE
- POST

N W E S

0 20
Scale in Feet

ADDITIONAL NOTES

1. Information for underground utility locations was compiled from field location marking provided from a one-call-locate, supplemented by survey of utility structures visible at ground level and or maps provided by the utility company at the time of survey. one-call does not guarantee location of utilities additional unmarked utilities may be present within the survey area.

CERTIFICATE OF SURVEY

I, Steven E. Swanson, Registered Land Surveyor in the State of North Dakota, hereby certify that this map is a true and correct representation of a survey performed by me or under my direct supervision on or before October 17, 2019. All distances and measurements are true and correct to the best of my knowledge and belief and all monuments are placed in the ground as shown.

STEVEN E. SWANSON REGISTERED LAND 4185 NORTH DAKOTA

Steven E. Swanson, North Dakota Registered Land Surveyor No. LS-4185

SYM	DATE	DESCRIPTION	APPR

UND MERRIFIELD SURVEY
UNIVERSITY OF NORTH DAKOTA
GRAND FORKS, NORTH DAKOTA
TOPOGRAPHIC SURVEY

CLIENT PROJECT NO.

DRAWING TYPE: TOPO
PREPARED BY: JEK
CHECKED / APPROVED: SES / SES
DATE: NOV. 2019
PROJECT NUMBER: P00163-2019-013
SHEET: 1 of 1
DRAWING: 1

Layout: MERRIFIELD
File: S:\UND QUAD SURVEY\UND Quad Survey\QUAD EXISTING CONDITIONS (OVERALL).dwg
Plotted By: Casey Berg Date: Friday, January 17, 2020
Last Saved By: Casey Berg Date: Friday, January 17, 2020 3:41:49 PM

Advanced Engineering and Environmental Services, Inc. ● 4050 Garden View Dr Ste 200 Grand Forks, ND 58201 ● (t) 701-746-8087 (f) 701-746-0370 ● www.ae2s.com

6.4 TWAMLEY FACILITY CONDITION ASSESSMENT

FACILITY ASSESSMENT
CONDITION ASSESSMENT

DESIGN FOR LIFE

BUILDING INFORMATION

BUILDING NAME	GROSS SF	YEAR BUILT	EXISTING DRAWINGS	PAST RENOVATIONS/ADDITIONS
Twamley Hall	76,706 SF	1962	X N	Interior Finishes
BUILDING OWNER/DIRECTOR	**BUILDING CONTACT**	**BUILDING ADDRESS**		**COMMENTS**
State Board of Higher Education (DBA UND)	NAME: Les Bjore P. 701.777.2252 E. leslie.bjore@UND.edu	Corner of Centennial Drive and Davis Drive - UND Campus Grand Fork, ND 58202		Part of UND's Historic District

RATING LEGEND

5 System condition is in new or near new condition.
4 System is generally suitable for intended use. Minor improvements are needed to improve building performance & longevity.
3 System is suitable, but requires specific upgrades to meet performance and operational objectives.
2 System has serious deficiencies.
1 System is unsuitable for intended use.

CATEGORY	SYSTEMS	RATINGS: EXCELLENT	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	POOR	COMMENTS
Site	Pavement	5	●	3	2	1	No lighting along side-walks or parking in back.
	Parking	5	●	3	2	1	
	Drainage	5	4	●	2	1	
	Signage	5	4	●	2	1	
	Lighting	5	4	3	●	1	
	Accessibility	5	●	3	2	1	
	Landscaping	5	●	3	2	1	
	Outdoor Program Space	5	4	●	2	1	
		5	4	3	2	1	
		5	4	3	2	1	

CATEGORY	SYSTEMS	RATINGS: EXCELLENT	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	POOR	COMMENTS
Roof	General Condition	5	4	●	2	1	
	Roof Edge	5	4	●	2	1	
	Gutter/Scupper	5	4	●	2	1	
		5	4	3	2	1	
		5	4	3	2	1	
		5	4	3	2	1	
		5	4	3	2	1	

FACILITY ASSESSMENT
CONDITION ASSESSMENT

DESIGN FOR LIFE

EXTERIOR BUILDING CONDITION

CATEGORY	SYSTEMS	RATINGS: EXCELLENT	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	POOR	COMMENTS
North	Foundation	5	●	3	2	1	Chipped paint and cracking in window frames and torn screens.
	Walls	5	●	3	2	1	
	Windows/Doors	5	4	3	●	1	
	Trim	5	●	3	2	1	
		5	4	3	2	1	
		5	4	3	2	1	
		5	4	3	2	1	
East	Foundation	5	●	3	2	1	Chipped paint and cracking in window frames and torn screens.
	Walls	5	●	3	2	1	
	Windows/Doors	5	4	3	●	1	
	Trim	5	●	3	2	1	
		5	4	3	2	1	
		5	4	3	2	1	
		5	4	3	2	1	
South	Foundation	5	●	3	2	1	Chipped paint and cracking in window frames and torn screens.
	Walls	5	●	3	2	1	
	Windows/Doors	5	4	3	●	1	
	Trim	5	●	3	2	1	
		5	4	3	2	1	
		5	4	3	2	1	
		5	4	3	2	1	
West	Foundation	5	●	3	2	1	Chipped paint and cracking in window frames and torn screens.
	Walls	5	●	3	2	1	
	Windows/Doors	5	4	3	●	1	
	Trim	5	●	3	2	1	
		5	4	3	2	1	
		5	4	3	2	1	
		5	4	3	2	1	

FACILITY ASSESSMENT
CONDITION ASSESSMENT

DESIGN FOR LIFE

RATING LEGEND

5 System condition is in new or near new condition.
4 System is generally suitable for intended use. Minor improvements are needed to improve building performance & longevity.
3 System is suitable, but requires specific upgrades to meet performance and operational objectives.
2 System has serious deficiencies.
1 System is unsuitable for intended use.

		RATINGS					
	SYSTEMS	EXCELLENT	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	POOR	COMMENTS
SPACE REVIEWED **1st Floor**	Floors	5	4	●	2	1	**New carpet tile in hallways. Worn terrazzo in entry.**
	Walls	5	●	3	2	1	**New paint**
	Ceilings	5	4	3	2	●	**Falling ceiling tiles.**
	Casework	5	4	●	2	1	
	Window(s)	5	4	3	2	●	**Chipped and worn trim.**
	Door(s)	5	4	3	●	1	**Chipped and dented doors.**
	Accessibility	5	4	3	●	1	**No ADA stalls in bathrooms**
	Signage	5	4	●	2	1	**Good, but outdated.**

OVERALL COMMENTS

Newer finishes on this floor compared to the rest of the building.

FACILITY ASSESSMENT
CONDITION ASSESSMENT

DESIGN FOR LIFE

RATING LEGEND

5 System condition is in new or near new condition.
4 System is generally suitable for intended use. Minor improvements are needed to improve building performance & longevity.
3 System is suitable, but requires specific upgrades to meet performance and operational objectives.
2 System has serious deficiencies.
1 System is unsuitable for intended use.

		RATINGS					
	SYSTEMS	EXCELLENT	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	POOR	COMMENTS
SPACE REVIEWED **2nd Floor**	Floors	5	4	●	2	1	**Worn terrazzo.**
	Walls	5	●	3	2	1	**New paint**
	Ceilings	5	4	3	2	●	**Falling ceiling tiles.**
	Casework	5	4	●	2	1	
	Window(s)	5	4	3	2	●	**Chipped and worn trim.**
	Door(s)	5	4	3	●	1	**Chipped and dented doors.**
	Accessibility	5	4	3	●	1	**No ADA stalls in bathroom**
	Signage	5	4	●	2	1	**Good, but outdated.**

OVERALL COMMENTS

New paint on walls.

FACILITY ASSESSMENT
CONDITION ASSESSMENT

DESIGN FOR LIFE

RATING LEGEND

5 System condition is in new or near new condition.
4 System is generally suitable for intended use. Minor improvements are needed to improve building performance & longevity.
3 System is suitable, but requires specific upgrades to meet performance and operational objectives.
2 System has serious deficiencies.
1 System is unsuitable for intended use.

		RATINGS					
	SYSTEMS	EXCELLENT	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	POOR	COMMENTS
SPACE REVIEWED **3rd Floor**	Floors	5	4	3	●	1	**Worn carpet.**
	Walls	5	4	3	●	1	**Older, chipped paint**
	Ceilings	5	4	3	2	●	**Falling ceiling tiles.**
	Casework	5	4	●	2	1	
	Window(s)	5	4	3	2	●	**Chipped and worn trim.**
	Door(s)	5	4	3	●	1	**Chipped and dented doors.**
	Accessibility	5	●	3	2	1	**No ADA stalls in bathroom**
	Signage	5	4	●	2	1	**Good, but outdated.**

OVERALL COMMENTS

Older finishes on this floor compared to rest.

FACILITY ASSESSMENT
CONDITION ASSESSMENT

DESIGN FOR LIFE

RATING LEGEND

5 System condition is in new or near new condition.
4 System is generally suitable for intended use. Minor improvements are needed to improve building performance & longevity.
3 System is suitable, but requires specific upgrades to meet performance and operational objectives.
2 System has serious deficiencies.
1 System is unsuitable for intended use.

		RATINGS					
	SYSTEMS	EXCELLENT	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	POOR	COMMENTS
SPACE REVIEWED **4th Floor**	Floors	5	4	●	2	1	**Worn terrazzo in entry.**
	Walls	5	4	3	●	1	**Old, chipped paint.**
	Ceilings	5	4	3	2	●	**Falling ceiling tiles.**
	Casework	5	4	●	2	1	
	Window(s)	5	4	3	2	●	**Chipped and worn trim.**
	Door(s)	5	4	3	●	1	**Chipped and dented doors.**
	Accessibility	5	●	3	2	1	
	Signage	5	4	●	2	1	**Good, but outdated.**

OVERALL COMMENTS

FACILITY ASSESSMENT

CONDITION ASSESSMENT

DESIGN FOR LIFE

CATEGORY	SYSTEMS	RATINGS: EXCELLENT	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	POOR	COMMENTS
Building Code Compliance	Entry Access	5	●	3	2	1	
	Protrusions	5	●	3	2	1	No Guardrails on any stairs.
	Guardrail Heights	5	4	3	2	●	No ADA Bathroom Stall.
	Restrooms	5	4	3	2	●	The current elevator opens into the main hallway. To meet code compliance the elevator lobby must be enclosed.
	Elevator Lobby	5	4	3	2	●	

OVERALL CODE COMMENTS

No Fire Sprinklers
No Guardrails on stairs
No ADA compliant/accessible bathrooms.
No fire rated lobby for elevator.

OVERALL COMMENTS

No guardrail on stair cases. bathrooms are not ADA compliant.

FACILITY ASSESSMENT

CONDITION ASSESSMENT

DESIGN FOR LIFE

NOTE: South West Elevation

NOTE: South Elevation

FACILITY ASSESSMENT
CONDITION ASSESSMENT

DESIGN FOR LIFE

NOTE: North Elevation

NOTE: North East Elevation

FACILITY ASSESSMENT
CONDITION ASSESSMENT

DESIGN FOR LIFE

NOTE: South Elevation

NOTE: East Elevation

JLG FACILITY ASSESSMENT
CONDITION ASSESSMENT
DESIGN FOR LIFE

NOTE: East Elevation

NOTE: West Elevation

Site Condition Assessment

For

Twamley Hall
University of North Dakota
Grand Forks, ND

January 23, 2020

1. **Location**
   Twamley Hall is located on a site of approximately 1.0 acre in the main academic core of the University of North Dakota Campus. It is located on the east side of the westerly loop of Centennial Drive, with Merrifield Hall immediately to the north and Carnegie Hall to the east.

2. **Site Features**

a. Southwest Yard: The primary entrance and visual façade of Twamley Hall face southwest toward the loop of Centennial Drive. The southwest yard maintains a setback of approximately 50 feet from Centennial Drive. The yard contains grass turf and small areas of landscape planting. The main entrance is at grade in the center of the building and is ADA accessible. Concrete sidewalks provide pedestrian connection from the entrance to a sidewalk along Centennial Drive which runs continuously from University Ave. to Carnegie Hall and the central Campus Quad. The sidewalks are in generally good condition, but should be reviewed in detail for any appropriate pedestrian safety improvements. A parking lot of 60 spaces is located directly across Centennial Drive from Twamley Hall. The parking lot is devoted largely to ADA and short-term metered parking.

b. North Yard: The north “side” yard provides about 70 feet of separation to Merrifield Hall. This yard area contains a visually attractive plaza surrounding the “Eternal Flame”, an often-photographed Campus signature feature. The north yard also provides a pedestrian and utility corridor between buildings.

c. Northeast Yard: The northeast yard is the main Campus Quad, which provides a large area of mature trees, grassed areas, and pedestrian paths. A large paved plaza provides access to an ADA compliant building entrance facing northeast in the building center. From the plaza, sidewalks radiate through the Quad, providing pedestrian and emergency vehicle access. The sidewalks are in generally good condition, but we understand condition will be reviewed in detail for any necessary improvements in conjunction with upcoming landscape improvements to the Quad.

d. East Yard: The east “side” yard provides about 200 feet of separation to existing Carnegie Hall. This yard currently functions as a service area containing seven spaces of ADA and service vehicle parking, as well as solid waste containers and an electrical transformer. This yard also provides direct access to landscaped areas of the Quad.

3. **Utility Services**
   All major utility services are functional and meet the needs of Twamley Hall in its current condition. However, most of the utility services are owned by UND and several are of significant

age. If a renovation project is undertaken, the utilities should be evaluated in detail for appropriate upgrade.

Specific descriptions of existing conditions are as follows:

a. Steam: Steam and condensate lines enter Twamley Hall near the center of the northeast face of the building. Capacity and condition will be evaluated by mechanical engineer during design of future improvements.
b. Potable Water: Potable water enters the central portion of the building through a 2.5-inch service from the southwest. Water service for fire protection is provided to fire hydrants by a 6-inch water main east of the building and an 8-inch water main along Centennial Drive southwest of the building. Both of these water mains are cast iron pipe of significant age and should be evaluated for condition and adequacy of fire flow.
c. Sanitary Sewer: The sanitary sewer exits the west side of the south wing of the building and is connected to a sewer main flowing to the west and north. The capacity and condition are adequate for present conditions, but the aging main and service line should be evaluated in conjunction with any renovation project.
d. Electrical Power: An underground electrical service enters Twamley Hall from a transformer near the east wall of the south wing, about 85 feet north of the southeast building corner.
e. Communications: Telecommunications duct lines enter the east side of the south wing near the electrical transformer. Underground telecommunications lines also are routed directly between Twamley and Merrifield Halls. Additional telecommunications facilities may serve Twamley Hall and should be researched in conjunction with any renovation project.
f. Natural Gas: We are not aware of a natural gas service to Twamley Hall. However, an Xcel Energy natural gas line serves the nearby “Eternal Flame”. If natural gas service is desired in the future, Xcel Energy may be contacted to verify feasibility.
g. Landscape Irrigation: Landscape irrigation systems were not visible at the time of field review. We are unaware whether landscape sprinkler systems are served from Twamley Hall.
h. Storm Sewer: Underground roof drain and/or sump pump leaders exit Twamley Hall in three locations and connect to the underground storm sewer system which discharges to the English Coulee. The storm drain pipes exit the building in the following locations:
    - West side of west wing
    - South side of west wing
    - West side of south wing

END

Prepared by:

Mark Lambrecht, PE
AE2S
Jan. 23, 2020

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Twamley Hall Structural Assessment

A walk through was conducted on January 10, 2020 none of the structure was visible, and there was no sign of any structural issues. Not a single crack was observed.

We did obtain structural construction documents for the building. The plans are dated 5-25-1961.
The building is founded on a conventional concrete spread footing foundation system. The first floor is a 4” concrete slab on grade. Second, third fourth and penthouse floors consist of a 4” slab on metal form deck supported by a steel frame. The roof is a steel frame with wide flange roof beams supporting a metal roof deck.

Merrifield Hall Structural Assessment

A walk through was conducted on January 10, 2020 a portion of the structure was visible in the mechanical boiler rooms and the floor of the hallways.

The concrete floors of first , second and third levels have a somewhat uniform pattern of 11 to 12 cracks across the corridor. It is undetermined if these crack extend to the concrete floor below the terrazo floor finish. The only other structural item to note is the brick at each entrance stair, is in need of repair. The mortar at the bottom of the brick at the top of the stair is in very poor condition or gone.

We obtained Architectural construction documents for this building dated November, 1927. The building is founded on conventional concrete spread footings. The first, second, third floors and roof appear to be constructed with a concrete frame consisting of a flat slab and concrete beam and column system. The concrete beams, columns and slab were visible in the lower level mechanical rooms.

UND TWAMLEY
EXISTING CONDITIONS REPORT

MECHANICAL SYSTEMS

FIRE PROTECTION

The existing building is currently not protected by a wet sprinkler system. During any significant remodel of any portion of the building, the entire building will need to be sprinkled to brought up to current life safety code requirements.

PLUMBING

Most plumbing fixtures throughout the building appear to be in working order. Existing public fixtures do not have code required ASSE 1070 scald protection mixing valves to keep hot water within acceptable limits. ADA access to plumbing fixtures needs to be verified. Trap guards are also missing from ADA height lavatories for protection of wheelchair access. The existing steam hot water heater is past its useful life and is in need of replacement. There is an insufficient hot water recirculation system present within the building requiring water to be ran for extended periods of time before hot water gets to the fixture needing hot water.

HVAC PIPING

There is an existing low-pressure steam and condensate line servicing the building. Existing air handling units have steam coils for heating. Heat exchangers in the penthouse mechanical room convert steam to hot water serving corridor convectors and fan coils units. Hot water pumps are reaching the end of their useful life and are in need of replacement.

VENTILATION & AIR CONDITIONING

The majority of spaces are served by through wall fan coils units with a louver to the exterior to provide ventilation air. Some fan coils have been replaced and have packaged DX cooling. The remaining existing units that were original to the building do not have cooling. There are indoor air handling units in the penthouse mechanical room and in main level mechanical rooms serving interior spaces. Lower level units are newer and in good condition. Penthouse level units are past their useful life and are in need of replacement. Recently replaced air handling units have DX cooling coils but are not connected to condensing units. A newer rooftop unit is located on the roof and is in good condition. Some air-cooled condensing units are located on the roof but not all are connected to indoor units. There is no code required ventilation air being provided to the corridors.

AUTOMATIC TEMPERATURE CONTROLS

The automatic temperature control consists of a mix of electric and pneumatic controls. The existing controls system is aged and out of date without any means of updating other than complete replacement. The automatic temperature controls do not follow current University standards which are DDC controls which also provide a means for monitoring the systems within the building and for providing alarms if there are any spaces or systems that would be too far out of set point, or if a piece of equipment was in alarm.

UND, TWAMLEY
EXISTING CONDITIONS REPORT

ELECTRICAL SYSTEMS

MEDIUM VOLTAGE POWER SUPPLY

Twamley is supplied medium voltage power from a 12.47 kV to 208/120 volt, 500 KVA pad-mounted step-down transformer. This transformer is connected to primary switch B-7-A, which is on UND Circuit #3.

LOW VOLTAGE POWER DISTRIBUTION

The main service disconnect is a Square D fused disconnect switch located on the first floor, near the UND Circuit #3 step-down transformer at the exterior of the building. Disconnect switch seems to be relatively new and in good condition.

The main service disconnect switch feeds a 1600-amp, 208/120 volt, Square D distribution switchboard on the fifth floor. Switchboard appears to be near the end of its useful life.

All building loads are supplied by fused switches in the main switchboard or breakers in sub-panels throughout all floors of the building.

Several pieces of the electrical distribution system, including the main distribution switchboard, appear to be original to the building. It is recommended that these portions of the system be replaced.

There is no emergency generator for backup power or life safety systems.

LIGHTING & CONTROL

<u>Light Fixtures</u>
Light fixtures within public spaces, such as corridors and stairways, consist primarily of surface mount 1x4 LED fixtures. Building entry space consisted of decorative LED pendant lighting.

Areas such as offices and conference rooms consist of 2x4 and 2x2 fluorescent recessed troffers.

Back of house areas, such as mechanical spaces, IT rooms, etc. consist of 4’ suspended and surface mount fluorescent light fixtures. A few spaces are utilizing incandescent light bulbs.

Exit signs are primarily LED.

Emergency egress lighting is provided via integral battery packs within normal lighting fixtures.. Emergency lighting coverage was not tested during this walkthrough.

<u>Lighting Control</u>
Lighting within the entire building is primarily controlled via toggle switches in every space. Occupancy sensors are located within all bathrooms and bathroom entry spaces.

UND Merrifield/Twamley
GRAND FORKS, ND

TECHNOLOGY

The building has fiber optic, copper telecommunications, and coaxial CATV services. All network equipment is housed within data closets on the third and fourth floors. Services for the entire building are fed from these two rooms.

New horizontal cabling and outlets should be provided with any new project. New cabling and devices should meet the current UND standards at that time.

Wireless access points seemed to be appropriately placed throughout the building to provide adequate service. However, higher bandwidth networks and Wi-Fi should be considered for any new project.

Networked scheduling system was observed outside of conference rooms.

SAFETY & SECURITY

Fire Alarm

Current zoned fire alarm system consists of Simplex 4100 Fire Alarm Control Panel. Panel is now obsolete and entire system should be replaced with new addressable system.

For the majority of the building, adequate fire alarm activation spacing and locations was observed for a building with no fire sprinkler system. This includes manual fire alarm pull stations and smoke detection. Adequate smoke detection was not observed within various larger spaces. All pull stations should be replaced with new addressable pull stations. Various newer smoke detection were observed. All older smoke detection should be replaced with new addressable devices.

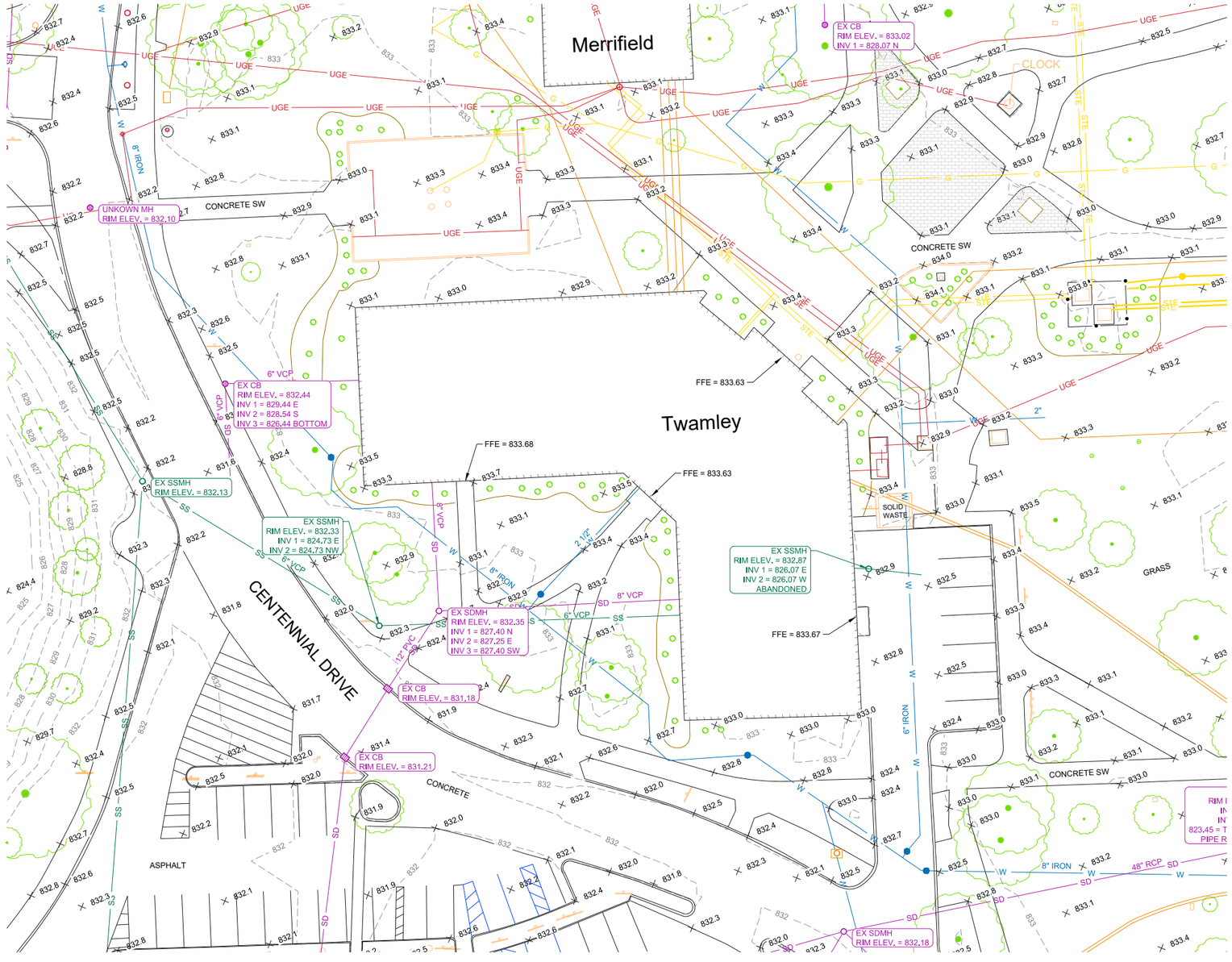
For the majority of the building, adequate notification spacing, including horns and strobes, was noted throughout all spaces observed. Notification devices are required within 15’ of the end of each corridor. This requirement was not observed at all locations. Various spaces of egress were noted to not contain any notification. It is also suggested that all non-addressable devices be replaced with new addressable devices.

Fire alarm system contains battery backup.

An assessment of every space within the building would be required to assess complete Code compliance.

Only electronic door card access was observed on southwest exterior door.

No video surveillance system was observed.



LEGEND

- BUILDING
- W — EXISTING WATER MAIN
- SS — EXISTING SANITARY SEWER
- SD — EXISTING STORM SEWER
- COMMUNICATIONS DUCTBANK
- COMMUNICATIONS
- G — EXISTING GAS LINE
- STE — EXISTING STEAM LINE
- CHAIN LINK FENCE
- OHE — OVERHEAD ELECTRIC
- UGE — UNDERGROUND ELECTRIC
- CURB AND GUTTER
- MAJOR CONTOUR
- MINOR CONTOUR
- BOUNDARY
- PROPERTY LINE
- SIGN
- EXISTING STORM MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING GATE VALVE
- EXSISTING HYDRANT
- EXISTING STORM CATCH BASIN
- CONTROL POINT
- DECIDUOUS TREE
- CONIFEROUS TREE
- SHRUB
- ELECTRICAL PEDESTAL
- EXISTING IRON MONUMENT
- SET 5/8" REBAR WITH CAP MARKED LS-4185
- COMMUNICATION MANHOLE
- CATCH BASIN AREA INLET
- TRAFFIC SIGNAL WITH ARM
- LIGHT POLE
- GAS VALVE
- GAS METER
- SANITARY SEWER VALVE
- POST

N W E S

0 20

Scale in Feet

ADDITIONAL NOTES

1. Information for underground utility locations was compiled from field location marking provided from a one-call-locate, supplemented by survey of utility structures visible at ground level and or maps provided by the utility company at the time of survey. one-call does not guarantee location of utilities additional unmarked utilities may be present within the survey area.

CERTIFICATE OF SURVEY

I, Steven E. Swanson, Registered Land Surveyor in the State of North Dakota, hereby certify that this map is a true and correct representation of a survey performed by me or under my direct supervision on or before October 17, 2019. All distances and measurements are true and correct to the best of my knowledge and belief and all monuments are placed in the ground as shown.

STEVEN E. SWANSON REGISTERED LAND SURVEYOR LS-4185 NORTH DAKOTA

Steven E. Swanson, North Dakota Registered Land Surveyor No. LS-4185

SYM	DATE	DESCRIPTION	APPR

AE2S

UND TWAMLEY SURVEY
UNIVERSITY OF NORTH DAKOTA
GRAND FORKS, NORTH DAKOTA
TOPOGRAPHIC SURVEY

CLIENT PROJECT NO.

DRAWING TYPE: TOPO
PREPARED BY: JEK
CHECKED / APPROVED: SES / SES
DATE: NOV. 2019
PROJECT NUMBER: P00163-2019-013
SHEET: 1 of 1
DRAWING: 1

Plotted By: Casey Berg Date: Friday, January 17, 2020
Last Saved By: Casey Berg Date: Friday, January 17, 2020 3:41:49 PM
File: S:\UND QUAD SURVEY\UND Quad Survey\QUAD EXISTING CONDITIONS (OVERALL).dwg
Layout: TWAMLEY

Advanced Engineering and Environmental Services, Inc. ● 4050 Garden View Dr Ste 200 Grand Forks, ND 58201 ● (t) 701-746-8087 (f) 701-746-0370 ● www.ae2s.com

6.5 MERRIFIELD FACILITY CONDITION ASSESSMENT SUMMARY

This Asset Executive Summary of existing conditions and costs association with improvements has been provided by UND, which was completed by ISES outside the scope of the Design Team's scope of work. This is meant to serve as an additional reference related to this project.

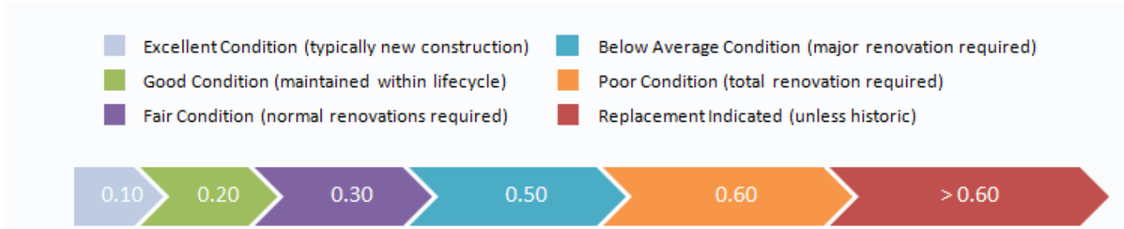
ASSET EXECUTIVE SUMMARY

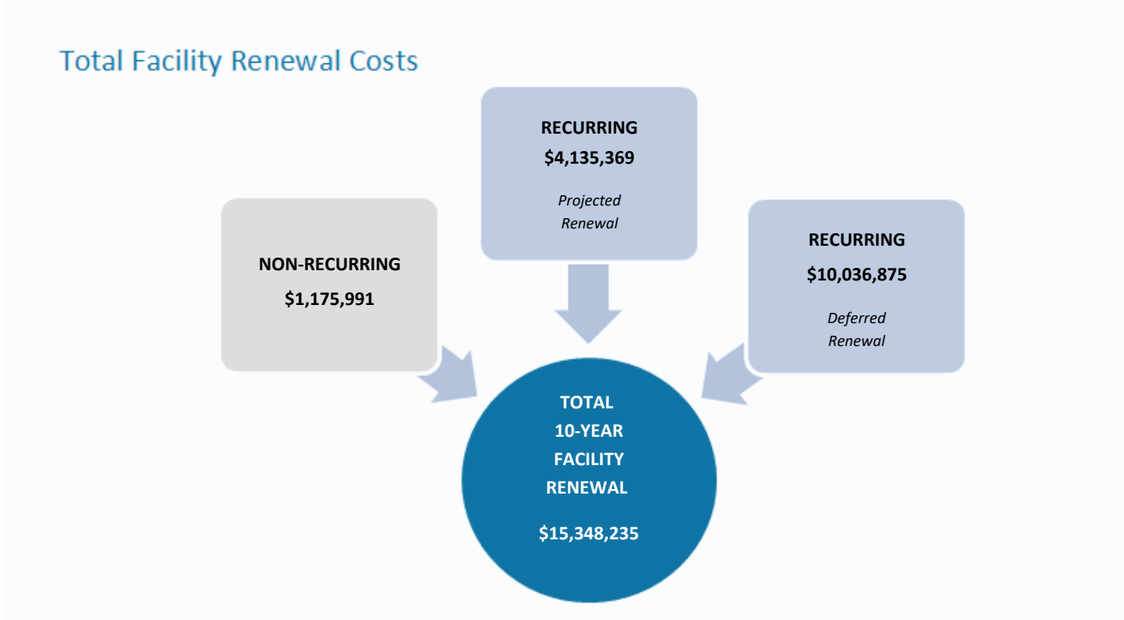
All costs shown as Present Value

ASSET CODE	0016		
ASSET NAME	MERRIFIELD HALL	**CURRENT REPLACEMENT VALUE**	$33,548,687
ASSET USE	Classroom / Academic	**FACILITY CONDITION NEEDS INDEX**	0.46
YEAR BUILT	1929	**FACILITY CONDITION INDEX**	0.30
GSF	94,138	**10-YEAR $/SF**	163.04
INSPECTION DATE	10/16/2019		

FCNI Scale

The FCNI for this asset is **0.46**

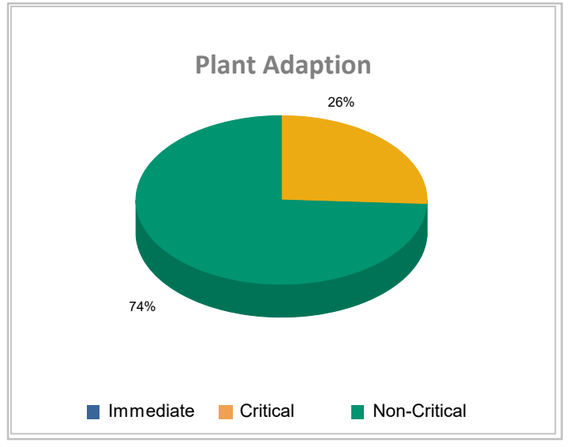




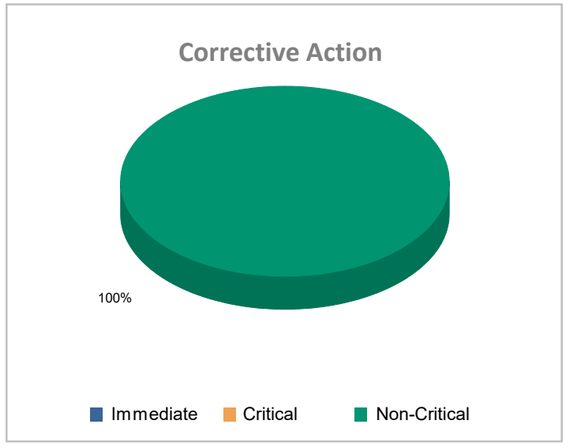
Non-Recurring Costs

Project Cost by Priority

PLANT ADAPTION	
1 - Immediate	$0
2 - Critical	$270,681
3 - Non-Critical	$780,080



CORRECTIVE ACTION	
1 - Immediate	$0
2 - Critical	$0
3 - Non-Critical	$125,230

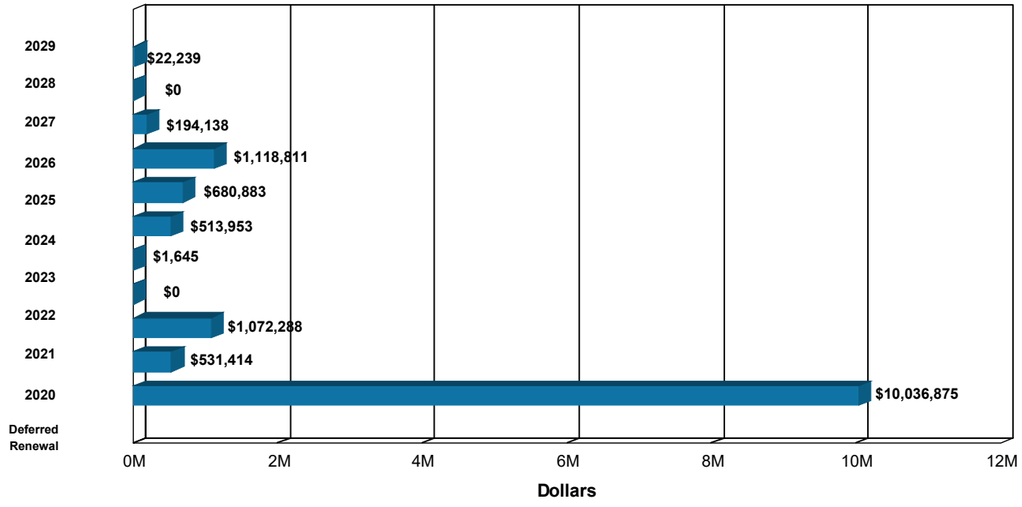


UNIVERSITY OF NORTH DAKOTA
MERRIFIELD HALL, 0016

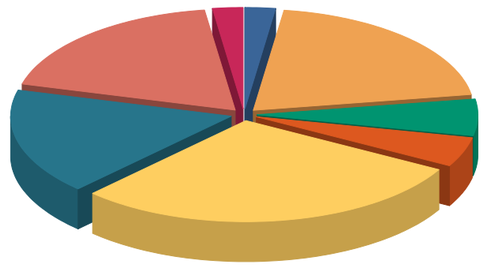
Facility Condition Assessment
Asset Overview

Recurring Costs

Component Replacement Cost by Year



Facilities Renewal Cost by System



Accessibility	$357,500	2%
Electrical	$3,090,937	20%
Exterior	$886,660	6%
Fire/Life Safety	$756,173	5%
Health	$0	0%
HVAC	$4,471,951	29%
Interiors	$2,586,680	17%
Plumbing	$2,853,255	19%
Site	$0	0%
Vert. Trans.	$345,079	2%
TOTAL	**$15,348,235**	

6.6 TWAMLEY FACILITY CONDITION ASSESSMENT SUMMARY

This Asset Executive Summary of existing conditions and costs association with improvements has been provided by UND, which was completed by ISES outside the scope of the Design Team's scope of work. This is meant to serve as an additional reference related to this project.

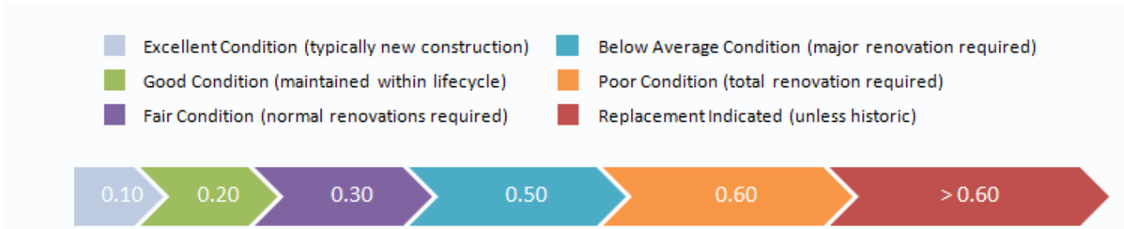
ASSET EXECUTIVE SUMMARY

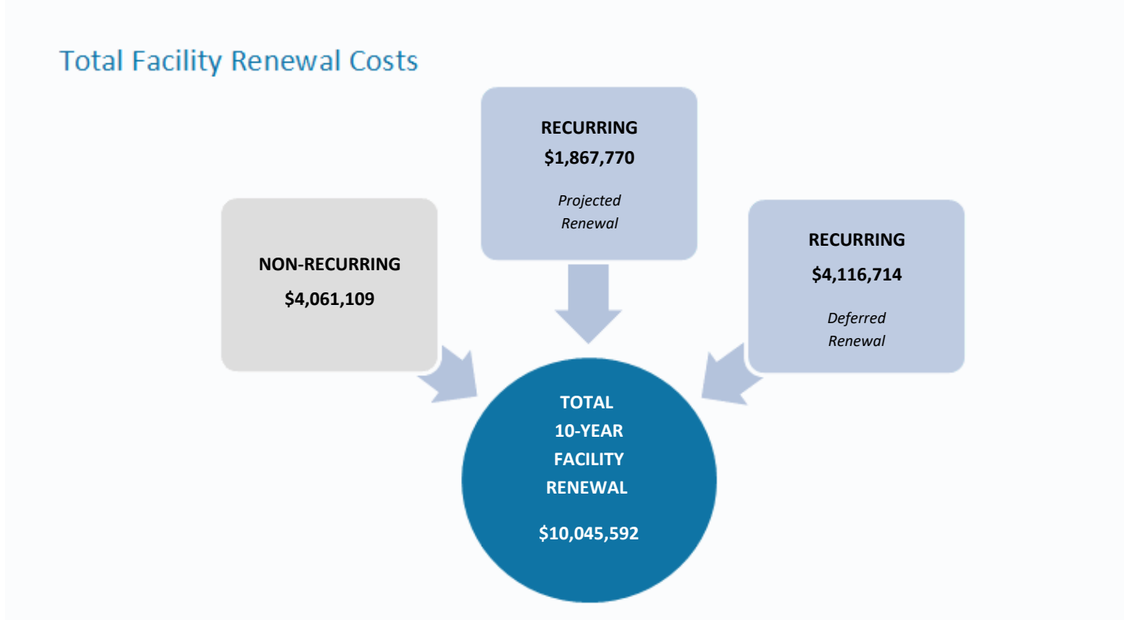
All costs shown as Present Value

ASSET CODE	0001		
ASSET NAME	TWAMLEY HALL	**CURRENT REPLACEMENT VALUE**	$30,991,781
ASSET USE	Office / Administrative	**FACILITY CONDITION NEEDS INDEX**	0.32
YEAR BUILT	1962	**FACILITY CONDITION INDEX**	0.13
GSF	76,706	**10-YEAR $/SF**	130.96
INSPECTION DATE	10/14/2019		

FCNI Scale

The FCNI for this asset is **0.32**

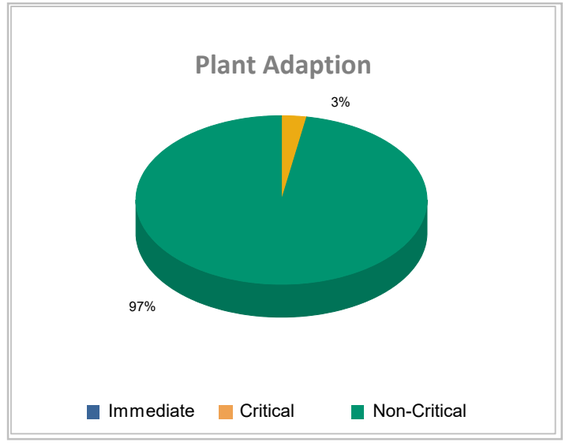




Non-Recurring Costs

Project Cost by Priority

PLANT ADAPTION	
1 - Immediate	$0
2 - Critical	$109,686
3 - Non-Critical	$3,867,958



CORRECTIVE ACTION	
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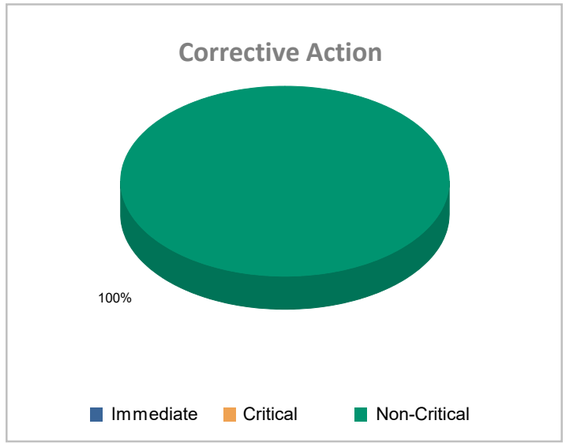
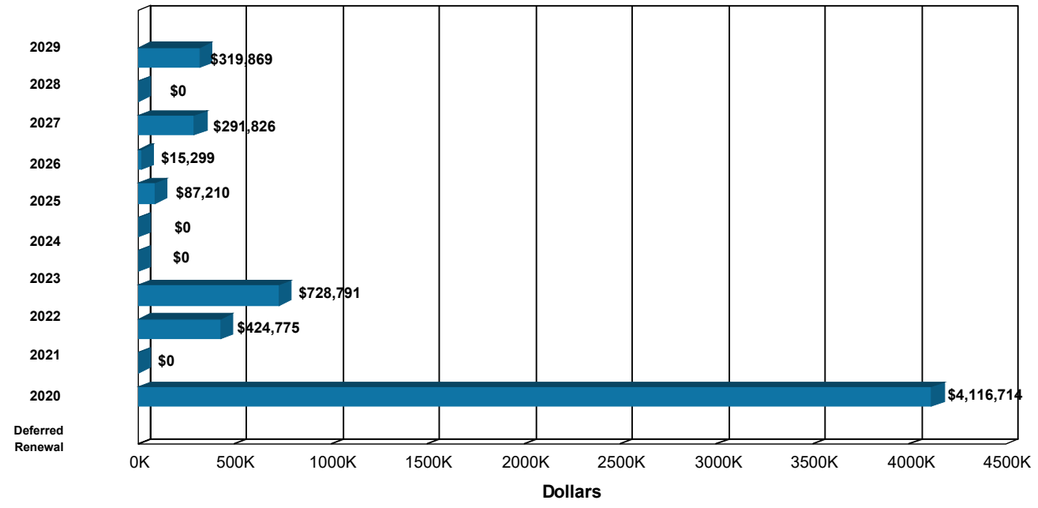
2 - Critical	$0
3 - Non-Critical	$83,465

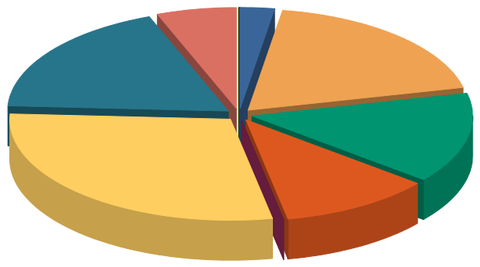


Recurring Costs

Component Replacement Cost by Year



Facilities Renewal Cost by System



Accessibility	$254,332	3%
Electrical	$1,902,488	19%
Exterior	$1,431,705	14%
Fire/Life Safety	$1,113,701	11%
Health	$10,686	0%
HVAC	$2,892,357	29%
Interiors	$1,843,060	18%
Plumbing	$583,681	6%
Site	$13,581	0%
Vert. Trans.	$0	0%
TOTAL	**$10,045,592**	