bmu

brij mohan lall munjal university | gurgaon, india

summary

program

master plan

HOK Design and Planning Services (India) Pvt. Ltd.

July 2013

summary

Executive Summary

Education today is about crossing boundaries. Our working lives are a blend of arts, humanities, science and technology. While we hear a lot about the “left brained” and the “right brained” personalities, the truth is stretching our brains to look at everything from many different perspectives helps us make connections elsewhere in our lives.

Faculty today must learn how to cross such boundaries and students have to adapt do a different way of learning. Engineering courses should include faculty members from art and architecture in much the same way as architecture courses should be infused with business and engineering.

Education today is not delivered between 9:00-5:00 in classrooms; but often in courtyards, corridors and coffee shops and most of the time into the late hours of the night.

At the same time our existing instructional spaces are becoming more technology intensive and require connections to other institutions of higher learning.

The central theme for BML Munjal University (BMU) revolves around innovation. Innovation, not just in the way classes are taught, but also in the way we think, in the way the campus is planned, designed, built and calibrated for change.

The university plans to forge alliances with the corporations and institutions through a research and development incubation center which will provide real opportunities for students to interact with industry and other institutions of higher learning.

The design for the project will be frugal in its approach yet sensible in its implementation. Students will not be lectured, but inspired to learn through problem based approach.

The client leadership clearly recognizes that we don’t need to build more, but find ways maximize what we have. To that end the team will continue to look for ways to use our resources, whether they are existing buildings or new ones we build.

The programming and master planning document that follows is a detailed documentation that captures much of what the design and client team have worked on in the first part of this year.

The team has thoughtfully programmed the needs of the university and how it will evolve and grow over the years.

The phasing of instructional spaces along with the growth of the campus has been planned in a way that gives the university enough latitude to change course as tomorrow’s world demands of them.

The document also covers the programming process in detail showing how facts, figures and benchmarks were gathered, analyzed and organized to arrive at a detailed statement of need. Feedback and comments are welcome.

Thank you.

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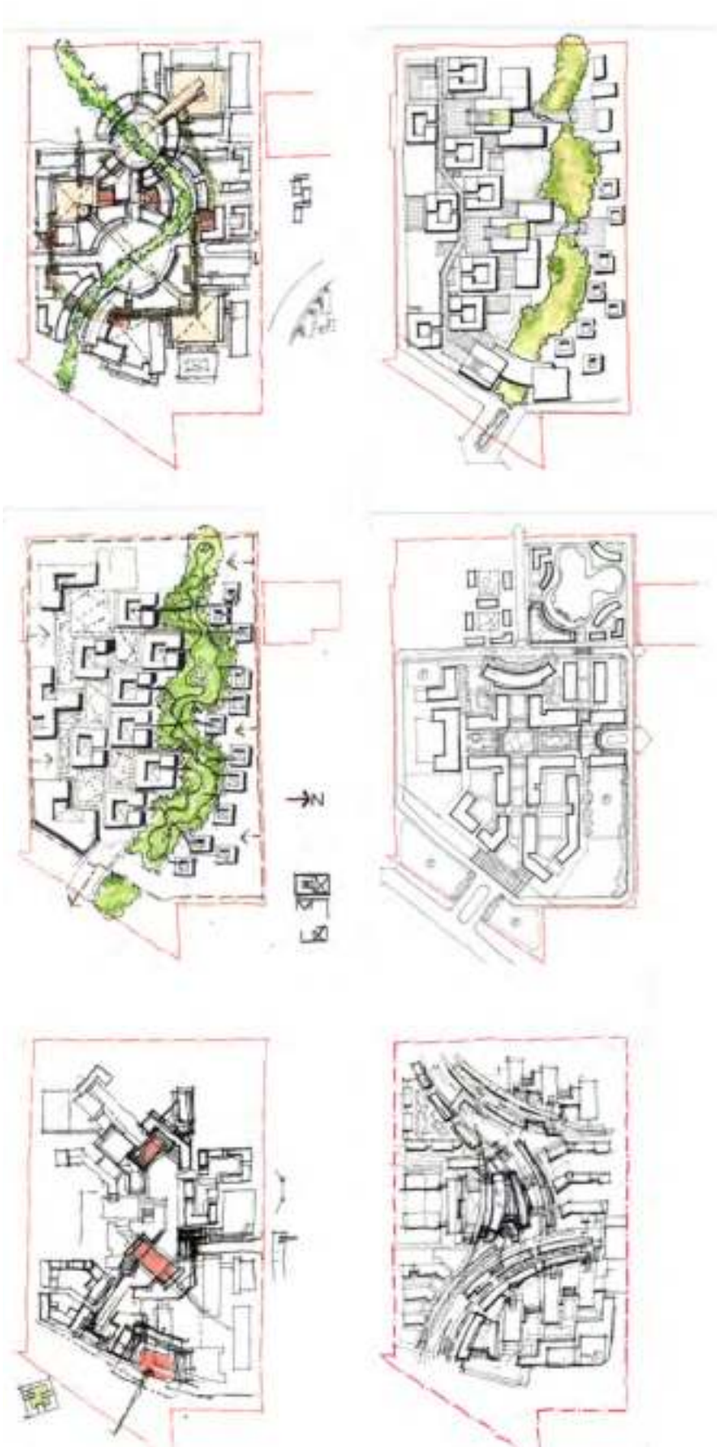

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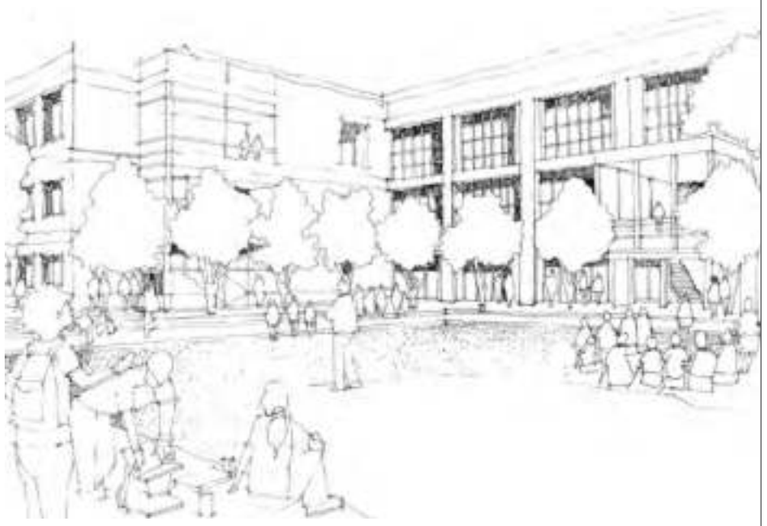


APPENDIX

program

The Programming Process

One of the primary methods we use to clarify complex problems and identify the interrelated components that will drive successful solutions is Problem Seeking®.

HOK has pioneered the premiere programming process that has been used worldwide for more than 50 years.

Programming is a systematic process of organizing information and is best understood as an information framework following a five-step process. The steps of the process cover both qualitative (goals, concepts, and problem statements) and quantitative (facts and needs) information.

Problem Seeking is a systematic process of inquiry, an objective analysis to:

Establish **Goals**	Collect & Analyze **Facts**	Uncover & Test **Concepts**	Determine **Needs**	State The **Problem**
Where do we want to go?	Where are we now?	How can we get there?	What can we Afford: when should it be done, who will do it?	What are the critical success factors?

This methodology covers four major categories of information: function, referring to people, activities and relationships; form, including site, quality and social/psychological environment; economy; and time, entailing historical aspects, present conditions, and future projections.

A unique feature of the method is the use of on site work sessions, analysis cards, spreadsheet data analysis, and visioning sessions. For projects we rely on these proven tools to collect data and to build consensus.

VISION SESSIONS
Facilitated work sessions or 'visioning' sessions are highly participative meetings that make use of a process by which key representatives of an organization are brought together to explore the critical aspects of an initiative. HOK believes collective participation has the power to translate goals and objectives into results for portfolio strategies, facility planning and workplace solutions. It is clear that a process to facilitate and document communication and information exchanges will create the foundation for success. Like all important business initiatives, a successful implementation starts with a solid strategy. Visioning can be invaluable in helping to align goals, build consensus and establish priorities.

THE PROGRAMMING PROCESS

The programming process for a university project involves many steps that are interconnected to each other. The fundamental goal of a program is to State the Problem.

Only when the Program is stated can the Design of the project begin.

As simple as it may appear, Stating the Problem is a five step process that has to be conducted in a systematic manner, during which goals are established, facts are collected and analyzed, concepts are tested and needs determined.

Put simply the 5 step process involves these steps

1. Establish Goals
2. Collect and analyze Facts
3. Uncover and test concepts
4. Determine Needs
5. State the Problem

The five step process is not always sequential or rigid. Information sources are often not accurate at first, often revised and the predictive capabilities of the group takes time to establish. Therefore, rather than having the rigor of accuracy of a mathematical problem, programming is a heuristic process and not an algorithm.

Also, one must note that the steps above are alternatively qualitative and quantitative. Goals, Concepts and Problem Statement are essentially qualitative. Facts and Needs are quantitative.

The programming process was based on a combination of interviews and work sessions. Interviews were used for asking questions and collecting data, particularly during the first three steps. Work sessions were used to verify information and stimulate client decisions, particularly in stage 4.

The programming was led by the HOK India with deep involvement of Hero Mindmine team members made up of leadership, educators, academicians, planners, administrators and consultants appointed by the client.

1 Establish **Goals**

- Mission and Vision of the university.
- Client Design Brief
- Student and faculty experience
- Academic focus of university
- Site Specific Goals.
- Resource Conservation
- University image
- Cost effectiveness and return on investment.
- Planning for change over time and campus growth.

2 Collect and Analyze **Facts**

- Student and faculty enrollment over time
- Proposed curriculum
- Organizational Structure
- Client's space requirements
- Site area and floor space index (FSI)
- Municipal regulatory requirements
- Climate Analysis
- Phasing

3 Uncover and Test **Concepts**

- Lessons learnt
- Understanding trends.
- Functional relationships
- Changes in Pedagogy.
- Designing for the Unknown
- Modularity and Flexibility
- Adaptive Redesign
- Educational Technologies
- Reuse of existing facilities.
- Sustainability concepts

4 Determine **Needs**

- Scheduling education spaces
- Detailed room data sheets for each unique space.
- Area requirements by phase
- Utilization of FSI by time and phase

5 State the **Problem**

- Performance Requirements
- Form considerations
- Implications of change and growth over the life of university

MISSION AND VISION OF THE UNIVERSITY

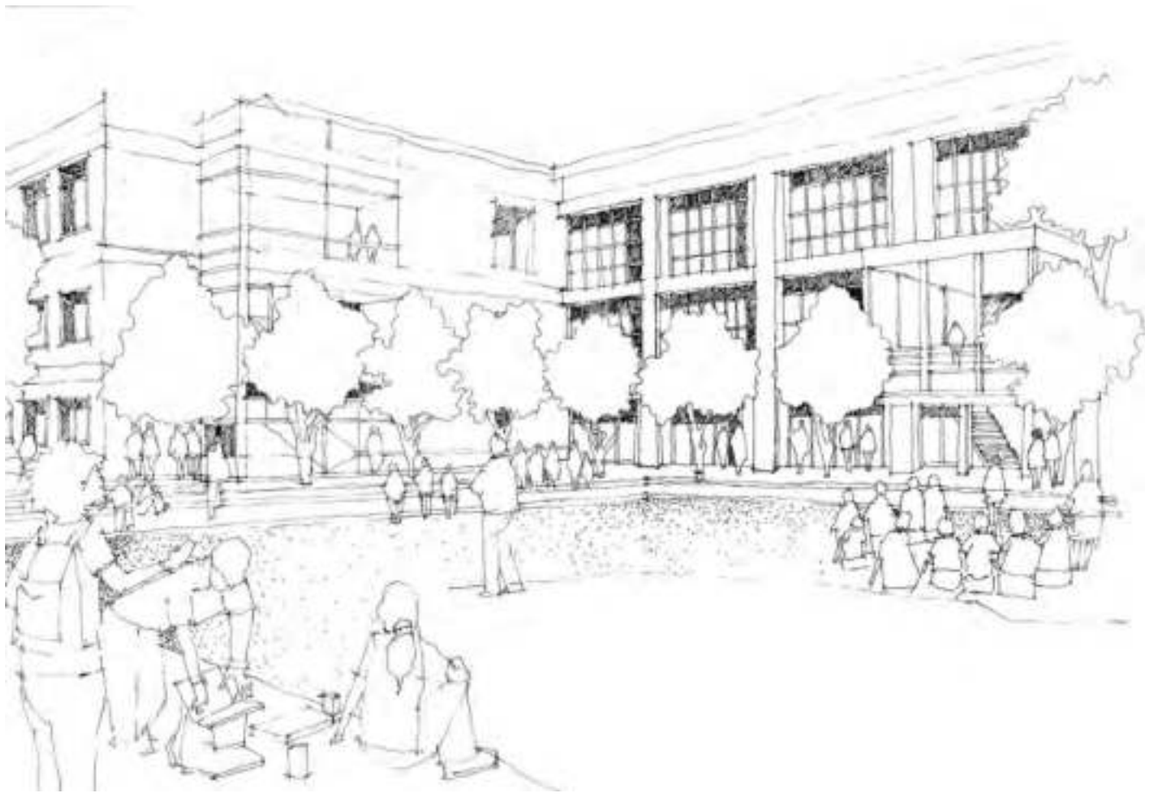
The design team started the programming process with a focussed session with Mr. Sunil Kant Munjal, Chairman of Hero Corporate Services, the services business arm of the Hero Group. Mr. Munjal also serves in the role of Director of *Hero Mindmine Institute Limited*, a premier organization delivering high quality learning solutions to corporations, professionals and students .

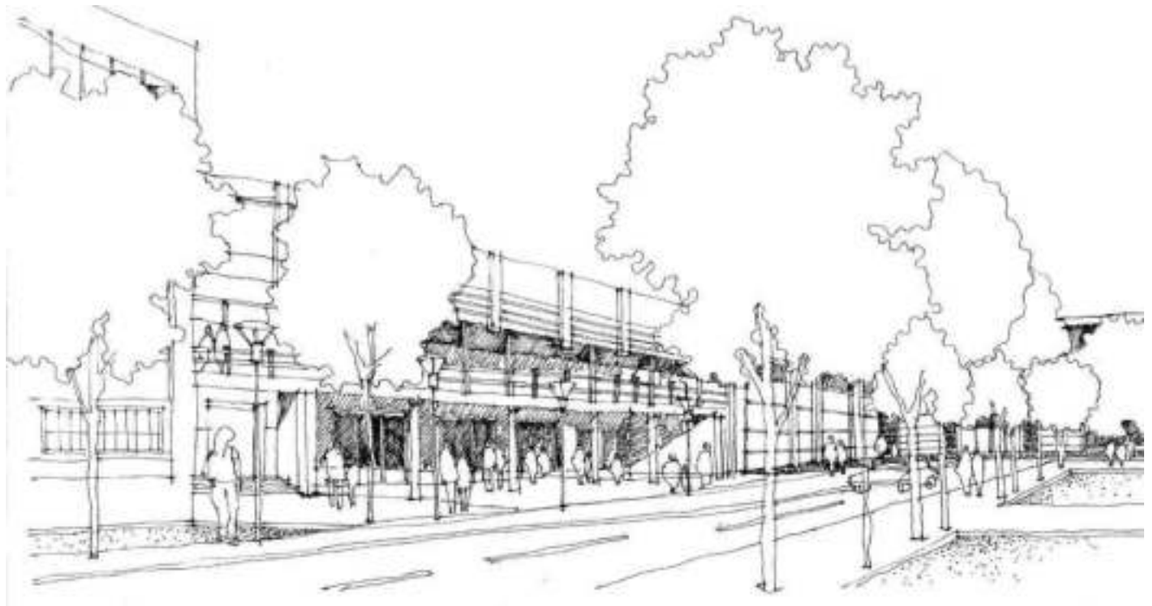
The process started with a vision session with the Munjal family members, Mr. Sunil Kant Munjal and Mr. Akshay Munjal, academic advisors, staff members and academicians to craft the vision and goals for this campus.

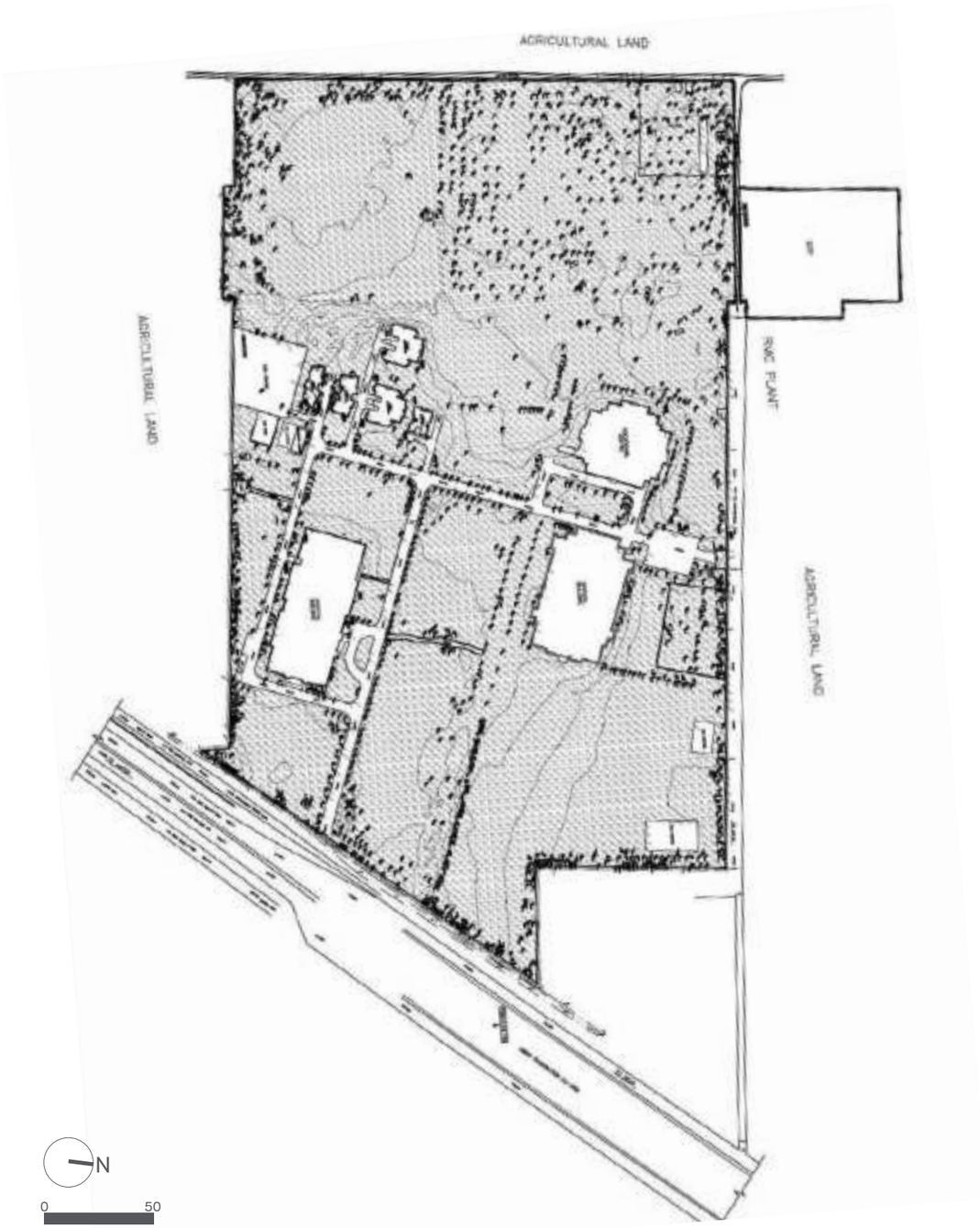
During the session Mr. Munjal offered an insight into his vision for the university which would offer state-of-the-art learning environment to students from around the country at an affordable rates. The university will focus on more hands-on learning and flexible curriculum while preparing students for real world solutions. The university will also bring together programs that integrate the arts and sciences through innovative learning and new curriculums. An evironment that brings together a convergence of liberal arts and science. Faculty from both liberal arts and science backgrounds (as well as from the industry) will be involved in teaching and research at the university

The following vision was broadly outlined:

- Innovation in all aspects of the university.
- Frugal design and frugal engineering at frugal cost.
- Optimize, not maximize.
- Design a flexible, shared-use and self-sustaining campus that would adapt to future needs.
- A context-sensitive, sustainable, state-of-the-art centre for learning, research and training.
- Create a pedestrian-friendly, shaded campus environment.
- Provide inter-disciplinary learning ~ by design.







CLIENT DESIGN BRIEF

The following client brief was provided to the design team at the start of the project. During the course of the programming and master planning exercise the brief was expanded and modified based on results of work sessions and input received as the project progressed.

GENERAL

Total plot area : 36 acres.
Permissible FAR : 1.0
Permissible Ground coverage: 25%

DESIGN OBJECTIVES

To create a unique academic township. To design an eco- friendly, comfortable and sustainable infrastructure for the community comprising of a diverse community of students and accomplished faculty and staff enabling them to pursue learning and innovation objectives.

SITE AND AMENITIES

11,400 students
500 faculty
200 support staff

The campus design will be built around four dimensions:

- Academic facilities;
- Common facilities like library, computer, student centre, health centre etc.;
- Residential area comprising of hostels, faculty and staff residences;
- Commercial area- shopping centre, Bank, faculty club etc.

The University will come up in three phases over a period of 13 years. (See note below)

The users will be high caliber students, highly reputed faculty members and highly competent staff members. There will be more emphasis on visiting faculty from the industry in addition to permanent faculty.

CAMPUS & BUILDING DESIGN

- To design and achieve target of a GREEN BUILDING (Certification level only) – need not be certified by IGBC.
- To plan for zero-discharge, energy- efficient building.
- To plan and design considering the maximum utilization of locally available resources.
- To ensure the VASTU compliance, to the extent possible.
- The look-n-feel of the campus should be unique and the only of its kind in the region.
- Clear demarcation of administrative block, academic blocks, hostel buildings, laboratory blocks, auditorium, and residential blocks for faculty.
- The entire design scheme should follow a theme and the entire campus including extension in later date should revolve around that theme.
- As the Construction shall be in phases, the blocks should be planned in such a manner that extension at a later date does not interfere in day-to-day operations of the university.
- The placing of the academic block should be based on study of wind and sunlight movement such that all classrooms are appropriately lit and ventilated.
- The design scheme should be cost-effective and the vertical transportation cores should be designed such that these serve maximum area.
- The entire campus should be connected with pathways to make it pedestrian-friendly.

Note:
The client originally envisioned three phases but as programming proceeded the actual number of phases were modified.
(See page 37)

STUDENT AND FACULTY EXPERIENCE

A campus plays an important role in a creating positive student and faculty experiences. Successful campus elements help foster an inter-disciplinary learning environment. Some of the key elements of a typical campus include:

Identity

Elements such as a clock tower, an iconic building on campus or even public spaces, plazas, etc can provide a unique identity for a campus.

Place making

A campus should have unique interior spaces and places for students to congregate. This can be achieved by unique placements of buildings within the layout.

Synergies

Synergies within the campus elements, departments and sub-districts are critical to create a cohesive campus feel.

Community

Community interface of the campus is essential for it to become a part of the larger context.

RESOURCE CONSERVATION

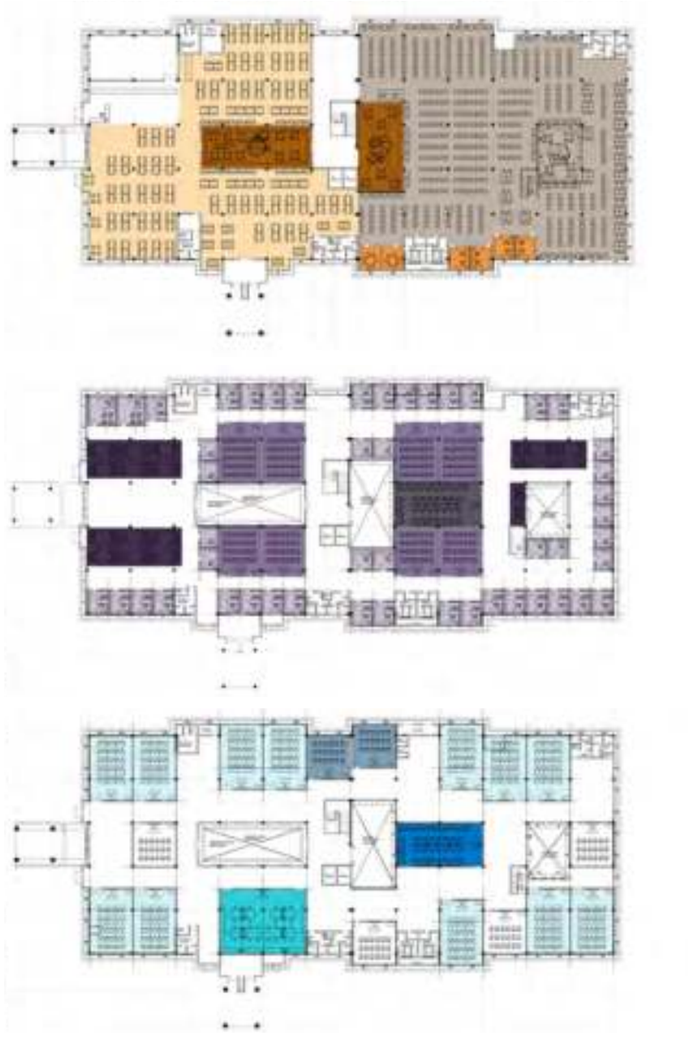
The client has a clear commitment for resource conservation throughout the development of the university. Three primary areas identified were:

The Site
The site is limited to 36 acres and is likely to be quite dense by the time it is fully built out. Current regulations allow the construction of Floor Space Index (FSI) of 1.0 so it is important the designers optimize the development plan in a way the FSI is consumed responsibly through the phases leading up to full build out. Ground coverage restrictions place additional challenge on location of structures on the site

Existing Buildings
While the hospital is currently unoccupied, the design team has suggested the client consider adaptive reuse of the facility as appropriate. Preliminary study suggests the facility could be used as a swing building during the early phases of construction. Where possible existing resources should be utilized to integrate with the new master plan.

New Buildings
The design should strive to provide maximum utilization of every space built. Where possible common functions should be combined for maximum usage. Similarly spaces should be designed so they could be adapted and retrofitted for multiple uses over the life of the university. By striving for higher utilizations, the built up area can be reduced.

CONSERVATION OF SITE RESOURCES



ADAPTIVE REUSE OF EXISTING BUILDINGS

ADAPTIVE REUSE OF NEW SPACES

ACADEMIC FOCUS OF UNIVERSITY

The academic focus of the university is primarily on engineering with strong connections to management, arts and architecture.

The university plans to offer degree and post graduate courses in key engineering streams such as:

- Computer Science
- Electrical Engineering
- Electronics Engineering
- Mechanical Engineering
- Civil Engineering
- Other fields

See page *B-12* for student curriculum

Other streams will include Bachelors and Masters program in:

- Business Administration
- Commerce
- Arts
- Law
- Architecture

The university desires to integrate the entire learning experience through interdisciplinary education between the arts and sciences. Course work may include sessions provided jointly by instructors from both arts and sciences.

There will also be linkages to the industry and the university foresees adding research and development components to its program as it grows.

ENROLLMENT AND STUDENT COUNT

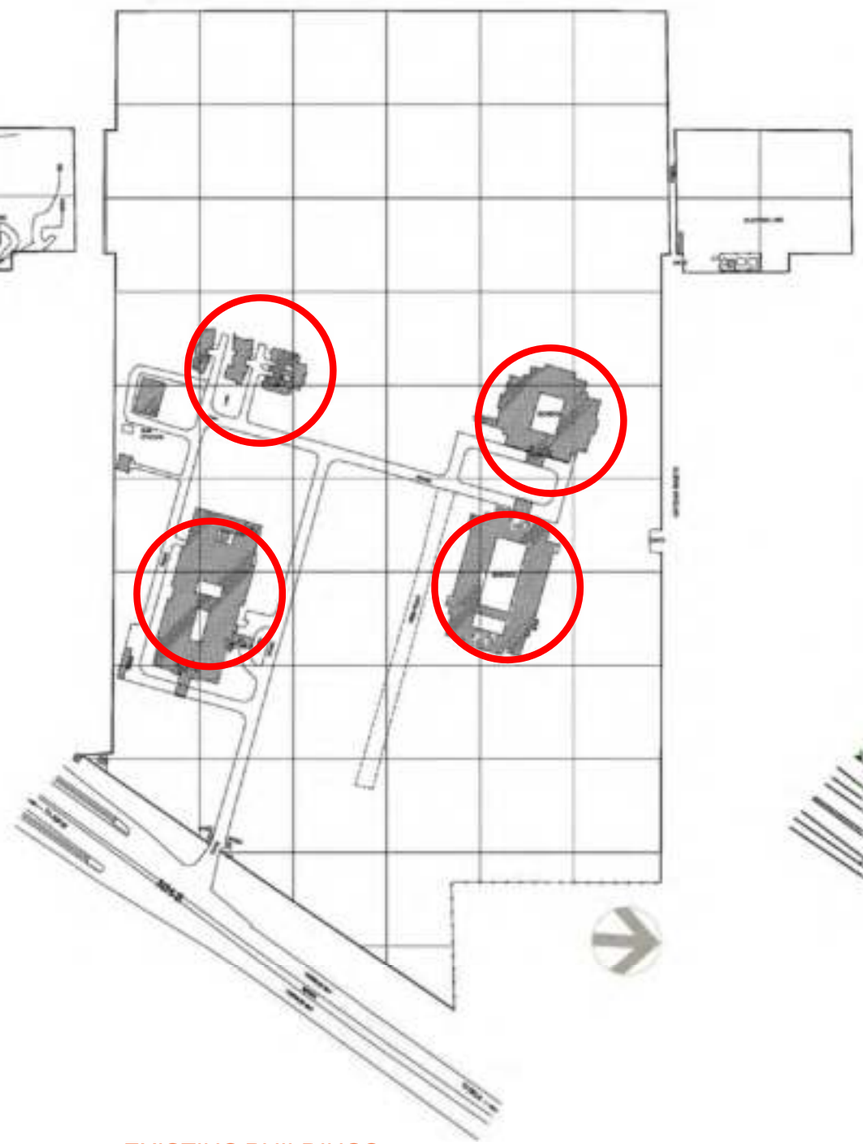
Current plans are for the university to increase enrollment steadily from 2014 to peak at 2025. The expected student enrollment at peak will be around 11,000 with a faculty count of around 600. During the early phases of the development the university anticipates housing a significant student population on campus along with key faculty. The enrollment details are discussed later in the report (see *B-11*)

CAMPUS POPULATION	2014	2016	2018	2020	2025
Students	420	2,440	4,200	6,000	11,380
Faculty	32	144	238	336	634
Non Academic Staff	52	80	103	137	217
TOTAL (STAFF+STUDENTS)	504	2,664	4,541	6,473	12,231

SITE SPECIFIC GOALS

There are several existing buildings on the site. There is a functioning school and vocational institute located on the north side of the campus. The client wishes to keep the school and vocational buildings functional during the full development of the campus plan. Additionally, there is a hospital building located at the south side of the campus. While the building is currently not being used, the client would like to consider options for reuse of the building during the early stages of the university's building program. The site contains many mature trees lining the existing street network that should be protected to the extent possible while not inhibiting new construction on the site. See page *B-06* for additional discussion on *Resource Conservation.*

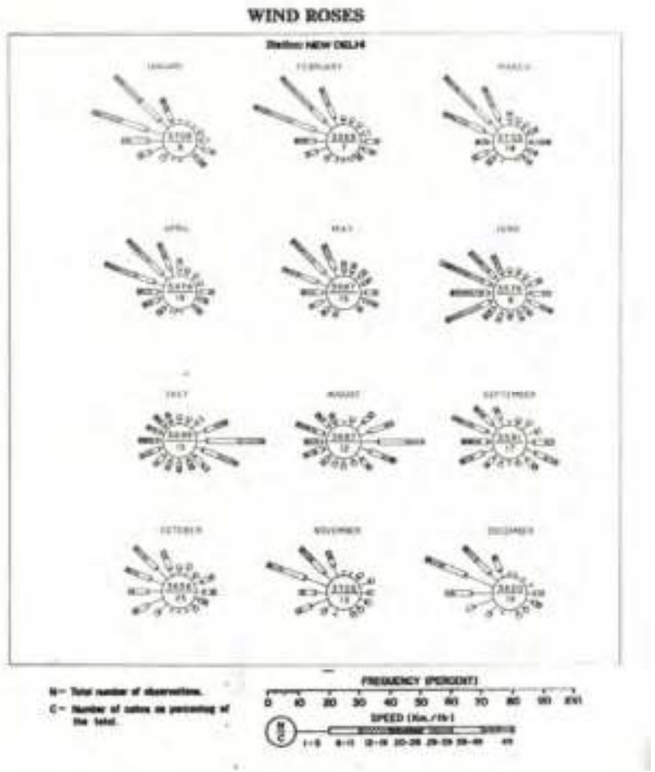
SITE CONTOURS:
The site has a gentle slope from 100M to 98M (2M) from east to west edge.

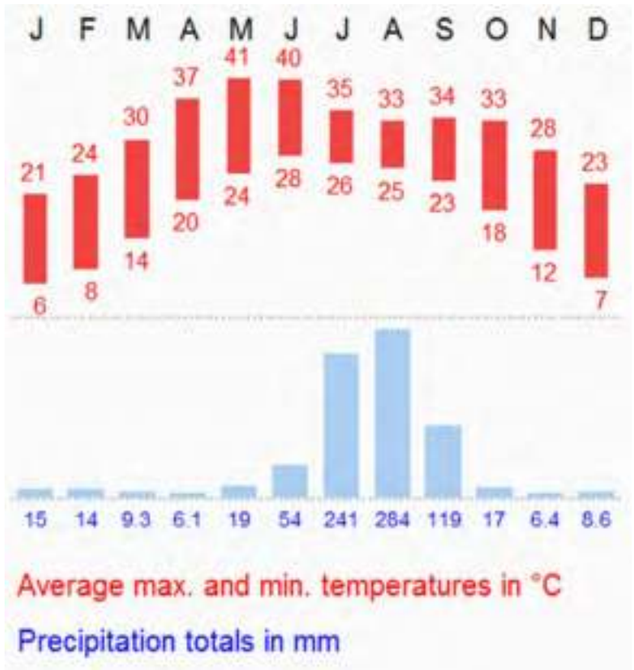


EXISTING BUILDINGS:
The site has 3 existing buildings (1 hospital, 1 primary school and 1 vocational training institute) and hospital staff quarters.

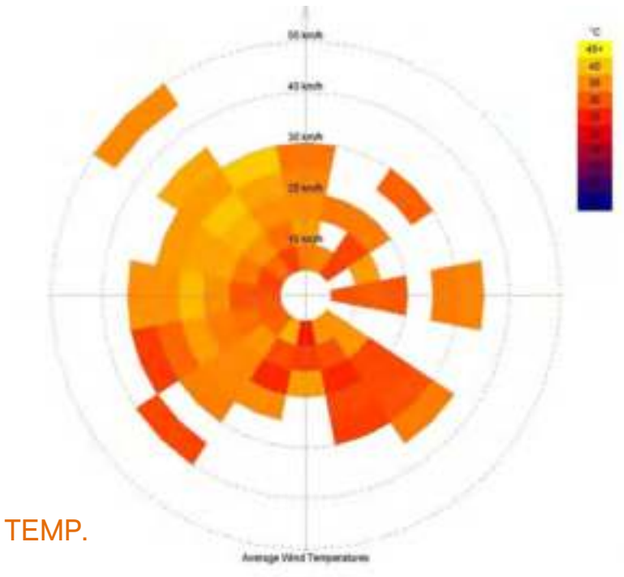
EXISTING TREES:
The site has a good network of mature existing trees - especially along the existing roads.

Climate data for Delhi [hide]													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °C (°F)	21.1 (70.0)	24.2 (75.6)	30.0 (86.0)	36.2 (97.2)	39.6 (103.3)	39.3 (102.7)	35.1 (95.2)	33.3 (91.9)	33.9 (93.0)	32.9 (91.2)	28.3 (82.9)	23.0 (73.4)	31.4 (88.5)
Average low °C (°F)	7.3 (45.1)	10.1 (50.2)	15.4 (59.7)	21.5 (70.7)	25.9 (78.6)	28.3 (82.9)	26.6 (79.9)	25.9 (78.6)	24.4 (75.9)	19.5 (67.1)	12.8 (55.0)	8.2 (46.8)	18.8 (65.8)
Rainfall mm (inches)	20.3 (0.799)	15.0 (0.591)	15.8 (0.622)	6.7 (0.264)	17.5 (0.689)	54.9 (2.161)	231.5 (9.114)	258.7 (10.185)	127.6 (5.031)	36.3 (1.429)	5.0 (0.197)	7.8 (0.307)	797.3 (31.39)
Avg. rainy days	1.7	1.3	1.2	0.9	1.4	3.6	10.0	11.3	5.4	1.6	0.1	0.6	39.1
Sunshine hours	213.9	217.5	238.7	261.0	263.5	198.0	167.4	176.7	219.0	269.7	246.0	217.0	2,688.4





WIND FREQUENCY



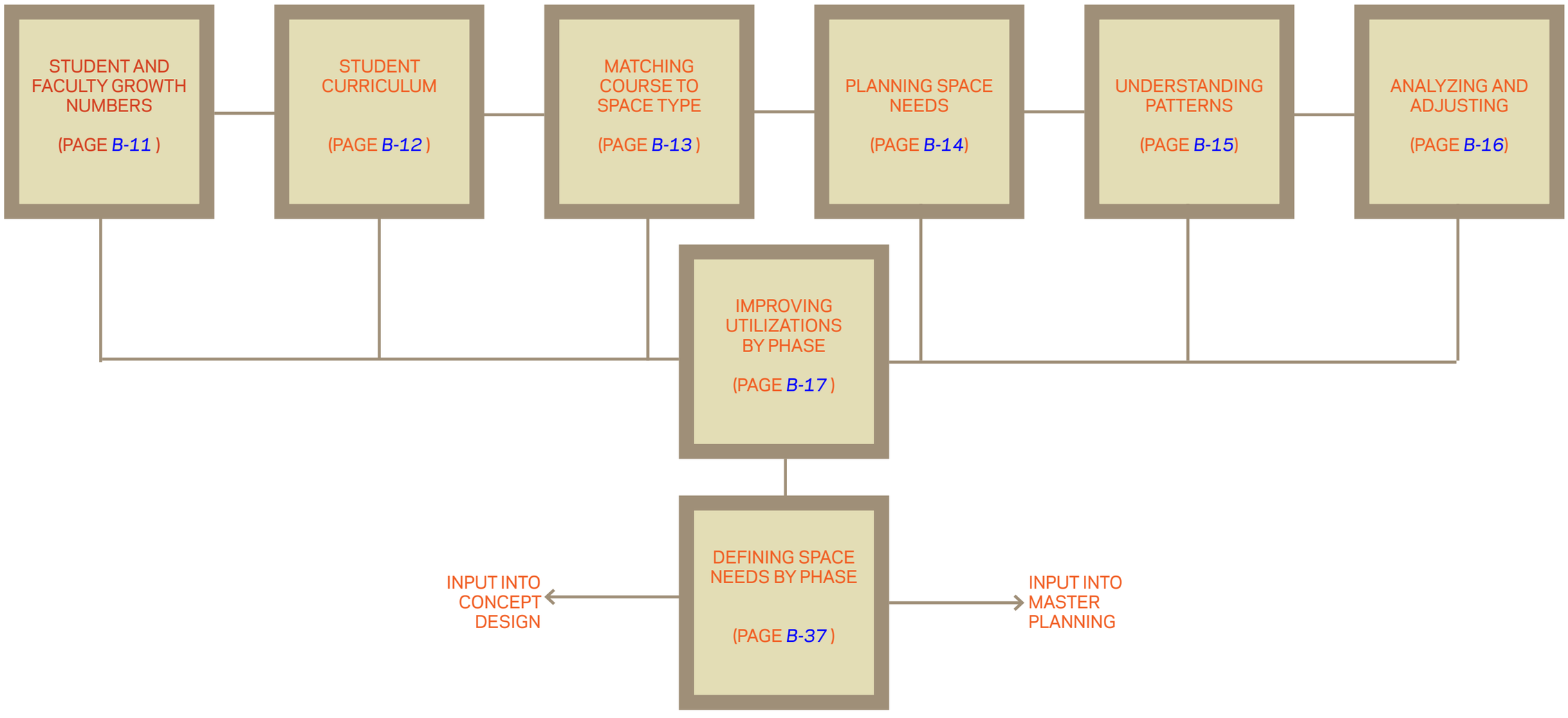
AVG. WIND TEMP.

Gurgaon has subtropical climate with high variation between summer and winter temperatures and precipitation. The city features dust storms, has relatively dry winters and has a prolonged spell of very hot weather. Summers start in early April and peak in May, with average temperatures near 32 °C (90 °F), although occasional heat waves can result in highs close to 45 °C (114 °F) on some days. The monsoon starts in late June and lasts until mid-September, with about 797.3 mm (31.5 inches) of rain. The average temperatures are around 29 °C (85 °F), although they can vary from around 25 °C (78 °F) on rainy days to 32 °C (90 °F) during dry spells. The monsoons recede in late September, and the post-monsoon season continues till late October, with average temperatures sliding from 29 °C (85 °F) to 21 °C (71 °F). Winter starts in November and peaks in January, with average temperatures around 12–13 °C (54–55 °F). Gurgaon's proximity to the Himalayas results in cold waves and the city is notorious for its heavy fog during the winter season.

WORKING THE NUMBERS

An important part of programming a university project is to understand and work the numbers. There are many variables and numerous inputs from client, consultants and other benchmarking data. For the purposes of the programming for BMU, we focussed on the following questions (all of which are discussed in details on the pages that follow)

- Student and faculty growth numbers; What are the university's plans for the disciplines they intend to teach and how many students will join the university and how will the enrollment grow over time?
- Student Curriculum: What are the students expected to learn on a semester basis throughout the course of their education?
- Matching courses with type of instructional space to be planned: We understand what they are studying, but what kind of space do they need?
- Planning student space needs: When are they in class and what are they studying
- Understanding Patterns: Who is on the campus and what are they studying?
- Analyzing and Adjusting: Analyze the interdependencies of the many factors and study their impact.
- Improving Utilizations: How can we adjust the many variables to come up with the most efficient combination of instructional spaces and high utilization of the spaces.
- Space Program: What is the make up of spaces by phase for the duration of the campus growth.



STUDENT AND FACULTY ENROLLMENT

Student enrollment numbers given by the client show how the student strength is anticipated to grow throughout the development of the university. On an average more than 70% of the students will be in engineering related field and 20% in business related programs.

STUDENT ENROLLMENT (NUMBERS)

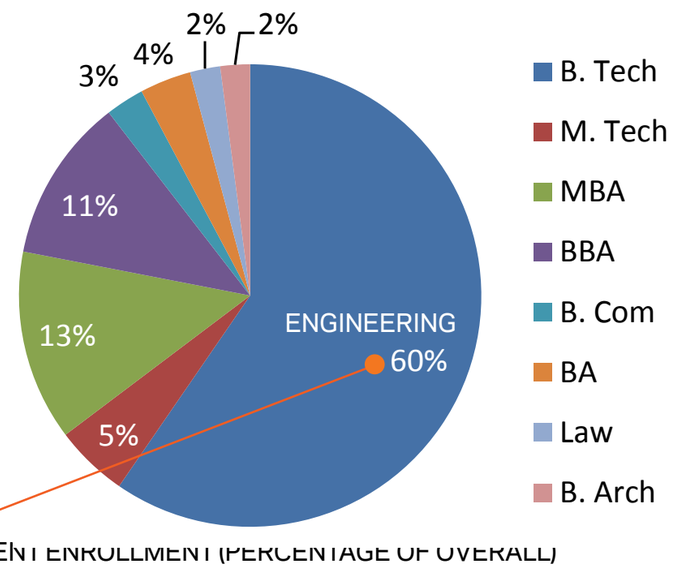
Course	Name	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
B. Tech	Bachelor of Technology	300	840	1,380	1,980	2,340	2,820	3,660	4,680	5,640	6,240	6,480	6,480
M. Tech	Master of Technology		60	180	240	240	240	300	420	540	600	600	600
MBA	Master of Business Administration	60	180	360	540	600	600	720	960	1,200	1,380	1,440	1,440
BBA	Bachelor of Business Administration	60	180	360	480	540	540	600	720	900	1,020	1,080	1,080
B. Com	Bachelor of Commerce			45	90	135	180	180	270	360	405	405	405
BA	Bachelor of Arts			60	120	180	240	240	360	480	540	540	540
Law	Law			25	50	75	100	150	200	275	350	425	475
B. Arch	Bachelor of Architecture			30	60	90	120	150	210	270	330	360	360
	TOTAL	420	1,260	2,440	3,560	4,200	4,840	6,000	7,820	9,665	10,865	11,330	11,380

STUDENT ENROLLMENT (PERCENTAGE OF OVERALL)

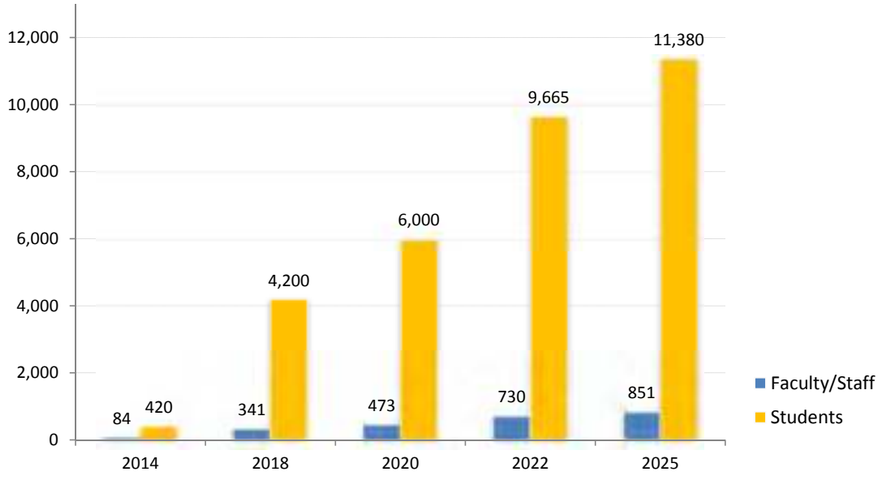
Course	Name	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	AVERAGE
B. Tech	Bachelor of Technology	71%	67%	57%	56%	56%	58%	61%	60%	58%	57%	57%	57%	60%
M. Tech	Master of Technology		5%	7%	7%	6%	5%	5%	5%	6%	6%	5%	5%	5%
MBA	Master of Business Administration	14%	14%	15%	15%	14%	12%	12%	12%	12%	13%	13%	13%	13%
BBA	Bachelor of Business Administration	14%	14%	15%	13%	13%	11%	10%	9%	9%	9%	10%	9%	11%
B. Com	Bachelor of Commerce			2%	3%	3%	4%	3%	3%	4%	4%	4%	4%	3%
BA	Bachelor of Arts			2%	3%	4%	5%	4%	5%	5%	5%	5%	5%	4%
Law	Law			1%	1%	2%	2%	3%	3%	3%	3%	4%	4%	2%
B. Arch	Bachelor of Architecture			1%	2%	2%	2%	3%	3%	3%	3%	3%	3%	2%
	TOTAL	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

STREAM WISE ENROLLMENT OF STUDENTS

Course	Name	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
B. Tech	Bachelor of Technology												
	Computer Science	60	180	300	420	480	540	660	780	900	960	960	960
	Electrical Engineering	60	180	300	420	480	540	660	840	1,020	1,140	1,200	1,200
	Electronics and Communications	60	120	180	240	300	420	600	780	900	960	960	960
	Mechanical Engineering	60	180	300	420	480	540	660	840	1,020	1,140	1,200	1,200
	Civil Engineering	60	120	180	300	360	480	600	660	720	720	720	720
	Others		60	120	180	240	300	480	780	1,080	1,320	1,440	1,440
	TOTAL	300	840	1,380	1,980	2,340	2,820	3,660	4,680	5,640	6,240	6,480	6,480
M. Tech	Master of Technology												
	Computer Science		20	60	80	80	80	80	120	160	160	160	160
	Electrical Engineering		20	40	40	40	40	60	80	100	120	120	120
	Electronics and Communications		20	40	40	40	40	60	80	100	120	120	120
	Mechanical Engineering			20	40	40	40	60	80	100	120	120	120
	Civil Engineering			20	40	40	40	40	60	80	80	80	80
	TOTAL		60	160	200	200	200	260	360	460	520	520	520



STUDENT ENROLLMENT (PERCENTAGE OF OVERALL)



POPULATION	2014	2018	2020	2022	
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Faculty	32	238	336	536	634
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TOTAL (STAFF+STUDENTS)	504	4,541	6,473	10,395	12,231

OVERALL GROWTH OF STUDENT AND FACULTY

STUDENT CURRICULUM

While it is difficult for any university to have a detailed curriculum for every stream and every batch, it remains important nonetheless that an attempt be made to reasonably establish what types of courses would be offered during every semester the student is enrolled in. The client provided a model program for the engineering degree students. Through the early part of the programming the curriculum was enhanced and modified through input received from various other engineering institutions throughout the country. The programming document prepared by HOK gives the client an opportunity to make changes to the curriculum as new information is developed. The curriculum is important because it allows us to match the right type of teaching space for the course being taught (see page *B-13*). The chart below shows a partial representation of the curriculum.

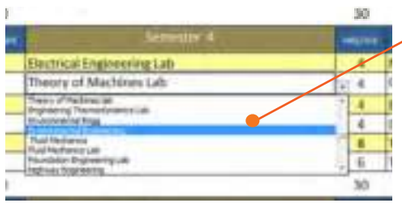
B'Tech Civil	Semester 1	HRS/WK	Semester 2	HRS/WK	Semester 3	HRS/WK	Semester 4	HRS/WK
BT-CE1	Basic Electrical & Electronics Lab	4	Chemistry Lab	4	Environmental Engineering	4	Computer Lab(Transportation Engineering)	4
BT-CE2	Computer Programming Lab	4	Material Sciences	4	Strength of Materials Lab	4	Design Concepts	4
BT-CE3	Engineering Graphics	4	Workshops	4	Survey Lab	4	Survey Lab II	4
BT-CE4	Physics lab	4	Engineering Drawing	4	Hydrology & Hydraulics	4	Engineering Mechanics	4
BT-CE5	Typical Lecture	8	Typical Lecture	8	Typical Lecture	8	Typical Lecture	8
BT-CE6	Tutorial	6	Tutorial	6	Tutorial	6	Tutorial	6
		30		30		30		30

B'Tech Computer Science	Semester 1	HRS/WK	Semester 2	HRS/WK	Semester 3	HRS/WK	Semester 4	HRS/WK
BT-CS1	Chemistry lab	4	Basic Electrical & Electronics Lab	4	Database Systems Lab	4	Microprocessors	4
BT-CS2	Computer Programming Lab	4	Data Structures & Computer Programming Lab	4	Digital Electronics and Communications Lab	4	Multimedia Development Lab	4
BT-CS3	Electrical Circuits Analysis Lab	4	Computer Graphics	4	Object Oriented Systems and Programming Lab	4	Signals and Systems Lab	4
BT-CS4	Physics lab	4	Workshops	4	Unix Programming Lab	4	Design Practices in Computer Science	4
BT-CS5	Typical Lecture	8	Typical Lecture	8	Typical Lecture	8	Typical Lecture	8
BT-CS6	Tutorial	10	Tutorial	6	Tutorial	6	Tutorial	6
		34		30		30		30

B'Tech Mechanical	Semester 1	HRS/WK	Semester 2	HRS/WK	Semester 3	HRS/WK	Semester 4	HRS/WK
BT-ME1	Computer Programming Lab	4	Chemistry Lab	4	Analogue Electronics Lab	4	Machine Tool Engineering Lab	4
BT-ME2	Basic Electrical & Electronics Lab	4	Engineering Mechanics	4	Engineering Thermodynamics Lab	4	Strength of Materials Lab	4
BT-ME3	Physics lab	4	Theory of Machines lab	4	Casting,Welding and Forming	4	Design of Machine Elements Lab	4
BT-ME4	Workshops	4	Material Sciences	4	Fluid Mechanics Lab	4	Thermodynamics II	4
BT-ME5	Typical Lecture	8	Typical Lecture	8	Typical Lecture	8	Typical Lecture	8
BT-ME6	Tutorial	6	Tutorial	6	Tutorial	6	Tutorial	6
		30		30		30		30

B'Tech Electrical	Semester 1	HRS/WK	Semester 2	HRS/WK	Semester 3	HRS/WK	Semester 4	HRS/WK
BT-EE1	Basic Electrical & Electronics Lab	4	Chemistry lab	4	Electrical Engineering Lab	4	Electrical Engineering Lab	4
BT-EE2	Physics lab	4	Networks Analysis Lab	4	Electronic Devices Lab	4	Theory of Machines Lab	4
BT-EE3	Workshops	4	Electric Drives	4	Measurement Lab	4	Integrated Circuits Lab	4
BT-EE4	Computer Programming	4	Engineering Graphics	4	Programming Language Lab	4	Analog Lab	4
BT-EE5	Typical Lecture	8	Typical Lecture	8	Typical Lecture	8	Typical Lecture	8
BT-EE6	Tutorial	6	Tutorial	6	Tutorial	6	Tutorial	6
		30		30		30		30

Note: The full version of the curriculum is available by soft copy with the client and the design team.



Drop down box allows user to change courses for any engineering stream for any semester or any class. This information is used later to determine the special type of laboratory or classroom that may be required for instructional purposes

MATCHING COURSES WITH TEACHING SPACES

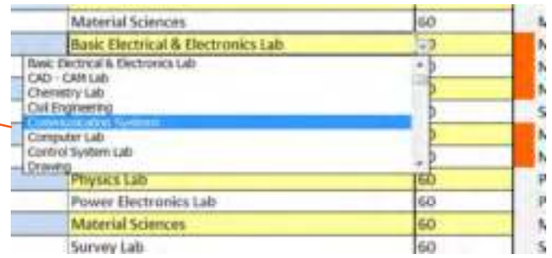
An important step in the collection of data was developing an understanding of the actual type of spaces required for each course being taught. Some courses were highly specialized requiring very unique teaching spaces such as laboratories or specialized workshops. Others were fairly straight forward in that the classes could be taught in a generic classroom or perhaps a generic laboratory. The client gave the design team their first cut of the matching between the classes and their associated spaces. During the programming process, the design team interacted with various faculty members from engineering institutions in the country and provided input based on their own experience to provide the best match.

As the detailed requirements for the individual instructional spaces were developed it became evident that many teaching spaces (with unique names) were quite similar to other spaces (with equally unique sounding names). By reducing the many different type of spaces the university could greatly improve the utilization of their classroom and laboratory spaces by making them available to a larger group of students.

HIGHLIGHT INDICATES WHERE CHANGES MADE TO CLIENT'S PROPOSED LAB ASSIGNMENTS

COURSE NAME	LAB TYPE (REVISED)	BATCH SIZE	LAB TYPE (PER CLIENT)
Analog Lab	Basic Electrical & Electronics Lab	60	Analog Lab
Analogue Electronics Lab	Basic Electrical & Electronics Lab	60	Analog Lab
Basic Electrical & Electronics Lab	Basic Electrical & Electronics Lab	60	Basic Electrical & Electronics Lab
Devices and Circuit simulation Lab	Basic Electrical & Electronics Lab	60	Basic Electrical & Electronics Lab
Electrical Circuits Analysis Lab	Basic Electrical & Electronics Lab	60	Basic Electrical & Electronics Lab
Electrical Engineering Lab	Basic Electrical & Electronics Lab	60	Basic Electrical & Electronics Lab
Electronic Devices Lab	Basic Electrical & Electronics Lab	60	Basic Electrical & Electronics Lab
Integrated Circuits Lab	Basic Electrical & Electronics Lab	60	Basic Electrical & Electronics Lab
Advanced Mechanical Design	Computer Lab	60	CAD - CAM Lab
CAD/CAM Lab	Computer Lab	60	CAD - CAM Lab
Design Concepts	Computer Lab	60	CAD - CAM Lab
Design of Machine Elements Lab	Computer Lab	60	CAD - CAM Lab
Chemistry Lab	Chemistry Lab	60	Chemistry Lab
RF and Microwave Engg.	Communication Systems	60	Communication Systems
Communication Systems	Communication Systems	60	Communication Systems
Digital Electronics and Communications Lab	Communication Systems	60	Communication Systems
Digital Signal Processing Lab	Communication Systems	60	Communication Systems
Digital Systems Lab	Communication Systems	60	Communication Systems
Signals and Systems Lab	Communication Systems	60	Communication Systems
Telecommunication Networks Lab	Communication Systems	60	Communication Systems
Computer Organization and Operating system	Computer Lab	60	Computer Lab
Computer Programming	Computer Lab	60	Computer Lab
Artificial Intelligence	Computer Lab	60	Computer Lab
Compiler design	Computer Lab	60	Computer Lab
Computer Graphics	Computer Lab	60	Computer Lab
Computer Lab	Computer Lab	60	Computer Lab
Computer Lab (Estimation, Costing & Valuation)	Computer Lab	60	Computer Lab
Computer Lab(Transportation Engineering)	Computer Lab	60	Computer Lab
Computer Programming	Computer Lab	60	Computer Lab
Computer Programming Lab	Computer Lab	60	Computer Lab
Data Structures & Computer Programming Lab	Computer Lab	60	Computer Lab
Database Systems Lab	Computer Lab	60	Computer Lab
Design Practices in Computer Science	Computer Lab	60	Computer Lab
Digital Hardware Design	Computer Lab	60	Computer Lab
Embedded System Design Laboratory	Computer Lab	60	Computer Lab
Engineering Graphics	Computer Lab	60	Computer Lab
Microprocessors	Computer Lab	60	Computer Lab
Multimedia Development Lab	Computer Lab	60	Computer Lab
Object Oriented Systems and Programming Lab	Computer Lab	60	Computer Lab
Operating Systems	Computer Lab	60	Computer Lab
Optional	Computer Lab	60	Computer Lab
Programming Language Lab	Computer Lab	60	Computer Lab
Robotics	Computer Lab	60	Computer Lab
Robotics Engineering	Computer Lab	60	Computer Lab
Software Engineering	Computer Lab	60	Computer Lab

Note: The full version of this information is available by soft copy with the client and the design team.



Drop down box allows user to change the type of instructional space for the corresponding course as the needs change or additional details are available.

The information changed here impacts directly the number of teaching spaces.

PLANNING STUDENT SPACE NEEDS

Once the client furnished data was analyzed, the design team worked closely with the client team to understand how students would use the instructional spaces. This stage was important because we needed to understand how many hours a day (and week) each student would spend and in what type of instructional space.

We charted each stream for each enrollment year and for every semester starting with 2014 all the way to 2025. Needless to say this process was tedious and involved a fair amount of guesswork. However, because it was tied to assumptions of curriculum (i.e. How many classes and how many hours per week) and space needs (what course and type of space), it provides real relevant data for programming. For one, it gave us the total number of instructional spaces as well as their utilization. Second, it also allowed us to understand better who was on the campus at any point of time

DISCIPLINE AND YEAR

Each student enrolling on campus is tagged to a unique number which provides important details: such as:

B. Tech CS 14

Program: B. Tech

Stream: Computer Science

Year of Enrollment: 2014

SEMESTER

SEMESTER 1

SEMESTER

SEMESTER 2

	MAJOR	COURSE	BATCH	COURSE	LAB TYPE	WEEK HOURS NEEDED	MON	TUE	WED	THU	FRI	HOURS ACCOMODATED
B. Tech CS14	BT-CS1	1	2014	Chemistry lab	Chemistry Lab	4	X	X				4
B. Tech CS14	BT-CS2	2	2014	Computer Programming Lab	Computer Lab	4		X	X			4
B. Tech CS14	BT-CS3	3	2014	Electrical Circuits Analysis Lab	Basic Electrical & Electronics Lab	4	X			X		4
B. Tech CS14	BT-CS4	4	2014	Physics lab	Physics Lab	4				X	X	4
B. Tech CS14	BT-CS5	5	2014	Typical Lecture	Typical Classroom	8	X	X	X		X	8
B. Tech CS14	BT-CS6	6	2014	Tutorial	Tutorial Room	10			X	X	X	6
					TOTAL		6	6	6	6	6	30
B. Tech EE14	BT-EE1	1	2014	Basic Electrical & Electronics Lab	Basic Electrical & Electronics Lab	4	X	X				4
B. Tech EE14	BT-EE2	2	2014	Physics lab	Physics Lab	4		X	X			4
B. Tech EE14	BT-EE3	3	2014	Workshops	Workshop	4			X	X		4
B. Tech EE14	BT-EE4	4	2014	Computer Programming	Computer Lab	4				X	X	4
B. Tech EE14	BT-EE5	5	2014	Typical Lecture	Typical Classroom	8	X	X	X		X	8
B. Tech EE14	BT-EE6	6	2014	Tutorial	Tutorial Room	6	X			X	X	6
					TOTAL		6	6	6	6	6	30
B. Tech EC14	BT-EC1	1	2014	Basic Electrical & Electronics Lab	Basic Electrical & Electronics Lab	4	X	X				4
B. Tech EC14	BT-EC2	2	2014	Computer Programming Lab	Computer Lab	4		X	X			4
B. Tech EC14	BT-EC3	3	2014	Electrical Circuits Analysis Lab	Basic Electrical & Electronics Lab	4			X	X		4
B. Tech EC14	BT-EC4	4	2014	Physics lab	Physics Lab	4				X	X	4
B. Tech EC14	BT-EC5	5	2014	Typical Lecture	Typical Classroom	8	X	X	X		X	8
B. Tech EC14	BT-EC6	6	2014	Tutorial	Tutorial Room	6	X			X	X	6
					TOTAL		6	6	6	6	6	30
B. Tech ME14	BT-ME1	1	2014	Computer Programming Lab	Computer Lab	4	X	X				4
B. Tech ME14	BT-ME2	2	2014	Basic Electrical & Electronics Lab	Basic Electrical & Electronics Lab	4		X	X			4
B. Tech ME14	BT-ME3	3	2014	Physics lab	Physics Lab	4			X	X		4
B. Tech ME14	BT-ME4	4	2014	Workshops	Workshop	4				X	X	4
B. Tech ME14	BT-ME5	5	2014	Typical Lecture	Typical Classroom	8	X	X	X		X	8

COURSE	LAB TYPE	HOURS NEEDED PER BATCH	MON
Basic Electrical & Electronics Lab	Basic Electrical & Electronics Lab	4	X
Data Structures & Computer Progr	Computer Lab	4	
Computer Graphics	Computer Lab	4	
Workshops	Workshop	4	
Typical Lecture	Typical Classroom	8	X
Tutorial	Tutorial Room	6	X
	TOTAL		6
Chemistry lab	Chemistry Lab	4	X
Networks Analysis Lab	Basic Electrical & Electronics Lab	4	
Electric Drives	Basic Electrical & Electronics Lab	4	
Engineering Graphics	Computer Lab	4	
Typical Lecture	Typical Classroom	8	X
Tutorial	Tutorial Room	6	X
	TOTAL		6
Chemistry lab	Chemistry Lab	4	X
Data Structures & Computer Progr	Computer Lab	4	
Engineering Drawing	Drawing	4	
Networks Analysis Lab	Basic Electrical & Electronics Lab	4	
Typical Lecture	Typical Classroom	8	X
Tutorial	Tutorial Room	6	X
	TOTAL		6
Chemistry Lab	Chemistry Lab	4	
Engineering Mechanics	Engineering Mechanics	4	X
Theory of Machines lab	Engineering Mechanics	4	
Material Sciences	Material Sciences	4	X
Typical Lecture	Typical Classroom	8	

COURSE NAME
ENROLLMENT YEAR
COURSE NUMBER
CLASS / LAB TYPE
DAY OF THE WEEK CLASS BEING TAKEN
TOTAL NUMBER OF HOURS

Note: The image above only shows 2 semesters of planning for 4 different batches of the university. The full details of course planning for each discipline, stream, semester and year of enrollment are available in soft copy format with the client.

UNDERSTANDING PATTERNS

An important step in the programming process of a university campus is the notion of "PATTERNING"

Simply put, it has to do with understanding who is on campus at any given time. As the campus grows and new students enroll in the many different streams offered, the picture of who is taking what class and when can be easily lost.

In other words as students advance through the semesters and new ones are added the mix is changing constantly.

For example in 2016 (see first set of columns) the campus will cater to students from:
- 2014 Batch, Semester 5
- 2015 Batch , Semester 3
- 2016 Batch, Semester 1

In 2018 (see second set of columns) the university will cater to:
- 2014 Batch, Semester 9
- 2015 Batch, Semester 7
- 2016 Batch, Semester 5
- 2017 Batch, Semester 3
- 2018 Batch, Semester 1

The university plans to offer 17 distinct programs to about 2400 students and 2016 and 4200 students just two years later in 2018.

If we take just one Program (Computer Science, in the example on this page), one can see the mix of courses that would be offered on a daily basis from Monday through Friday and the types of classroom spaces needed.

This is an essential piece of information, because knowing this allows us to best organize classrooms throughout the day so we can avoid duplication and increase utilization of classroom space.

The programming team studied the "patterning" for all 17 disciplines for each year between 2014 and 2025. The data was analyzed next to ascertain the best combination of classroom spaces needed for the university.

2016 "PATTERN"

2014 BATCH, SEMESTER - 5
2015 BATCH, SEMESTER - 3
2016 BATCH, SEMESTER - 1

POPULATION	NO
Students	2,440
Faculty	144
Non Academic Staff	80
TOTAL	2,664

SEMESTER 5

COURSE	LAB TYPE	MON	TUE	WED	THU	FRI
Communication Systems	Communication Systems	X	X			
Operating Systems	Computer Lab				X	X
Software Engineering	Computer Lab		X	X		
Web Technology	Computer Lab			X	X	
Typical Lecture	Typical Classroom	X	X	X		X
Tutorial	Tutorial Room	X			X	X

SEMESTER 3

COURSE	LAB TYPE	MON	TUE	WED	THU	FRI
Database Systems Lab	Computer Lab	X	X			
Digital Electronics and Communic	Communication Systems	X	X			
Object Oriented Systems and Prog	Computer Lab			X	X	
Unix Programming Lab	Computer Lab				X	X
Typical Lecture	Typical Classroom	X	X	X		X
Tutorial	Tutorial Room			X	X	X

SEMESTER 1

COURSE	LAB TYPE	MON	TUE	WED	THU	FRI
Chemistry lab	Chemistry Lab	X	X			
Computer Programming Lab	Computer Lab		X	X		
Electrical Circuits Analysis Lab	Basic Electrical & Electronics Lab			X	X	
Physics lab	Physics Lab				X	X
Typical Lecture	Typical Classroom	X	X	X		X
Tutorial	Tutorial Room	X			X	X

2018 "PATTERN"

2014 BATCH, SEMESTER - 9
2015 BATCH, SEMESTER - 7
2016 BATCH, SEMESTER - 5
2017 BATCH, SEMESTER - 3
2018 BATCH, SEMESTER - 1

POPULATION	NO
Students	4,200
Faculty	238
Non Academic Staff	103
TOTAL	4,541

SEMESTER 9

COURSE	LAB TYPE	MON	TUE	WED	THU	FRI

SEMESTER 7

COURSE	LAB TYPE	MON	TUE	WED	THU	FRI
Digital Hardware Design	Computer Lab	X	X			
Embedded System Design Laborat	Computer Lab			X	X	
Computer Graphics	Computer Lab				X	X
Optional	Computer Lab	X	X			
Typical Lecture	Typical Classroom	X		X		X
Tutorial	Tutorial Room		X		X	X

SEMESTER 3

COURSE	LAB TYPE	MON	TUE	WED	THU	FRI
Database Systems Lab	Computer Lab	X	X			
Digital Electronics and Communic	Communication Systems	X	X			
Object Oriented Systems and Prog	Computer Lab			X	X	
Unix Programming Lab	Computer Lab				X	X
Typical Lecture	Typical Classroom	X	X	X		X
Tutorial	Tutorial Room			X	X	X

SEMESTER 3

COURSE	LAB TYPE	MON	TUE	WED	THU	FRI
Database Systems Lab	Computer Lab	X	X			
Digital Electronics and Communic	Communication Systems	X	X			
Object Oriented Systems and Prog	Computer Lab			X	X	
Unix Programming Lab	Computer Lab				X	X
Typical Lecture	Typical Classroom	X	X	X		X
Tutorial	Tutorial Room			X	X	X

SEMESTER 1

COURSE	LAB TYPE	MON	TUE	WED	THU	FRI
Chemistry lab	Chemistry Lab	X	X			
Computer Programming Lab	Computer Lab	X	X			
Electrical Circuits Analysis Lab	Basic Electrical & Electronics Lab			X	X	
Physics lab	Physics Lab				X	X
Typical Lecture	Typical Classroom	X	X	X		X
Tutorial	Tutorial Room			X	X	X

ACADEMIC SPACE UTILIZATION

Based upon the data collected and our own analysis of patterning, lab use, curriculum, the team took a detailed look at the quantities and types of academic teaching spaces needed to satisfy the many different streams as well as the student enrollment numbers. Where possible we grouped similar functions to allow us to reduce the number of spaces needed. We also looked at utilization of each space across the inventory for each year. In general the more unique the space the lower was the utilization.

UTILIZATION STUDY FOR YEAR 2016

ACADEMIC AREAS	UTILIZATION	UNITS	AREA	SM
Analog Lab				
Basic Electrical & Electronics Lab	72%	4	180	720
CAD - CAM Lab				
Chemistry Lab	23%	1	180	180
Civil Engineering				
Communication Systems	67%	1	180	180
Computer Lab	94%	4	150	600
Control System Lab	7%	1	180	180
Drawing	3%	1	300	300
Electrical Drives				
Electrical Engineering				
Engineering Mechanics	40%	1	180	180
Environmental Engg	7%	1	180	180
Fluid Mechanics Lab	40%	1	180	180
Hydrology & Hydraulics	27%	1	180	180
Internal Combustion Engines Lab	13%	1	180	180
Machine Tool Engineering Lab	27%	1	330	330
Material Sciences	53%	2	180	360
Networks Lab				
Physics Lab	27%	2	180	360
Power Electronics Lab	7%	1	180	180
Survey Lab	13%	1	60	60
Thermodynamics	80%	1	180	180
Workshop	48%	1	330	330
Typical Classroom	92%	14	120	1,680
Tutorial Room	91%	12	60	720
Architectural Studio	30%	1	180	180
Generic Laboratory	57%	2	180	360
Mock Court				
Mtech Lab - Generic	85%	5	90	450
MTech Lab - CE				
MTech Lab - CS				
Mtech Lab - ME				
Mtech Lab - EE				
Mtech Lab - EC				
	Subtotal	60		8,250
	Circulation			3,300
	TOTAL ACADEMIC AREAS			11,550

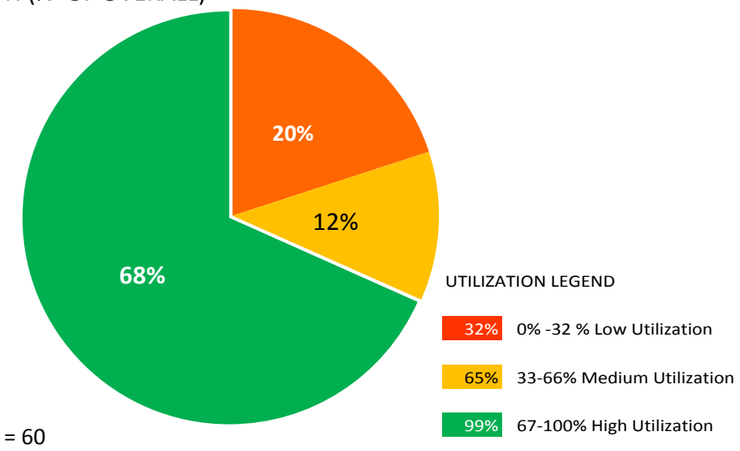
The utilization study was run for each year and the team ran comparisons from one year to the next to establish a strategy for build up of space. The results are viewed in a simple color coded manner to provide a visual guide of overall utilization. Please see Appendix for a year by year utilization study.

Top 5 Most Used Spaces		No.
1 Computer Lab	94%	4
2 Typical Classroom	92%	14
3 Tutorial Room	91%	12
4 Mtech Lab - Generic	85%	5
5 Thermodynamics	80%	1

Top 5 Built Spaces	No.
1 Typical Classroom	14
2 Tutorial Room	12
3 Mtech Lab - Generic	5
4 Basic Electrical & Electronics Lab	4
5 Computer Lab	4

Least Used Space		No.
1 Drawing	3%	1

TEACHING SPACE UTILIZATION (% OF OVERALL)



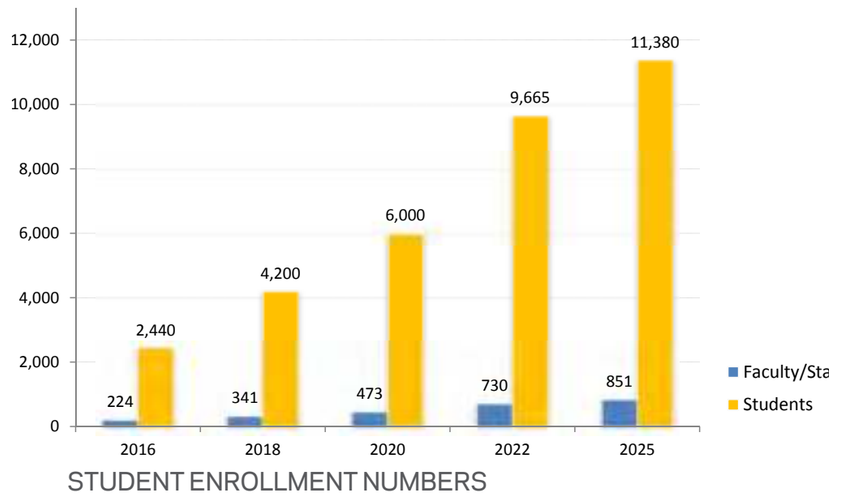
NUMBER OF TEACHING ROOMS = 60

IMPROVING UTILIZATION

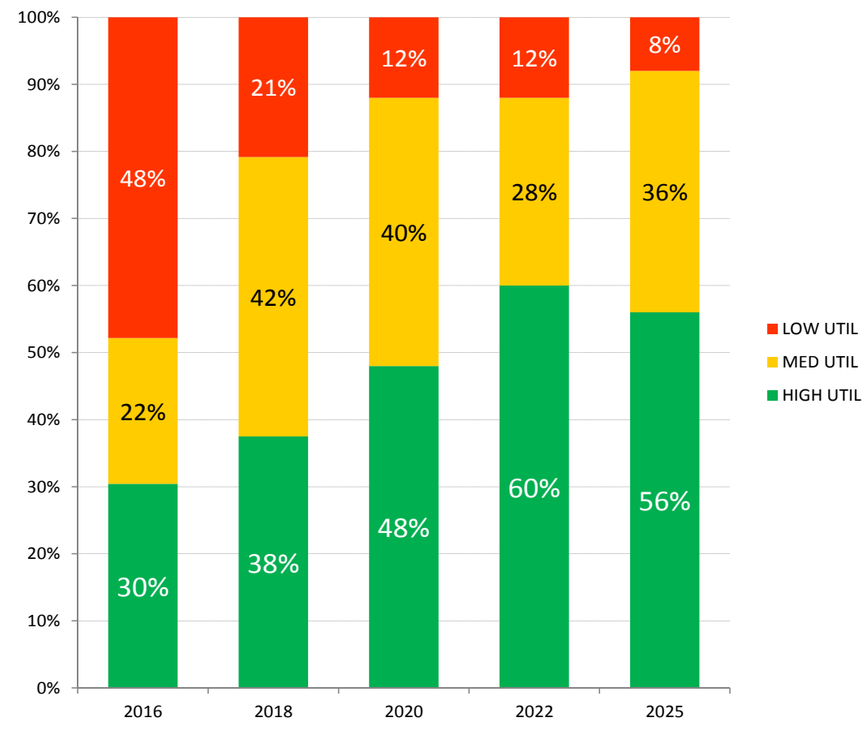
An obvious observation during programming analysis was the low utilizations of specialized spaces during the early years of the university. Between 2016 and 2025 the university plans to increase its enrollment 5 fold while the disciplines and streams remain relatively the same. As more students are added, the utilization of spaces improves significantly as evidenced in the larger blocks of green in the table below.

POPULATION (SEE CHART 1)	2016	2018	2020	2022	2025
Students	2,440	4,200	6,000	9,665	11,380
Faculty	144	238	336	536	634
Non Academic Staff	80	103	137	194	217
TOTAL (STAFF+STUDENTS)	2,664	4,541	6,473	10,395	12,231

UTILIZATION OF ACADEMIC SPACES	2016	2018	2020	2022	2025
Analog Lab					
Basic Electrical & Electronics Lab	72%	88%	93%	91%	92%
CAD - CAM Lab					
Chemistry Lab	23%	27%	53%	57%	57%
Civil Engineering		53%	53%	80%	80%
Communication Systems	67%	60%	90%	82%	88%
Computer Lab	94%	90%	92%	96%	99%
Control System Lab	7%	67%	67%	73%	83%
Drawing	3%	7%	10%	10%	10%
Electrical Drives					
Electrical Engineering					
Engineering Mechanics	40%	50%	60%	68%	76%
Environmental Engg	7%	40%	47%	60%	60%
Fluid Mechanics Lab	40%	40%	33%	36%	36%
Hydrology & Hydraulics	27%	40%	67%	80%	80%
Internal Combustion Engines Lab	13%	27%	27%	27%	33%
Machine Tool Engineering Lab	27%	27%	40%	33%	33%
Material Sciences	53%	67%	80%	87%	87%
Networks Lab					
Physics Lab	27%	33%	42%	47%	47%
Power Electronics Lab	7%	33%	40%	67%	63%
Survey Lab	13%	27%	40%	40%	40%
Thermodynamics	80%	53%	67%	80%	89%
Workshop	48%	55%	51%	62%	67%
Typical Classroom	92%	99%	98%	98%	99%
Tutorial Room	91%	97%	98%	99%	99%
Architectural Studio	30%	81%	70%	81%	93%
Generic Laboratory	57%	77%	83%	97%	99%
Mock Court			4%	4%	13%
Mtech Lab - Generic	85%	83%	87%	97%	48%



STUDENT ENROLLMENT NUMBERS



UTILIZATION OVER TIME

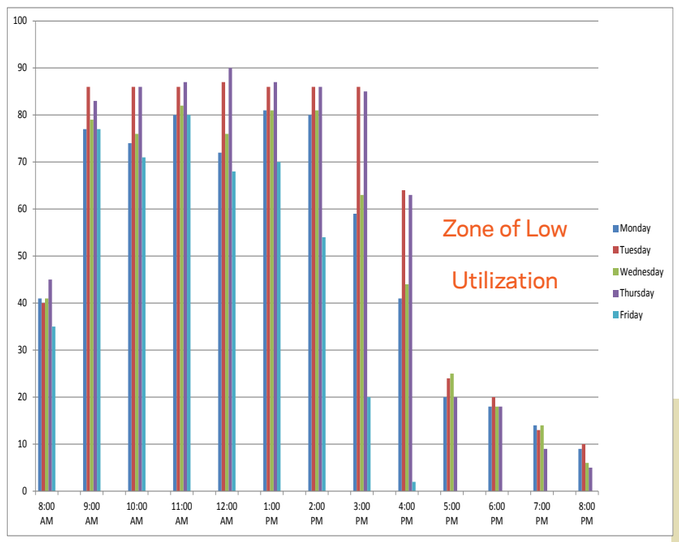
LESSONS LEARNT

Even the best of established universities today are facing a serious challenge to their building programs on account of many issues that have evolved as their institutions have grown.

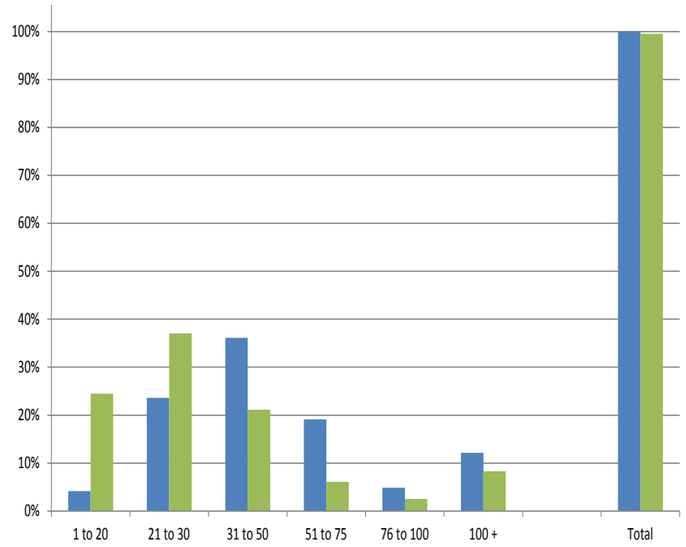
The changes have been small and have occurred over a span of several years. And while the incremental problems may not have been as noticeable on a year to year basis, the cumulative affect has been quite serious for many. Typical problems faced include:

- Mismatch between Supply and Demand of teaching spaces
- Administration and Scheduling of classroom spaces.
- Changes in Pedagogy and higher learning.
- Designing for the unknown.

During the early programming stage, the design team and client team recognized these issues and set upon to examine them in greater detail and approach the programming process in a systematic manner to address them.



UNIVERSITY OF NORTH CAROLINA, CHAPEL HILL
Sources: University of North Carolina, Classroom Utilization & Mix Analysis



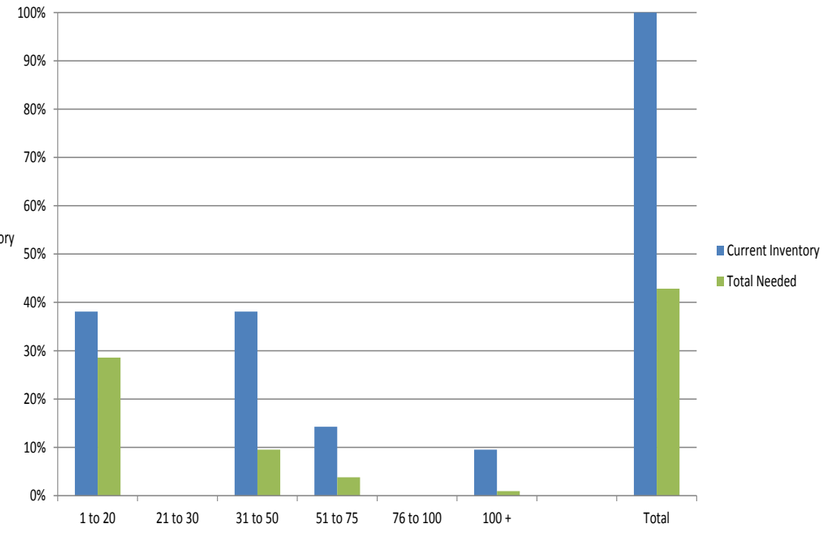
Seating Capacity of Classrooms versus Batch Size of Scheduled Classes
UNIVERSITY OF ARIZONA
Sources: University of Arizona, Instructional Space Utilization Analysis Report

Mismatch between Supply and Demand of teaching spaces

While many universities we studied reported having the correct overall square footage of academic spaces they found many spaces were under utilized. One of the reasons for under utilization was that the spaces were not of the correct size or configuration. As class sizes and teaching trends have changed universities that built inflexible teaching spaces found a hard time filling out the spaces and departments often competing for the few adequately sized classrooms available.

At Arizona State University (graph above) : Almost 75% of the classes are small, with strengths of 40 or fewer students. This has triggered a demand for 'right sizing' the current inventory, especially in terms of creating more small-size classrooms.

At Stanford University The overwhelming majority of classes (86%) are small, with enrollments of 30 or fewer. By contrast, more than half of the inventory accommodates 30 or more students.

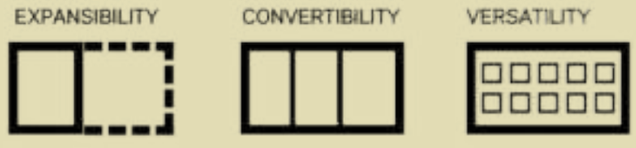


Seating Capacity of Classrooms versus Batch Size of Scheduled Classes
DARTMOUTH COLLEGE
Sources: SCUP -39 Annual Conference.

Administration and Scheduling of classroom spaces.

Most universities tend to have peaks during which most classes and laboratories are held. Outside of these peak hours the utilization drops off tremendously. The peaks occur between the hours of 9:00 AM and 2:00 PM for most universities (see graph on left). The afternoon and evening hours have very low utilizations. By scheduling classes over a longer stretch of the day utilizations can be improved, resulting in reduction to the need of building more spaces.

At Dartmouth College (graph above): For each room size, there are a greater number of hours available for scheduling than there are courses. This indicates more spaces built out than necessary.

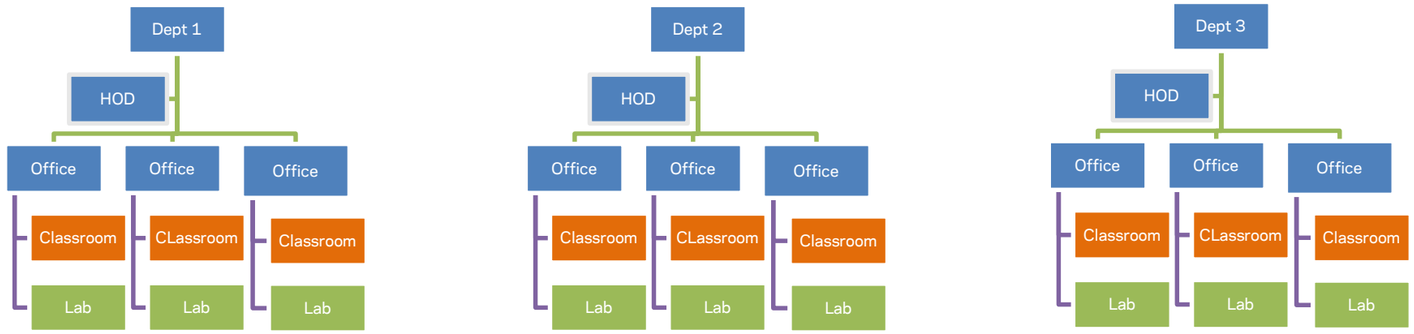


Flexibility, Convertibility and Versatility of spaces can result in higher utilizations . These concepts are discussed on page B-23

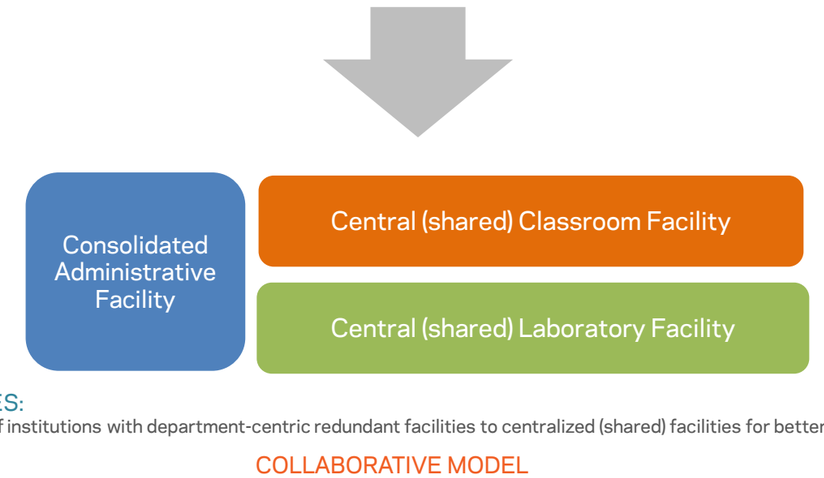
FUNCTIONAL RELATIONSHIPS

Established universities tend to have departmental Hierarchies and separations often resulting in duplication of spaces and resources. By combining resources through centralized university administration much of the duplication can be avoided. This results in higher optimization and less construction of physical spaces.

Not only does this help reduce the amount of built space, it fosters greater interdisciplinary learning through the many interactions that occur when faculty and students from many streams when they have to be next to each other in the same space.



TRADITIONAL UNIVERSITY SET-UP WITH MULTIPLE DEPARTMENTS



CONSOLIDATED FACILITIES:

Change the traditional approach of institutions with department-centric redundant facilities to centralized (shared) facilities for better utilization and cost savings.

COLLABORATIVE MODEL

CENTRALIZED SCHEDULING OF CLASSROOM SPACES FOSTERS GREATER COLLABORATION AND BETTER UTILIZATION OF INSTRUCTIONAL SPACES

CHANGES IN PEDAGOGY

Teaching spaces today have gone through many changes because of the way pedagogy has changed in recent years. Lecture format which was very typical in the past has now changed to problem based learning. The focus has shifted clearly from the teacher to the learner, and from prescribed materials to Outcomes-based teaching and learning *(OBTL)*. Several international universities, including *Hong Kong Baptist University* have made this an important part of their approach. Clearly such approaches result in administrative issues, teacher training as well as the physical teaching spaces.

Mr. S.K. Munjal, himself has framed a vision that curriculum being developed for the university will include more interdisciplinary and collaborative learning. An evironment that brings together a convergence of liberal arts and science. Faculty from both liberal arts and science backgrounds (as well as from the industry) will be involved in teaching and research at the university.

TRENDS

Some of the trends in higher education include:

Interdisciplinary & Collaborative Learning
- Problem Based Curriculum
- Hands-on, Team Learning
- Emphasis on Practical Application

Informal, Social Learning Networks
- A campus where teaching and learning can happen everywhere
- Focus on informal spaces extended beyond the "classroom"

Student-centered Approach
- Emphasis on students' needs, abilities and interests
- Flexibility in curriculum, course content and availability of resources

High Dependence on Sophisticated Technology
- Multi-media, learning environments, with network and wireless connectivity
- Seamless integration of technology

Focus on Campus & Community as well as Campus & Private Industry Partnerships
- Campus involvement in addressing issues challenging the community
- Encourage resource sharing
- Academic credentials directly linked to industry job requirements and program expansion based on future job openings

College and University as a "Brand"
- Emphasis on providing "state of the art" facilities and infrastructure
- Competition for the best students and faculty
- Constant scramble for funds

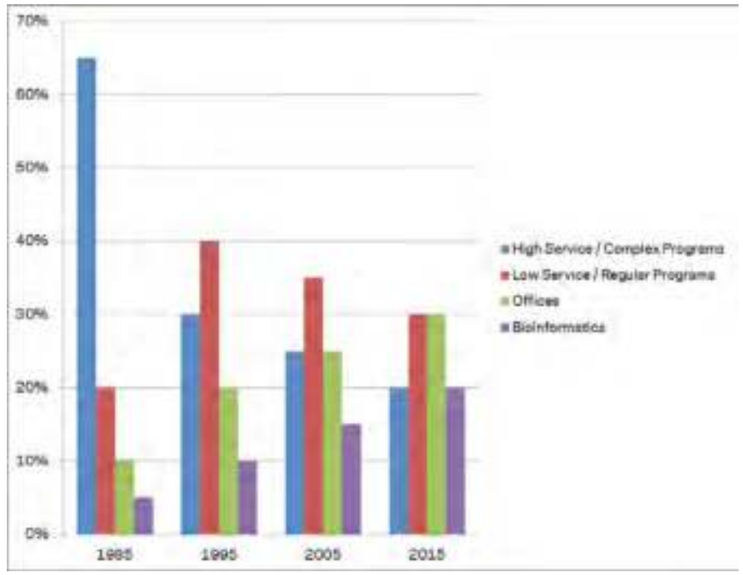
DESIGNING FOR THE UNKNOWN

The last 30 years has seen a change in the amount and type of laboratory spaces being used for both teaching and research uses. (See graph on right)

There is an overall reduction in the use of spaces requiring complex utilities and infrastructure whereas there has been a marked increase in computational spaces. Today more of the research and teaching is based on simpler spaces requiring greater data, electricity and simulation and less fume hoods, heavy equipment or machines.

This clearly indicates a greater need for spaces that can be modified or adapted as needs change. Flexible classrooms that can be converted from simple instructional spaces to more complex teaching and study spaces are becoming increasingly important.

The amount of flexibility added to spaces has an impact on cost and clearly requires sensible balance when designing for the unknown



CHANGE IN USE OF LAB TYPE OVER TIME

Adopting Flexibility

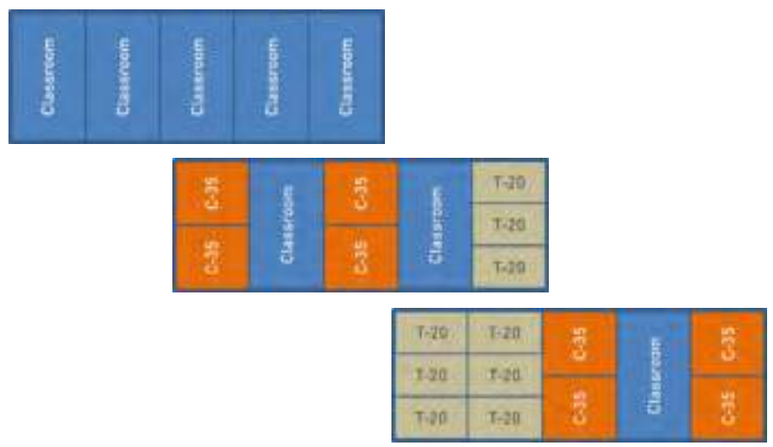
Expandability - Development of program needs based on growth by module, where all modules are capable of being converted to meet the ongoing requirements of the program.

Convertibility — Development of areas and layouts that can be easily re-configured or changed with minimal disruption to the building infrastructure or to ongoing activities in the building.

Versatility — Development of areas that function as a "kit of parts" or spaces that can be used for various functions; for example, an enclosed instrument lab can be converted into an open lab, or vice-versa, simply by installing or removing demising walls or rearranging furniture and equipment.

Modularity

Modularity of the planning grid and spaces becomes an important factor that establishes how adaptable the current spaces will be to the unknowns or changing pedagogy of the future. In the programming approach for the project the design team has taken care to size the various type of spaces (classrooms, tutorial rooms and laboratories) so they can be expanded, converted or reused with relative ease in the future.



MODULARITY OF SPACE TYPES

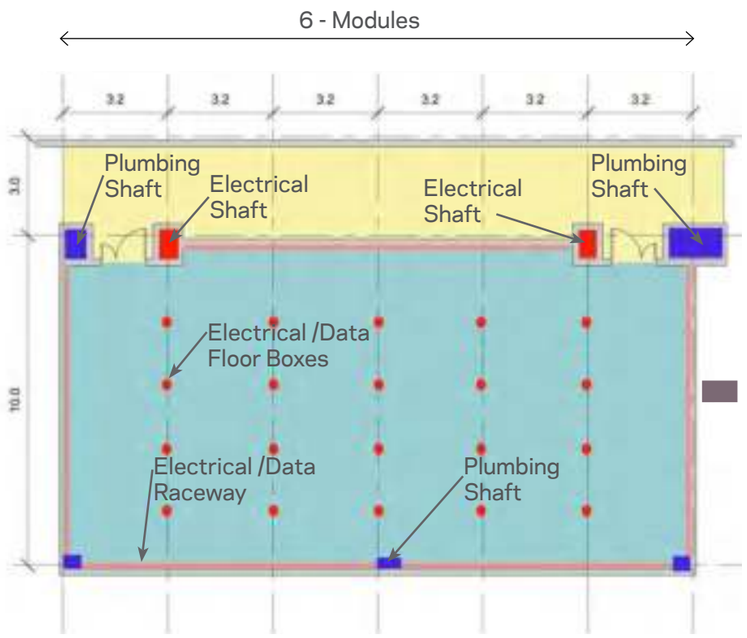
ADAPTING SINGLE SPACE FOR MULTIPLE USE

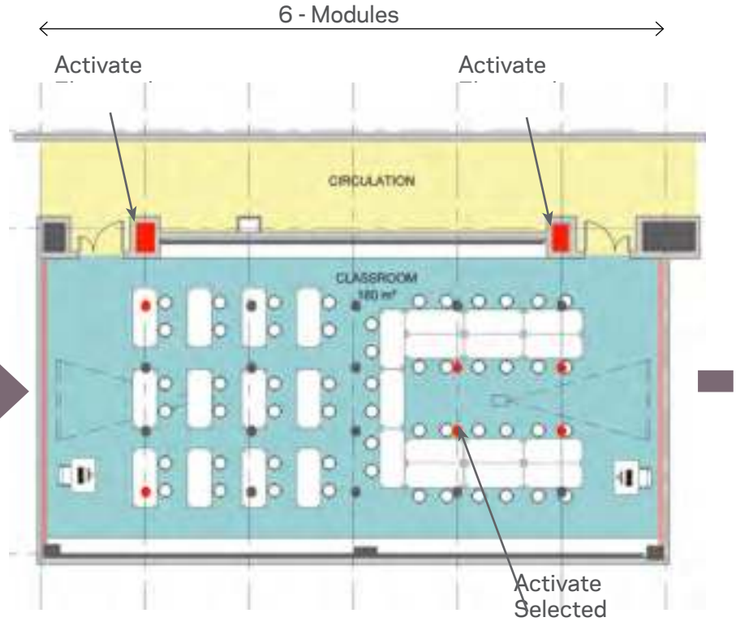
ADAPTIVE DESIGN

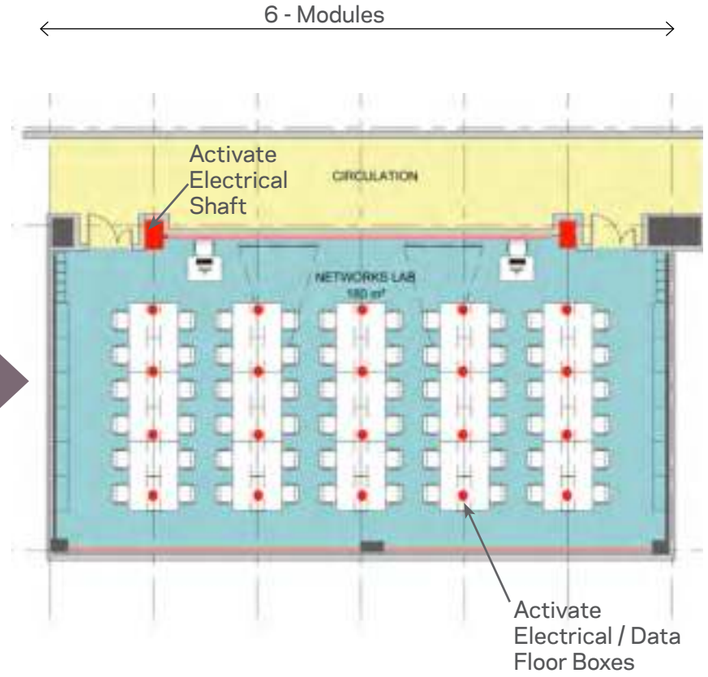
A key aspect of planning the classroom and lab space for the university was to come up with a design that allows the space to be used from a simple classroom to a complex laboratory use. This requires not just planning for the correct infrastructure, but also requires careful thought of what systems should be used and when.

One single module or a grouping of 2, 3 or more modules can be designated as a program space, and these spaces can be developed in parallel with the structural and building services concepts to optimize long-term flexibility and economy.

HVAC systems, electrical and piped services serving each laboratory space may be designed and located in a manner that allows them to be isolated from those in the adjacent spaces. Electrical panels and shutoffs for all piped laboratory services are placed in a convenient and consistent location relative to the laboratory being served.







BASIC 6 - MODULE INSTRUCTIONAL SPACE

Basic Instructional Space with the following basic infrastructure in place:

1. Plumbing Shafts
2. Electrical Shafts
3. Electrical/ Data Wall Raceways
4. Electrical/ Data Floor Boxes
5. A/V Hookup

6-MODULE CLASSROOM

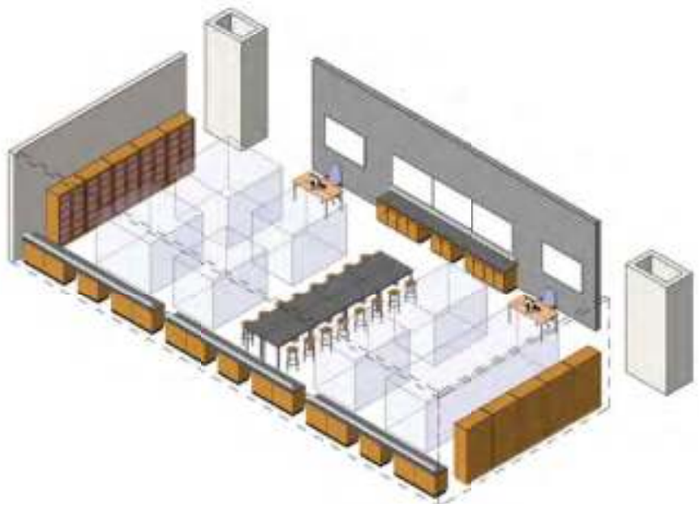
By activating the following services, the basic 6-Module Space can be converted to a Classroom:

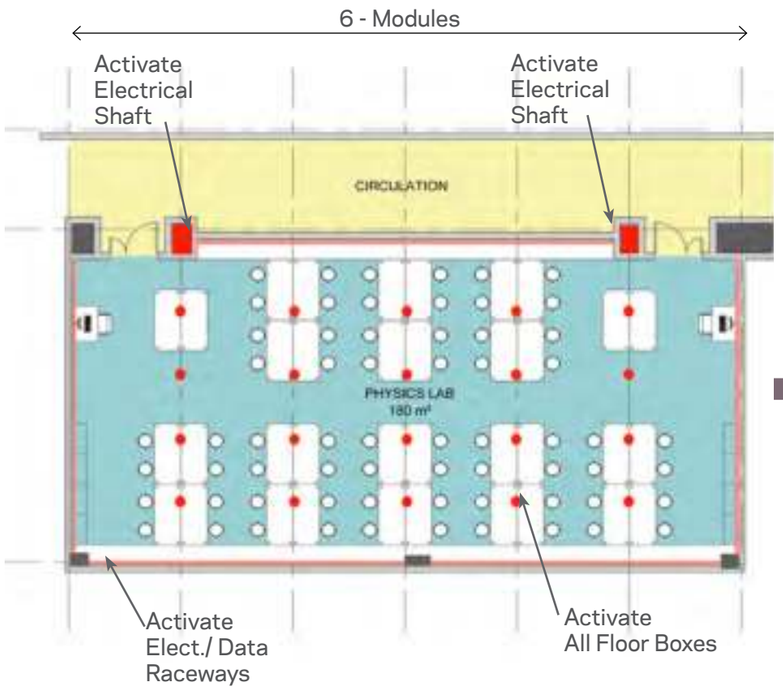
1. Electrical Shafts
2. Few Electrical/ Data Floor Boxes
3. A/V Hookup

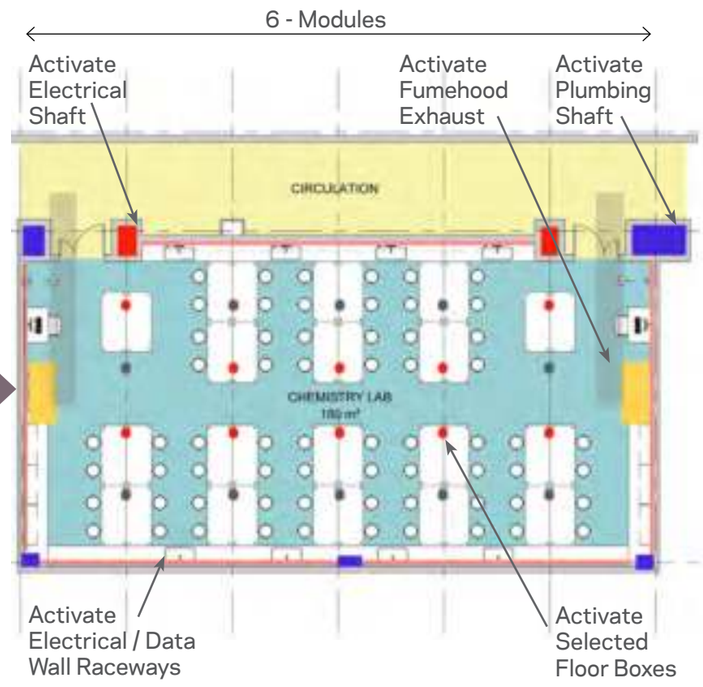
6 - MODULE ELECTRONICS LAB

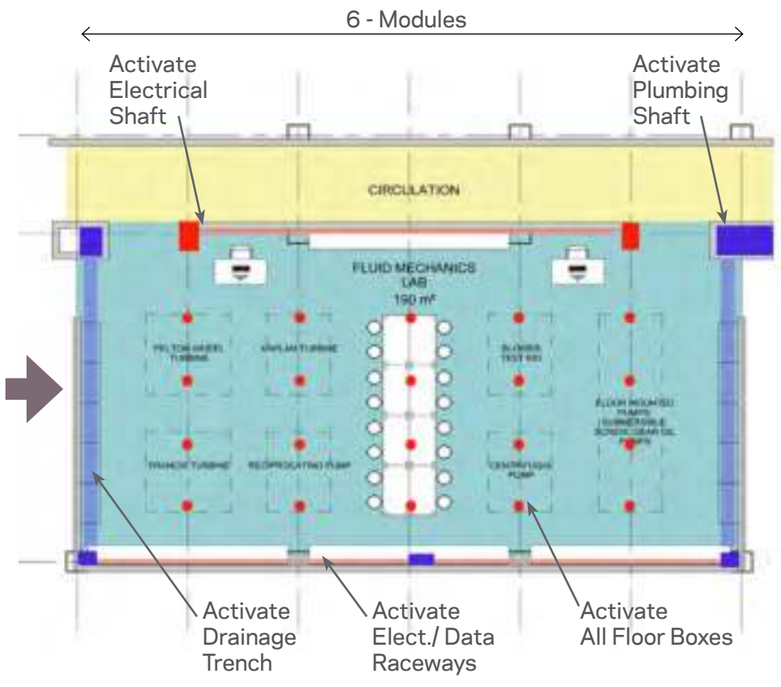
By activating the following services, the basic 6-Module Space can be converted to an Electronics Lab:

1. Electrical Shafts
2. All Electrical / Data Floor Boxes
3. A/V Hookup









6-MODULE PHYSICS LAB

By activating the following services, the basic 6-Module Space can be converted to a Physics Lab:

1. Electrical Shafts
2. All Electrical/ Data Floor Boxes
3. All Electrical/ Data Wall Raceways

6-MODULE CHEMISTRY LAB

By activating the following services, the basic 6-Module Space can be converted to a Chemistry Lab:

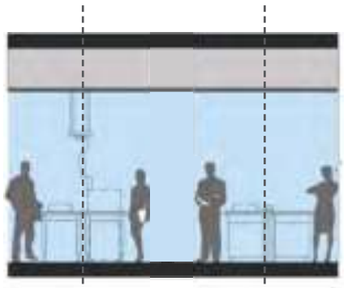
1. Electrical Shafts
2. Plumbing Shafts
3. Fumehood Exhaust
4. Electrical/ Data Wall Raceways
5. Few Electrical/ Data Floor Boxes

6-MODULE EQUIPMENT LAB

By activating the following services, the basic 6-Module Space can be converted to an Equipment Intensive Lab:

1. Electrical Shafts
2. Plumbing Shafts
3. All Electrical/ Data Floor Boxes - Heavy Power Requirement
4. All Electrical/ Data Wall Raceways - Heavy Power Requirement
5. Drainage Trenches

(Note: Most of the labs in the above category tend to be located in the Workshop Areas because of their large floor space, high ceiling, easy vehicular access & heavy-duty service requirements.)



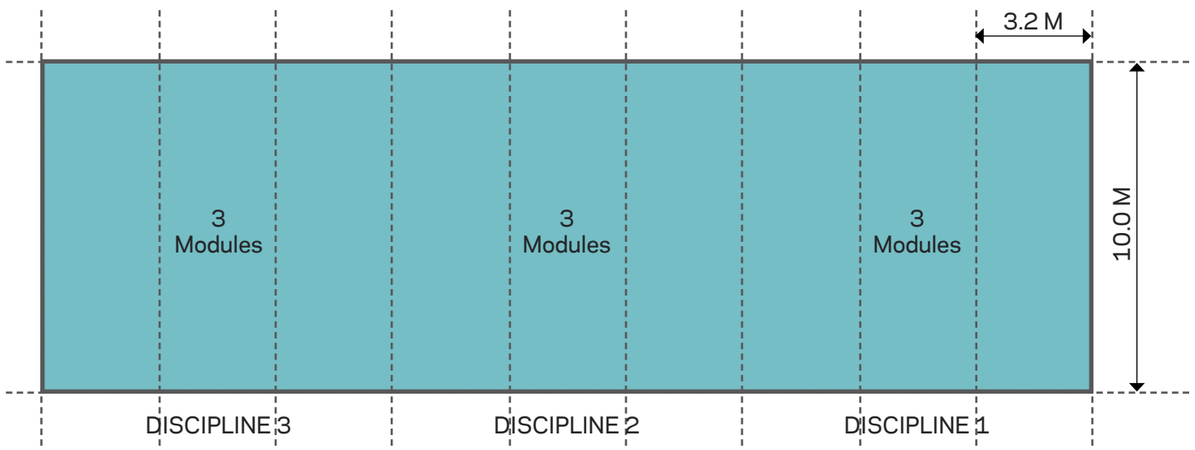
3.2 M
1 Lab Module

SECTION

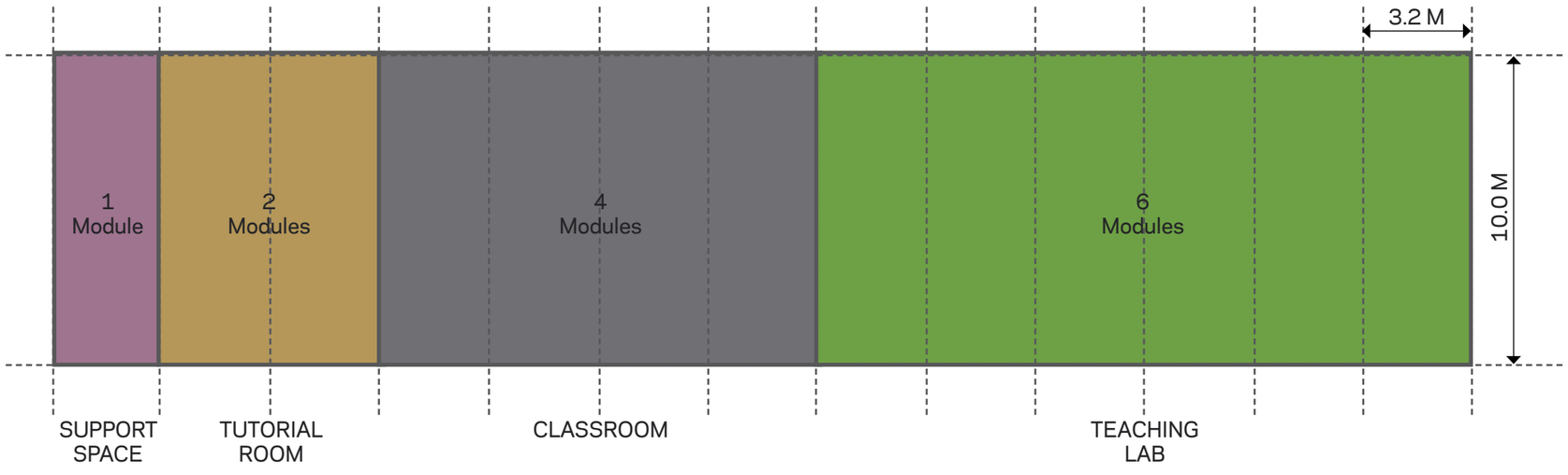
1.5 M
Min.

3.2 M
1 Lab Module

PLAN



INTERDISCIPLINARY
OPEN RESEARCH LAB
(ACADEMIC OR R&D)



PLANNING MODULES ALLOW FLEXIBILITY IN SIZE AND USE OF TEACHING SPACES

MODULARITY AND FLEXIBILITY

The width dimension of a standard bench lab module for this lab type is typically 10'6 to 10'8" (3.2 M.). This dimension accommodates wall thickness and 30" deep benches on either side of a 5' (1.5 M.) wide aisle (the 5' aisle is wide enough to accommodate people working back to back at opposite benches and the 5' ADA wheel chair turning diameter).

A significantly greater width becomes inefficient and gains little in additional functional workspace unless it is to accommodate unusually large pieces of research equipment.

A significantly narrower width becomes too tight to allow efficient functioning room for lab technicians, students or researchers who use lab benches and equipment on both sides of the room.

The critical dimension is the width, not the length, of the wet lab bench module. Ideally, lab module lengths are multiples of their width. This adds flexibility to the building or space in that modules (benches and aisles) can be arranged longitudinally or transversely without loss of efficiency. In addition, two or more lab modules can be placed side-by-side, creating double or triple width labs. In this case, the intermediate "side" walls are eliminated and the lab benches in the center become double-width island benches, providing workspace on both sides.

APPLICATION OF PLANNING MODULE

Laboratory modules have the potential to become building blocks for other instructional spaces. Larger units can be created by aggregating a number of modules. The planning module is repetitive and regular and enables flexibility in design.

In this project, most teaching labs are 6 modules, classrooms are 4 modules, tutorial rooms are 2 modules & support or prep spaces 1 module. The teaching and research labs both work within this framework. This arrangement can set the building up for maximum flexibility of use in the future and creates a set of standards based on interchangeable parts providing the following benefits: Expandability, Convertibility & Versatility.

FROM SIMPLE CLASSROOM TO COMPLEX LABS

	TYPE 1 (General)	TYPE 2 (Computer)	TYPE 3 (Electronics)	TYPE 4 (Physics)	TYPE 5 (Wet Lab)	TYPE 6 (Equipment-Intensive)
	1. Tutorial Room 2. Classroom 3. Drawing Studio 4. Survey Lab	1. Computer Lab	1. Basic Electrical & Electronic Lab 2. Communication Systems Lab 3. Power Electronics Lab 4. Control Systems lab	1. Physics Lab 2. Engineering Mechanics	1. Chemistry Lab 2. Environmental Engineering	1. Thermodynamics lab 2. Fluid Mechanics Lab 3. Hydraulics & Hydrology Lab 4. Civil Engineering Lab 5. Workshop 6. Machine Tool lab 7. I.C. Engine Lab 8. Material Sciences
Number of Modules	2 or 4	5	6	6	6	6 or more
Area	60 or 120 Sqm	150 Sqm	180 Sqm	180 Sqm	180 Sqm	180 Sqm or more
Plumbing Hookup					x	x
HVAC Hookup		x	x		x	
Basic Electrical & Data Hookup	x	x	x	x	x	x
A/V Hookup	x	x				
Teaching tools such as marker boards, chalk boards etc.	x	x	x	x	x	x
Fumehood Exhaust					x	
Regular Window Blinds	x	x	x	x	x	
Black-out Capability				x		
Heavy Electrical Requirement			x	x		x
Equipment Intensive						x
Vibration Sensitive				x		
Vibration Producing						x
Noise Producing						x
Heat Producing		x	x			x
High Ceiling Requirement						x
Drainage Trench Requirements						x
Storage Provision			x	x	x	x
	4	6	7	7	7	11

COMPLEXITY & COST OF SPACE TYPE INCREASE
SPACE COUNT SHOULD DECREASE & UTILIZATION SHOULD INCREASE
(Provide more of the simpler space types and less of the complex ones. Maximize utilization of the more complex space types.)

FROM SIMPLE CLASSROOM TO COMPLEX LABS

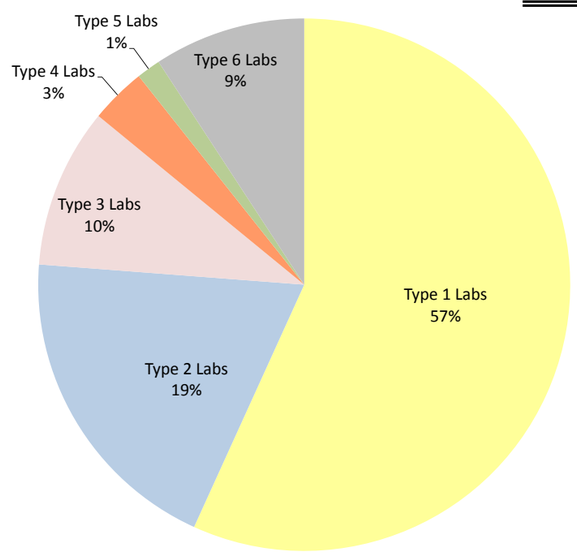
LAB TYPE	NAME	QTY	UTIL
Type 1 - General	Classroom	55	99%
Type 1 - General	Tutorial Room	54	99%
Type 1 - General	Drawing Studio	6	93%
Type 1 - General	Survey Lab	1	40%
Type 1 - General	Mock Court	1	13%
Type 2 - Computer Lab	Computer	16	99%
Type 2 - Computer Lab	Generic Lab	13	13%
Type 2 - Computer Lab	M Tech Lab	11	99%
Type 2 - Computer Lab	CAD/CAM Lab		
Type 3 - Electronics Lab	Basic Electrical & Electronics Lab	11	92%
Type 3 - Electronics Lab	Electrical & Electronics Measurement Lab		
Type 3 - Electronics Lab	Communication Systems Lab	4	88%
Type 3 - Electronics Lab	Networks Lab		
Type 3 - Electronics Lab	Power Electronics Lab	2	63%
Type 3 - Electronics Lab	Control Systems Lab	3	83%
Type 3 - Electronics Lab	Electric Drives Lab		
Type 4 - Physics Lab	Physics	3	47%
Type 4 - Physics Lab	Engineering Mechanics Lab	4	76%
Type 5 - Wet Lab	Chemistry	1	57%
Type 5 - Wet Lab	Environmental Engineering	2	60%
Type 6 - Equipment Intensive Lab	Engineering Workshop	3	67%
Type 6 - Equipment Intensive Lab	Fluid Mechanics	3	36%
Type 6 - Equipment Intensive Lab	I.C. Engines Lab	2	34%
Type 6 - Equipment Intensive Lab	Machine Tools Lab	2	34%
Type 6 - Equipment Intensive Lab	Heat Transfer & Thermodynamics Lab	3	89%
Type 6 - Equipment Intensive Lab	Highway Engineering	1	80%
Type 6 - Equipment Intensive Lab	Hydrology & Hydraulics	1	80%
Type 6 - Equipment Intensive Lab	Material Sciences Lab	3	87%
Type 6 - Equipment Intensive Lab	Soil Mechanics & Foundation Engineering Lab	1	80%

All instructional classes at the university were organized in the order of complexity and cost to allow the client to better understand and manage the utilizations. Type 1 spaces were the simplest and cheapest with Type 6 being the most intensive and therefore most expensive. During the programming exercise the effort was focussed on finding the simples teaching space with the highest use.

The table to the left shows the total quantities of each unique lab (also totaled on the table below) and the utilization for 2025 . It was interesting to note that only 20% of the labs were of the most complex type. Majority of the classes could be held in standard classrooms. In fact more than 75% of the classes could be held in (Type 1 and Type 2) labs

For detailed Room Data Sheets please see page *D-27*

LAB TYPE	QTY	% OF OVERALL
Type 1 Labs	117	57%
Type 2 Labs	40	19%
Type 3 Labs	20	10%
Type 4 Labs	7	3%
Type 5 Labs	3	1%
Type 6 Labs	19	9%
	206	100%



EDUCATIONAL TECHNOLOGIES

Active learning methods are placing unique demands on the physical space in which education occurs. Today, there is more emphasis on creating collaborative settings, where students cluster together to learn not only by doing, but by doing together. It is important to plan for multi-media environments, with network and wireless connectivity, video conference equipment, and opportunities for hands-on experimentation.

Writing Surfaces

Blackboards and white boards are the primary "low-tech" writing surfaces in use today. In rooms with technology, chalk dust can create problems, so these rooms are generally fitted with white boards. Exceptions to the white board preference are for disciplines which make heavy use of writing surfaces for complex proofs, analyses, etc. (E.g., Math, Engineering).

- Boards should be installed across as much of the front (instructor's) wall as possible.
- Additional boards may be required on secondary classroom surfaces.

Enhanced Technologies

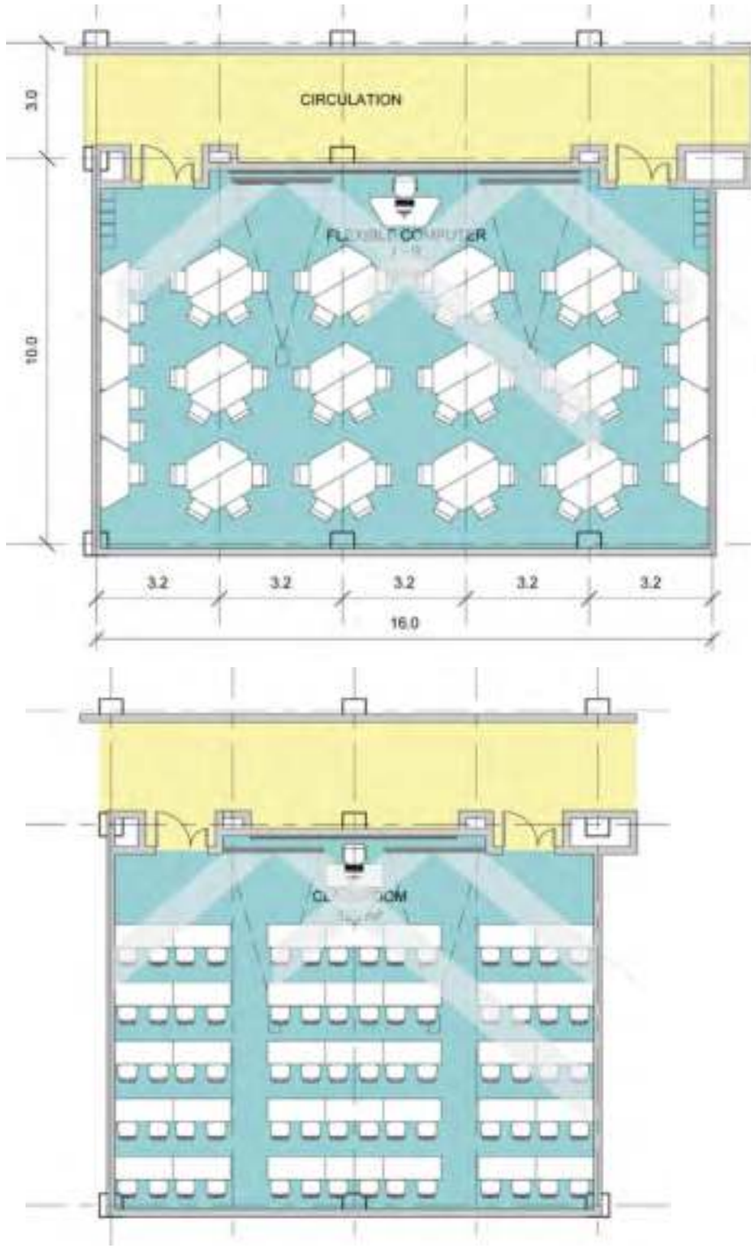
Instructional spaces such as classrooms, tutorial rooms & teaching labs should be designed to accommodate advanced audio-visual technologies and facilitate multi-media presentations as an extension to the traditional way of teaching. These settings may include one or more of the following:

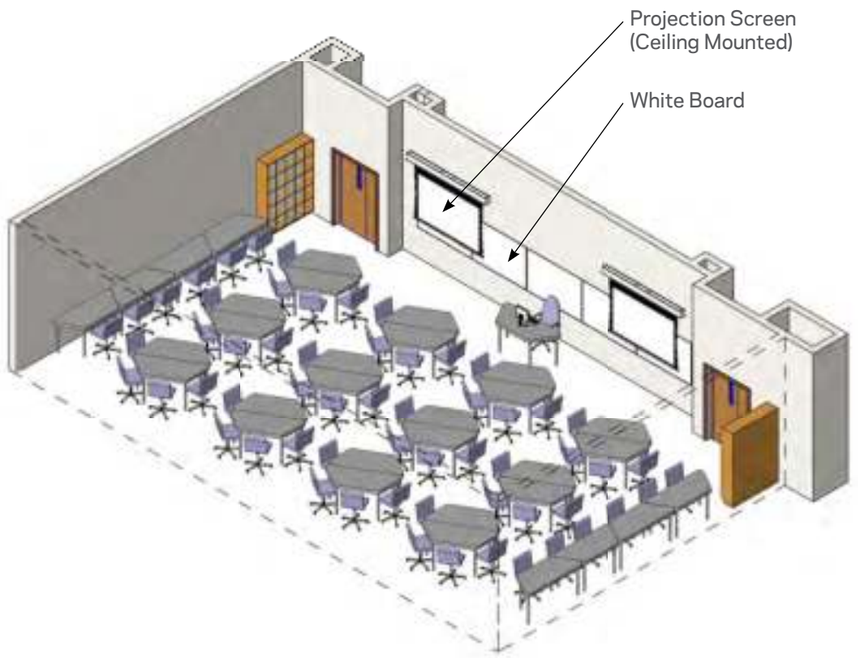
- Smart Panels
- Data/ Video Projectors
- Playback Audio Systems
- Overhead Projectors
- Installed Standard VCR or specialized VCR/ DVD players

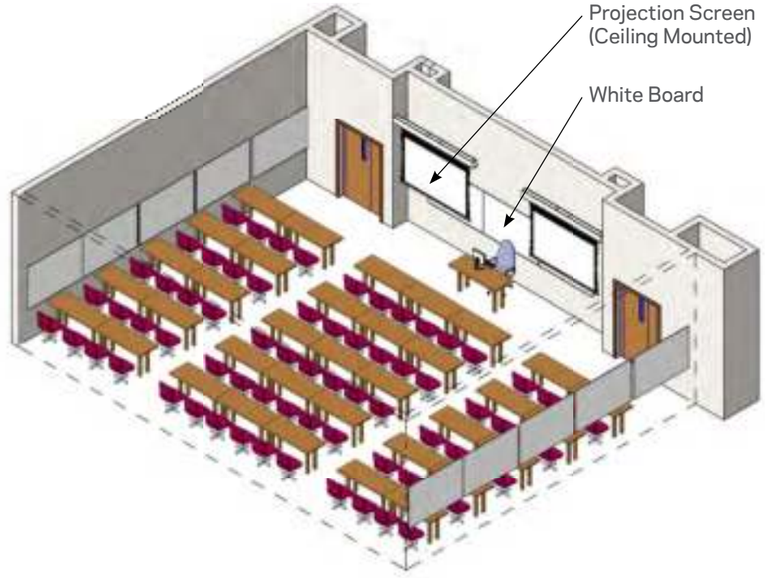
To create consistent standards for instructional technology, all presentation spaces should be programmed to have similar basic AV capabilities.

Room Sketches

The sketches on this page depict the proposed type of equipment to be used in each space. These sketches are intended to show the presentation orientation and relative positioning of equipment in the room.



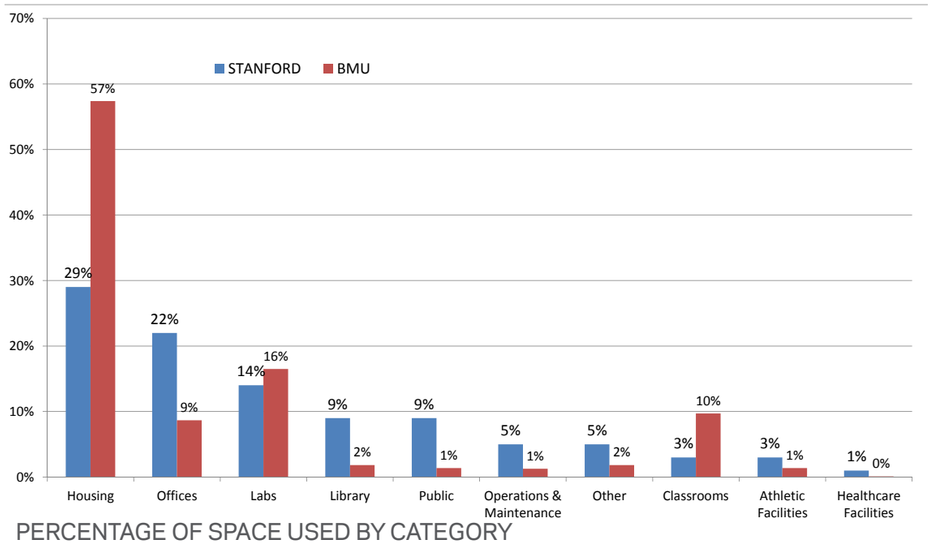




We studied the percentage distribution of spaces across campus between Stanford and BMU to understand how we were allocating spaces compared to a premier institution like Stanford. Housing stood out as the largest anomaly (60 percent of BMU's built up area vs. 30% of Stanford's) The main reason for this variation is that Stanford is located in the heart of a bustling city in California whereas at Gurgaon there are currently not enough housing availability. It is anticipated that as the areas around the campus grow, future housing plans may be reduced to allow the university to conserve Floor Space Index (FSI) in the future.

Another variation is in the amount of public spaces. This comparison can be misleading, particularly because US universities tend to be built on large tracts of land compared to Indian universities where land is often in short supply.

Space category	Stanford	BMU
Housing	29%	57%
Offices	22%	9%
Labs	14%	16%
Library	9%	2%
Public	9%	1%
Operations & Maintenance	5%	1%
Other	5%	2%
Classrooms	3%	10%
Athletic Facilities	3%	1%
Healthcare Facilities	1%	0%
	100%	100%



PERCENTAGE OF SPACE USED BY CATEGORY

Source: Stanford University Space and Furniture Planning Guidelines

Institution	Student/Faculty Ratio Fall 08
Vanderbilt University	8:1
Brandeis University	9:1
Brown University	9:1
Case Western Reserve University	9:1
University of Southern California	9:1
Johns Hopkins University	10:1
University of Rochester	10:1
Cornell University	11:1
New York University	11:1
Carnegie Mellon University	12:1
University of Washington-Seattle Campus	12:1
Purdue University - Main Campus	14:1
Rutgers University - New Brunswick	14:1
University of North Carolina at Chapel Hill	14:1
Ohio State University - Main Campus	15:1
Syracuse University	15:1
University of Iowa	15:1
University of Michigan - Ann Arbor	15:1
University of Pittsburgh - Main Campus	15:1
Iowa State University	16:1
Michigan State University	16:1
University of Buffalo - SUNY	16:1
University of California - Berkeley	16:1
University of California - Davis	16:1
University of Illinois at Urbana Champaign	16:1
University of Virginia - Main Campus	16:1
Virginia Polytechnic Institute and State University	16:1
North Carolina State University	17:1
Pennsylvania State University - Main Campus	17:1
Univeristy of Texas at Austin	17:1
University of California - Los Angeles	17:1
University of California - Santa Barbara	17:1
University of Wisconsin - Madison	17:1
BMU	18:1
Texas A&M University	18:1
University of Colorado at Boulder	18:1
University of Georgia	18:1
University of Maryland - College Park	18:1
Indiana University - Bloomington	19:1
Suny at Stony Brook	19:1
University of California - Irwine	19:1
University of California - San Diego	19:1
University of Missouri - Columbia	19:1
Georgia Institute of Technology - Main Campus	20:1
University of Arizona	20:1
University of Florida	20:1
University of Nebraska at Lincoln	20:1
University of Oregon	20:1
University of Minnesota - Twin Cities	21:1

Student Faculty Ratios

Source: US News & World Report, America's Best Graduate Schools, 2011 Edition

Student Faculty Ratios

BMU's planned student faculty ratio is at par with the best universities in the United States. A practical challenge for the university administration will be finding the large numbers of qualified faculty needed for the growth planned until 2025.

Laboratory Space Standards

Laboratories are an important part of any universities instructional spaces. The design team compared the US standards with what has been programmed at BMU. The assignable spaces at BMU are slightly smaller than US universities but adequate for their intended use. The BMU instructional spaces have been categorized by type (Type 1 being most simple and Type 6 being the most intensive). Please see page *B-26* for additional discussion of space types.

U.S. Standards		
LAB CATEGORY	DISCIPLINE EXAMPLES	SQM/Station
Highly Intensive	Engineering, Textiles, Applied Design, Dramatic Arts, etc.	10.0
Intensive	Biological & Physical Sciences, Agriculture, Architecture, etc.	6.5
Moderate Intensive	Communication, Computer/Info. Technology, Education, Psychology, etc.	4.6
Non-Intensive	Business, Music, Mathematics, Public Affairs, Social Sciences, etc.	3.1

BMU		
LAB CATEGORY	DISCIPLINE EXAMPLES	SQM/Station
Highly Intensive	Type 6: Engineering Workshop, Machine Tools Labs, Mechanical & Civil Engineering Labs	7.0
Intensive	Type 4 & 5: Physics & Chemistry Labs, Drawing Studio	4.2
Moderate Intensive	Type 2 & 3: Electronics, Communication, Computer Science Labs etc.	3.0
Non-Intensive	Type 1: Classrooms	2.0

LABORATORY SPACE STANDARDS

Source: North Carolina State University Construction Guidelines

Classroom Space Standards

Depending on how an instructional space is being fitted out, the assignable space per student can vary. The benchmarking studies show classroom spaces for BMU class size of under 100 students is close to international university standards.

Room Category	Room Capacity (No. of Stations)	Movable Chairs w/ Tablet Arm (SQM/Station)	Fixed Pedestal or Riser Mounted Seating w/ Tablet Arm (SQM/Station)	Audotorium Seating	Audotorium Seating (SQM/Station)	Movable Table & Chairs (SQM/Station)	Fixed Pedestal Table & Chairs (SQM/Station)
U.S. Standards							
Seminar/ Conference/ Small Class	0 - 25	1.9	1.6	-	-	2.0	2.0
Classrooms	26 - 49	1.6	1.6	-	-	2.0	1.8
Classrooms	50 - 99	1.4	1.2	14 - 17	1.5	1.8	1.8
Classrooms	100 - 149	-	1.2	12 - 15	1.25	1.8	1.8
Lecture Rooms	150 - 299	-	-	10 - 14	1.1	1.8	1.7
Lecture Rooms	300+	-	-	10 - 14	1.1	1.8	1.6
BMU							
Tutorial Room	26 - 49	1.7	-	-	-	2.0	-
Classroom	50 - 99	1.3	-	-	-	1.7	-

CLASSROOM SPACE STANDARDS

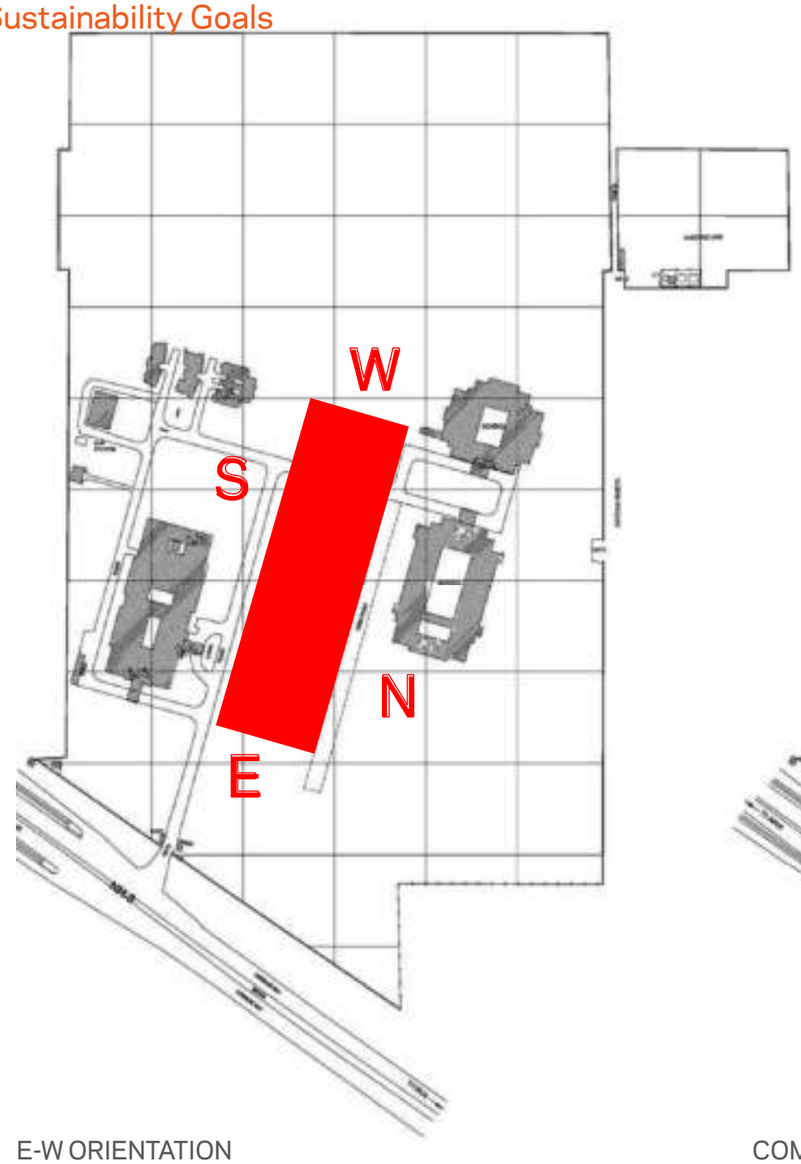
Source: Idaho University, Auburn University Space Standards, Cornell University

Classroom Utilization

Most universities find themselves challenged in increasing their classroom utilizations because of the fact their class schedules tend to follow peaks and valleys. (see "*Academic Space Utilization*" on page *B-16*). The design team worked very closely with the university in increasing utilization through class scheduling and studying enrollment numbers and patterning (see "*Understanding Patterns*" on page *B-15*)

State University System	Weekly Room Hours	Standard Occupancy Rate (%)	SQM/Student Station
U.S. State Universities			
California	42	71%	1.4
Colorado	30	67%	1.4
Kansas	30	60%	1.4
Ohio	32	67%	1.4
Tennessee	30	67%	1.4
New York	30	60%	1.4
Alaska	30	60%	1.5
Nedraska	30	65%	1.5
New Hampshire	30	60%	1.5
Oklahoma	84	80%	1.5
Oregon	33	60%	1.5
Washington	20	60%	1.5
Wisconsin	30	67%	1.5
South Dakota	44	60%	1.5
Utah	34	67%	1.6
Maryland	30	65%	1.6
Louisiana	30	60%	1.7
North Carolina	35	65%	1.7
Wyoming	33	60%	1.7
Arizona	35	65%	1.8
Kentucky	38	67%	1.9
BMU	40	90%	2.0
South Carolina	35	60%	2.0
Florida	40	60%	2.0
Texas	38	67%	2.0

CLASSROOM UTILIZATION
Source: MGT of America, Inc. survey, August 1998



E-W ORIENTATION

Design Buildings with East-West Orientations to the extent possible to reduce heat gain from low sun angles

COMPACT FORM

Develop the campus fabric in a compact form to provide self shading. Augment development with roofs, overhangs, bridges and courtyards.

PASSIVE SOLAR DESIGN

Create water body towards the lowest side of site to allow prevailing winds to provide evaporative cooling during the hot dry summer months.

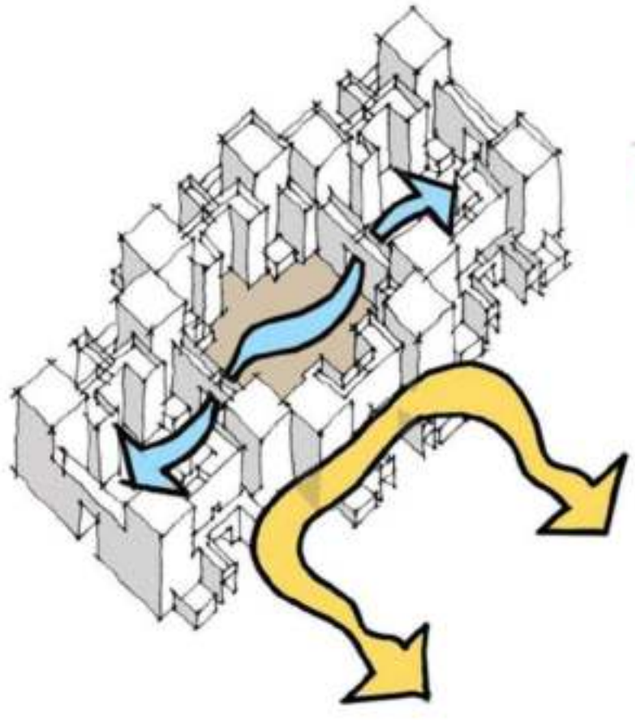
1. Courtyards

Ajmer

Bhavnagar

Jaipur

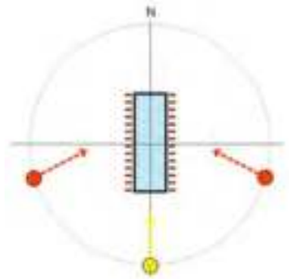
Shahjahanabad



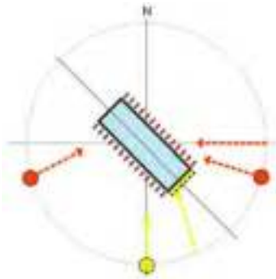
Courtyard creates micro climate

- The courtyard is an ideal Passive Response to hot/dry climate.
- In hot/dry climates large expanses of open space tend to be used less in the day in summer.
- The courtyard scales down the open space to a usable dimension.
- It remains shaded by the building edge.
- Compact urban form with central stack.
- Since prevailing winds are too hot in summer and too cold in winter, the courtyard/cluster creates an enclosure that protects against the cold winter winds and hot summer winds

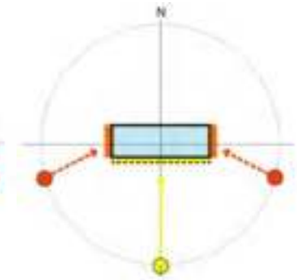
2. Solar Orientation



North to south orientation makes controlling solar heat gain extremely difficult



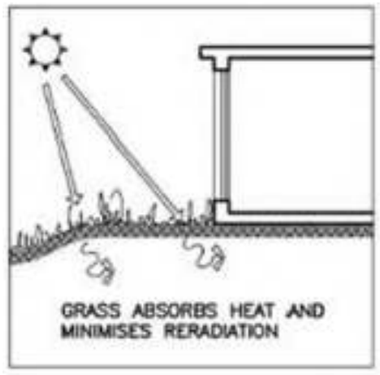
North-west to south-east orientation requires intense brise-soleil shading



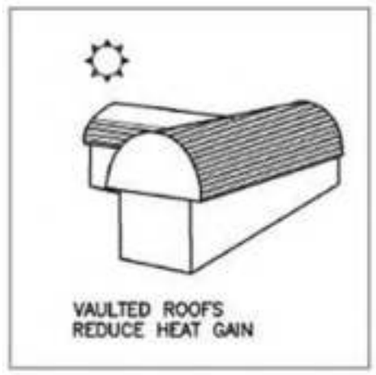
East to west orientation affords superior control of solar heat gains.

3. Evaporative Cooling and Roof Profiles

WATER BODIES / FOUNTAINS HELP IN EVAPORATIVE COOLING

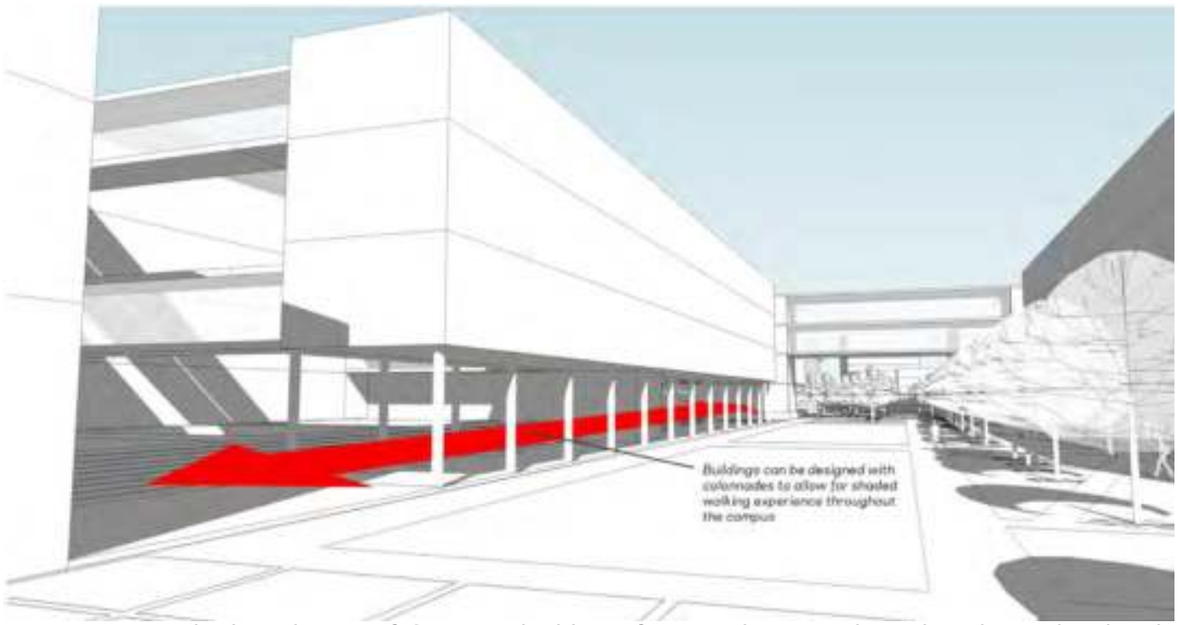


GRASSES AND SOFTSCAPE MINIMIZE RADIATION

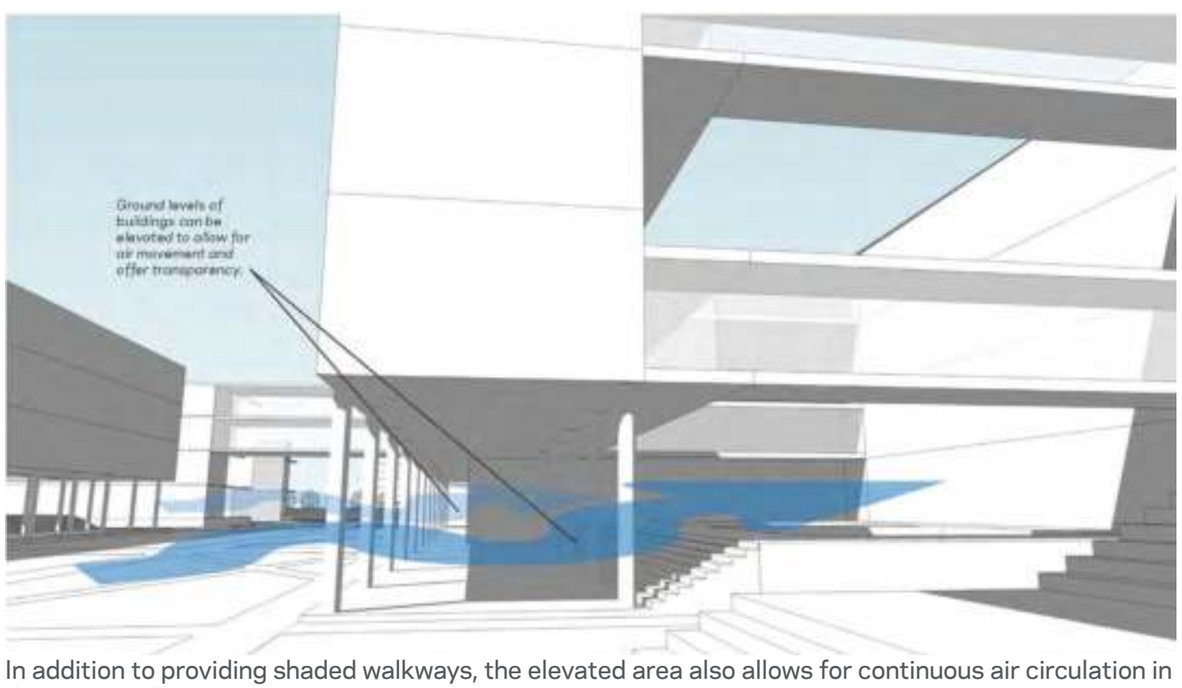


ROOF PROFILE AND OVERHANGS REDUCING HEAT GAIN

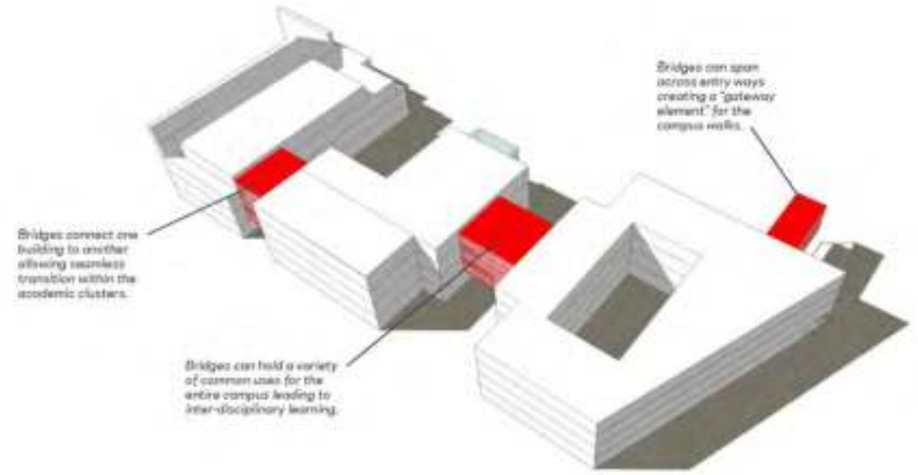
SUSTAINABLE GOALS



In response to the hot climate of Gurgaon, buildings framing the central quadrangle are lined with colonnades to provide shaded walkways.

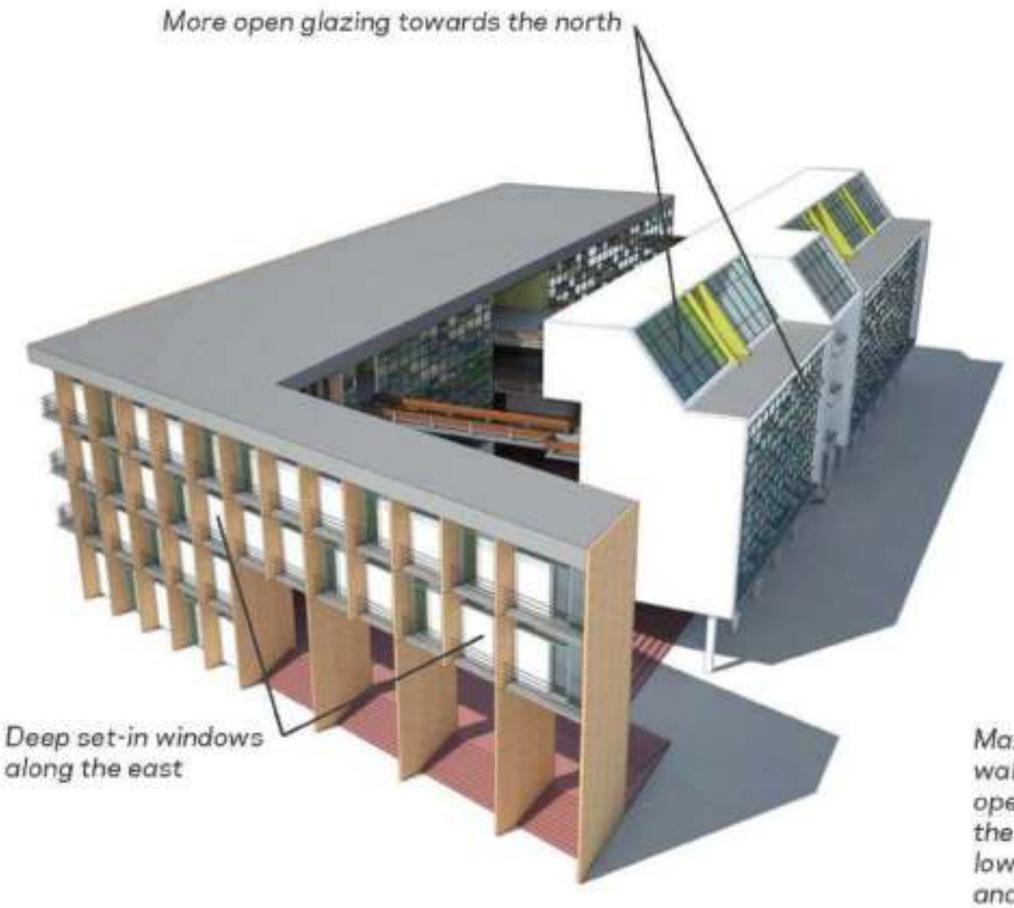


In addition to providing shaded walkways, the elevated area also allows for continuous air circulation in the courtyard.

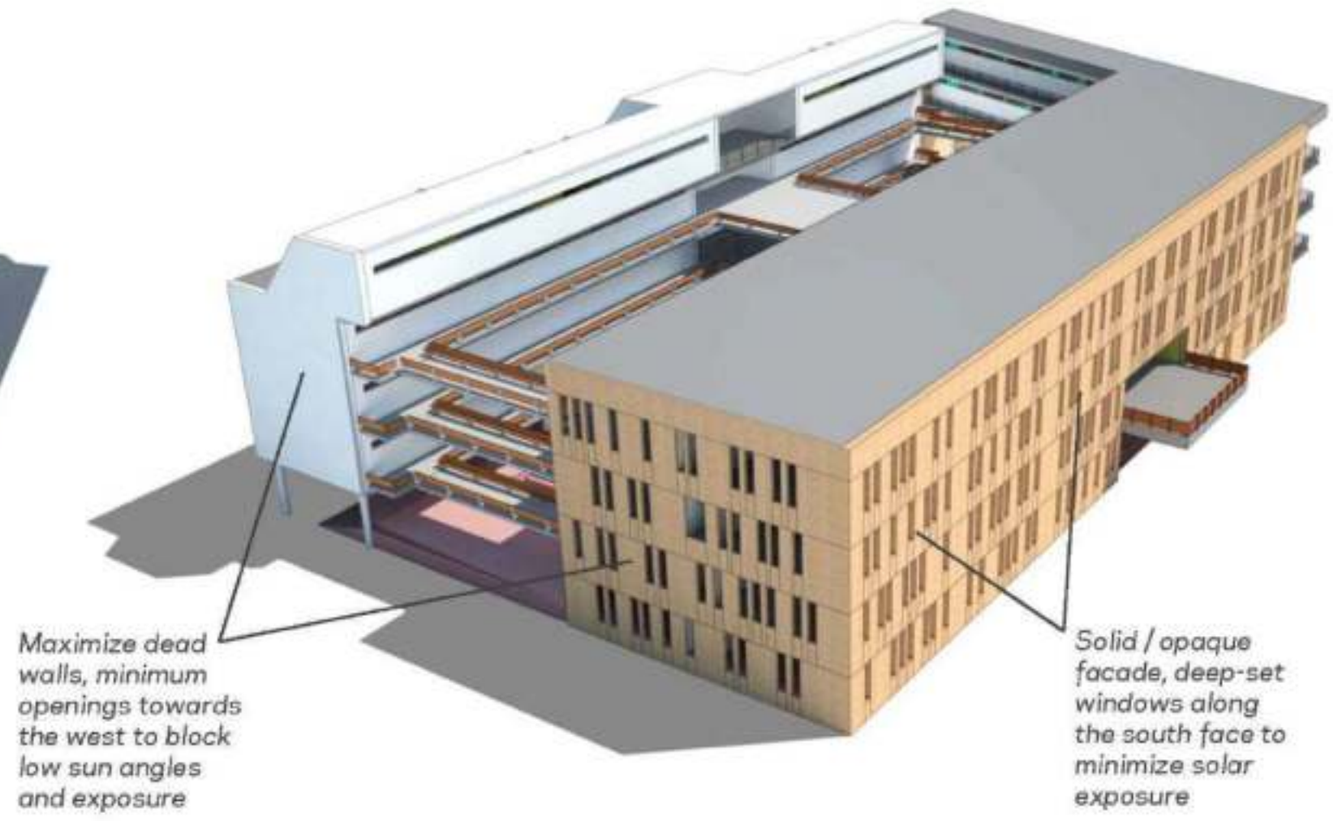


Bridges form an important feature of an academic campus. They can hold a variety of common uses as well as connect buildings to one another allowing a seamless transition within academic clusters.

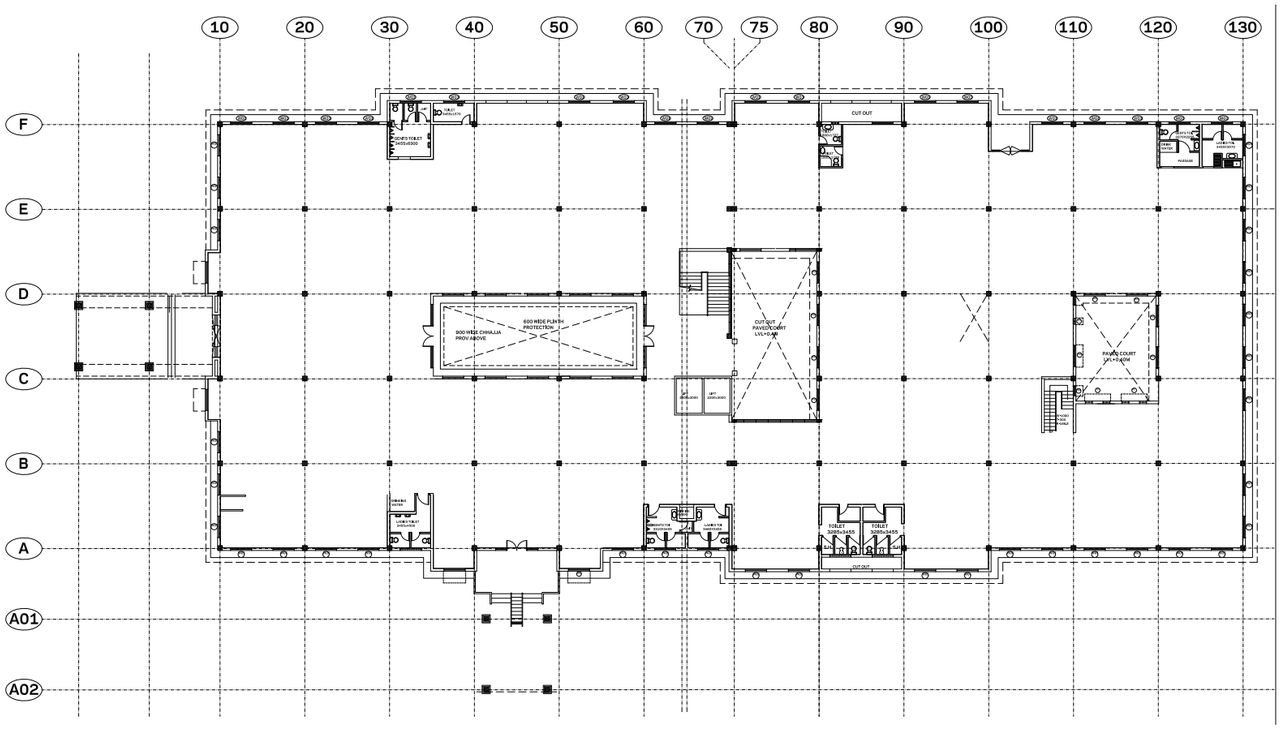
The façade strategy varies as per solar exposure. Deep set windows on South facades shades the interiors from the afternoon sun. Sun breakers on the east and west facades shield the classroom areas from the glare. North facade can afford a higher amount of transparency.



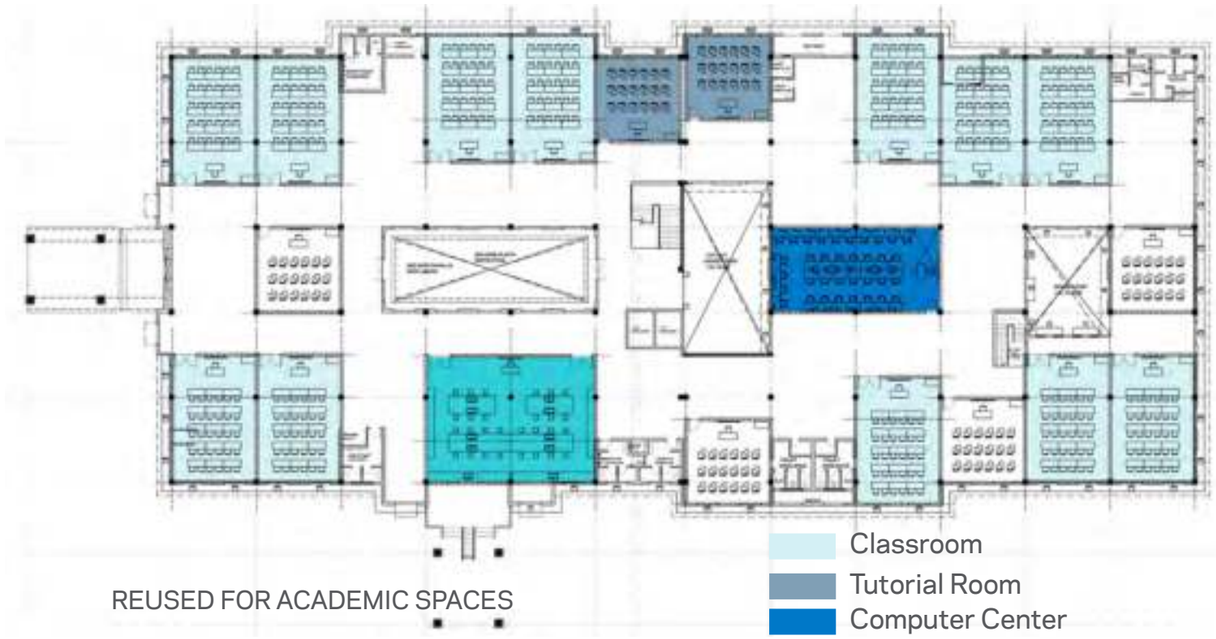
View showing north and east façade strategy



View showing south and west façade strategy



EXISTING HOSPITAL BUILDING



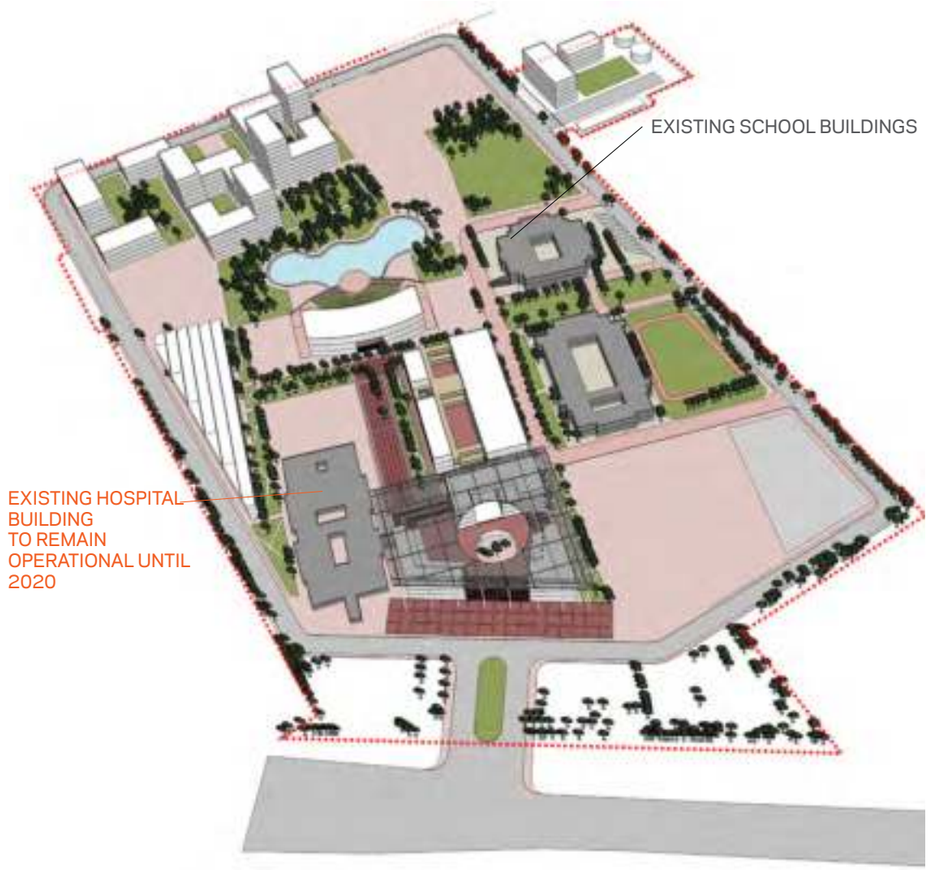
REUSED FOR ACADEMIC SPACES

During the programming exercise, the design team studied the existing hospital building with the idea that it could be utilized as a swing building for the foreseeable future. While it is easy to demolish buildings, the design team kept the *"Resource Conservation"*concept in mind and looked at ways it could be adapted to the needs of a growing university.

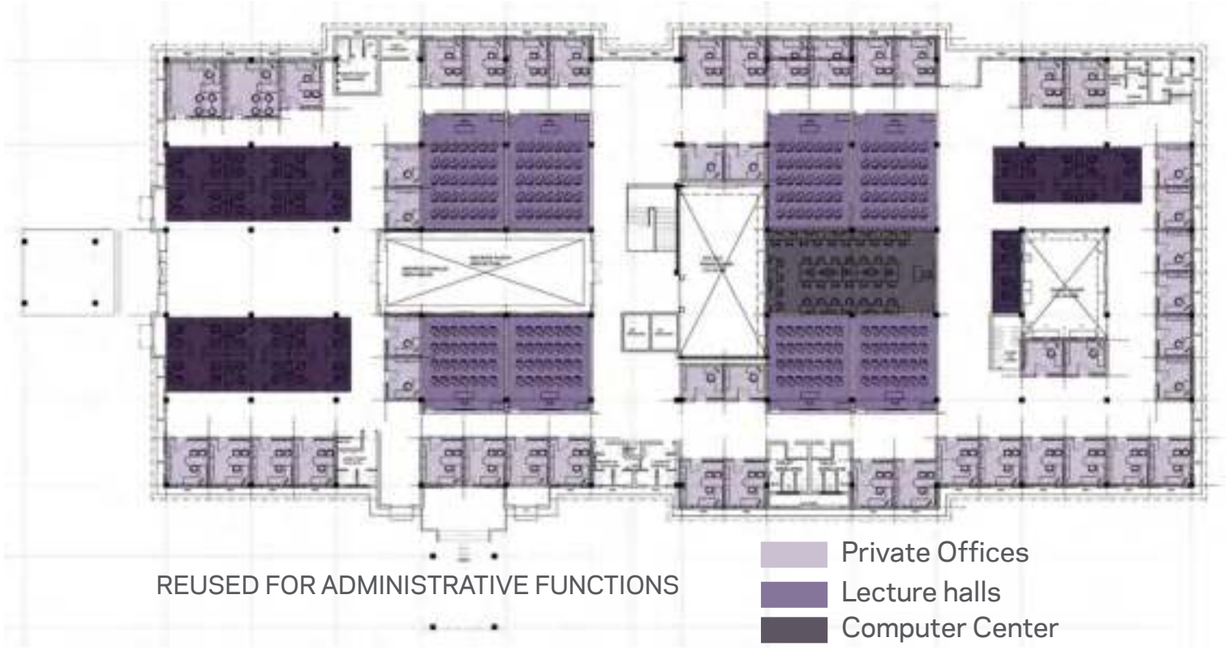
The current design approach leaves the hospital building in place until

The existing hospital building has a uniform grid of 7.2 m X 7.2 m that lends itself effectively to a variety of uses. The Master Plan proposed to reuse the building as a 'swing' building until FY 2020 (see page *C-25*)

The grid of the building has been tested to accommodate classrooms, labs, computing rooms, cafeteria, library and office functions.



CAMPUS PLAN WITH EXISTING HOSPITAL

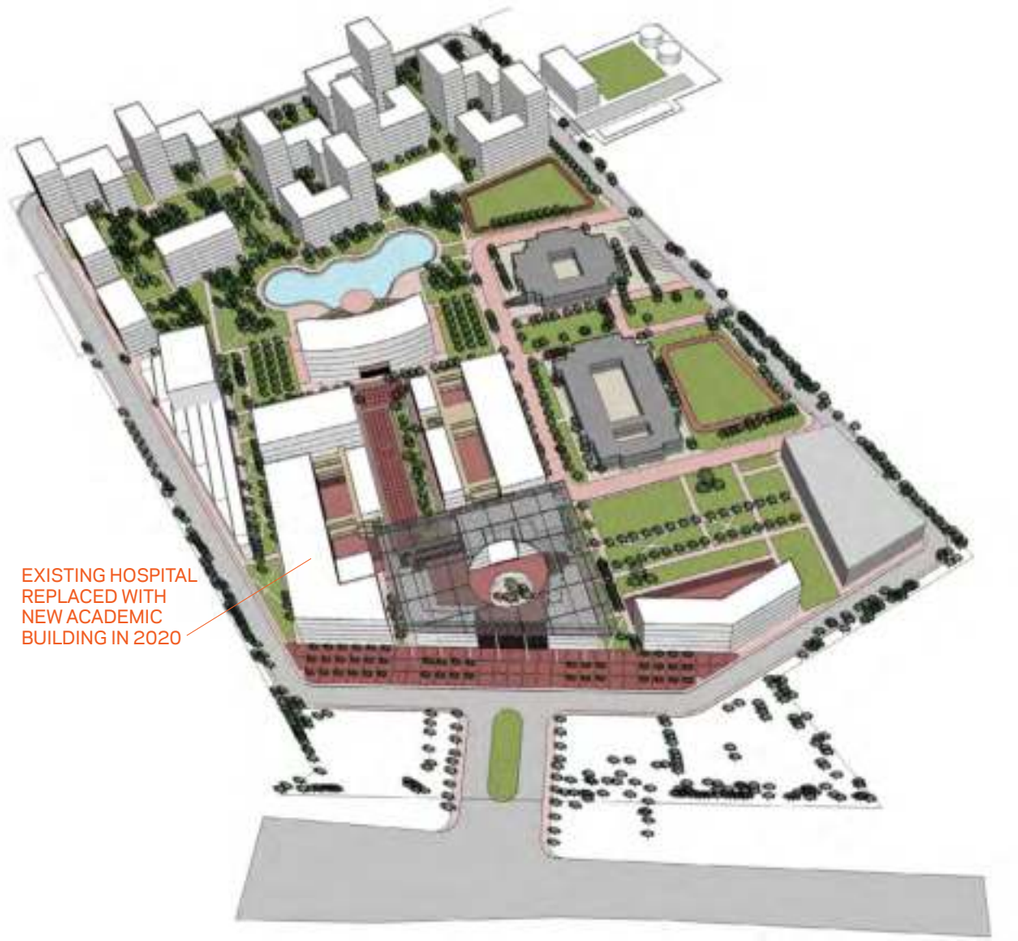


REUSED FOR ADMINISTRATIVE FUNCTIONS

Private Offices
Lecture halls
Computer Center
Laboratory

REUSED FOR LIBRARY/ CAFETERIA

Cafeteria seating
Library Stacks
Courtyards
Study carrels



CAMPUS PLAN WITH HOSPITAL REMOVED

Determine Needs

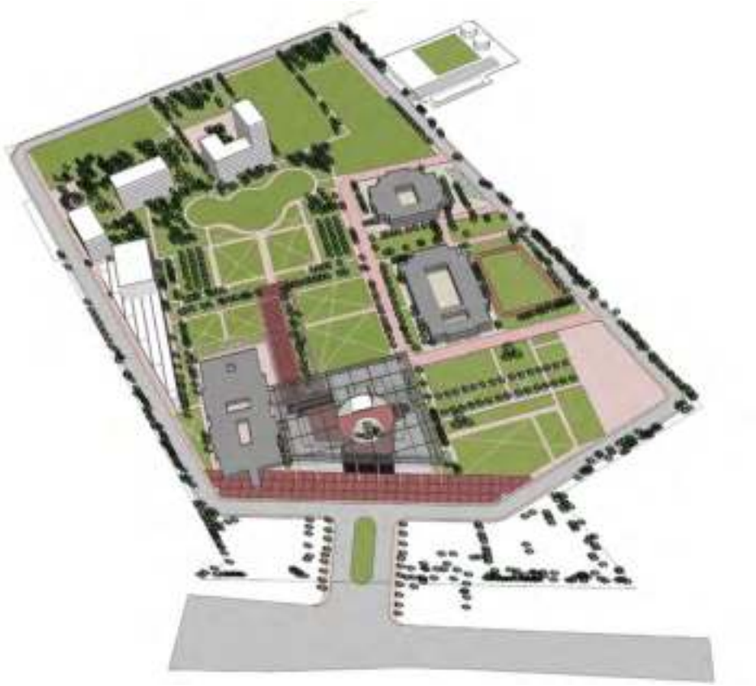
Upon completion of analysis, the programming team prepared a year by year program showing the following key pieces of information:

- Population of the Campus for all students, faculty and support staff.
- Total areas needed for academic, non academic, offices and housing
- Floor Space Index (FSI) calculations to show how much of the allowable site area was being consumed.
- A list of each space type showing numbers of spaces, areas and the utilization.

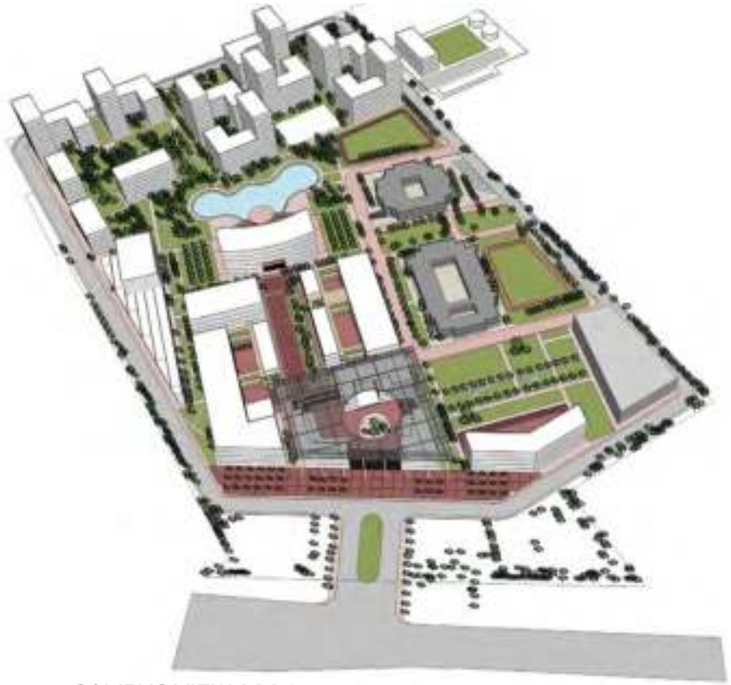
The customized spreadsheet program has been furnished to the client in soft copy form and allows the user to change variables such as enrollment numbers, curriculum and other selected variables to view revised space needs differently.

However, for the purposes of concept design stage the program has now been fixed as shown on the pages that follow . It is also important to note that the list of program spaces shown on the pages should not to be considered absolute but a solid foundation on which the project can proceed. Some tweaking to the program spaces is a natural part of concept design and is inevitable so long as the overall intent of the program is maintained.

The design team worked with the client to create a phasing strategy for the site that was tied closely to the enrollment numbers. It was agreed that the campus growth and the corresponding space needs be calculated for the following 7 different points of time as follows:



CAMPUS VIEW 2014



CAMPUS VIEW 2024

2014 PROGRAM SUMMARY

Campus begins with only 420 students with little requirement for highly specialized labs. The utilizations are low since the university has to build a variety of instructional spaces even though the enrollment numbers are low. While the summary below shows the total amount of area needed programmatically for 2014, the university will be required to build additional square footage as required for regulatory and *All India Council Technical Education (AICTE)* norms.

POPULATION	NO
Students	420
Faculty	32
Non Academic Staff	52
TOTAL	504

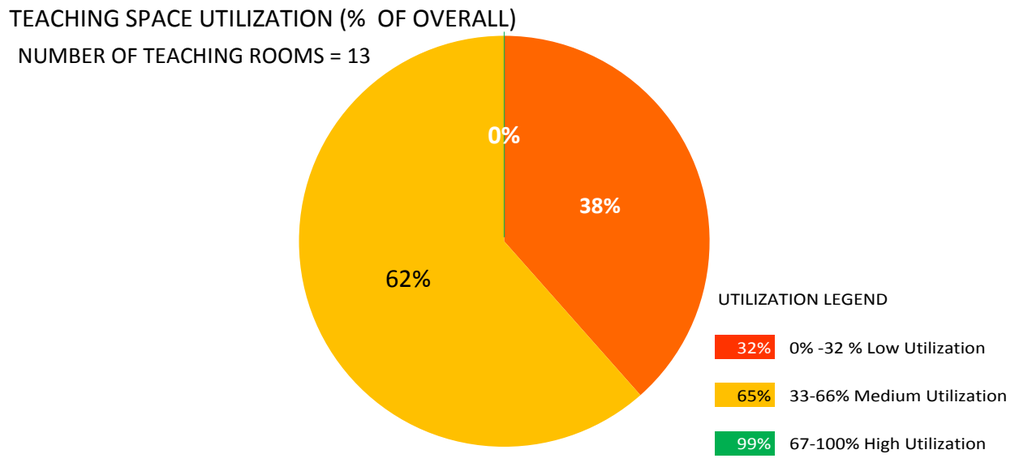
AREAS	SM
ACADEMIC AREAS	3,024
NON ACADEMIC AREAS	
Non Academic Areas	
Auditorium Etc.	
OFFICES AND SUPPORT	812
Faculty Offices	445
Non Academic Staff Offices	367
Administrative Support Spaces	
HOUSING	13,059
Student Housing	5,803
Faculty / Staff Housing	7,255
Staff Housing	
TOTAL	16,894

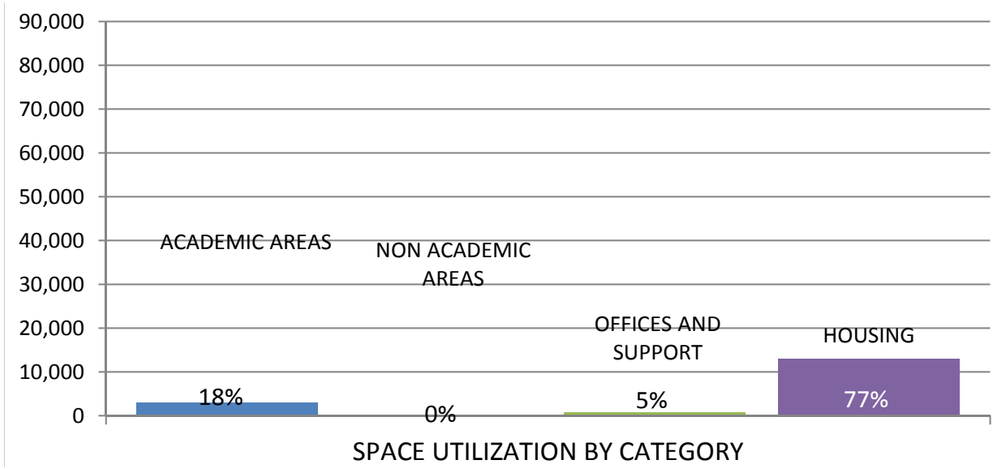
FSI CALCULATIONS	SM
Site Area available at FSI 1.0	145,357
FSI of existing school	(9,089)
Available Area	136,268
Area Consumed	16,894
FSI Consumed	0.12

Top 5 Most Used Spaces		No.
1 Typical Classroom	63%	3
2 Tutorial Room	63%	2
3 Basic Electrical & Electr	43%	1
4 Computer Lab	40%	1
5 Physics Lab	33%	1

Top 5 Built Spaces	No.
1 Typical Classroom	3
2 Tutorial Room	2
3 Basic Electrical & Electronics Lab	1
4 Chemistry Lab	1
5 Computer Lab	1

Least Used Space		No.
1 Engineering Mechanics	3%	1





2014 PROGRAM AREAS

ACADEMIC AREAS	%	No.	Area (sm)	Total
Analog Lab				
Basic Electrical & Electronics Lab	43%	1	180	180
CAD - CAM Lab				
Chemistry Lab	13%	1	180	180
Civil Engineering				
Communication Systems				
Computer Lab	40%	1	150	150
Control System Lab				
Drawing	3%	1	300	300
Electrical Drives				
Electrical Engineering				
Engineering Mechanics	3%	1	180	180
Environmental Engg				
Fluid Mechanics Lab				
Hydrology & Hydraulics				
Internal Combustion Engines Lab				
Machine Tool Engineering Lab				
Material Sciences	7%	1	180	180
Networks Lab				
Physics Lab	33%	1	180	180
Power Electronics Lab				
Survey Lab				
Thermodynamics				
Workshop	13%	1	330	330
Typical Classroom	63%	3	120	360
Tutorial Room	63%	2	60	120
Architectural Studio				
Generic Laboratory				
Mock Court				
Subtotal		13		2,160
Circulation				864
TOTAL ACADEMIC AREAS				3,024

FACULTY OFFICES	No.	Area (sm)	Total
Vice Chancellors	1	23	23
Directors	2	14	28
Professors	4	11	44
Associate Professors	7	11	77
Assistant Professors	18	11	199
Mtech			
Subtotal	32		371
Circulation			74
TOTAL FACULTY OFFICES			445

NON ACADEMIC STAFF OFFICES	No.	Area (sm)	Total
Lab Assistant	11	12	132
Librarian	11	3	33
Admin Staff	11	6	66
Computer Staff	11	3	33
Placement Officer	11	2	22
Physical Education Instructor	11	1	6
Registrar	14	1	14
Subtotal	80		306
Circulation			61
TOTAL NON ACADEMIC STAFF OFFICES			367

NON ACADEMIC AREAS	No.	Area (sm)	Total
Library	1		
Recreation Centre + Gym + Pool	1		
Café	1		
Hostel Dining Hall	1		
Shopping / Convenience / ATM	1		
Health Centre	1		
Materials Handling Facility / Maintenance	1		
Nursery			
Subtotal	7		
Circulation			
TOTAL NON ACADEMIC AREAS			

ADMINISTRATIVE SUPPORT SPACES	No.	Area (sm)	Total
Campus Administration Offices	1		
Reprographic Facility (printers/copy/fax/scanners)	1		
Campus Security	1		
IT / Support Department	1		
Facilities Management (Real Estate) Dept	1		
Subtotal	5		
Circulation			
TOTAL ADMINISTRATIVE SUPPORT SPACES			

AUDITORIUM ETC.	No.	Area (sm)	Total
Auditorium	1		
Subtotal	1		
Circulation			
TOTAL AUDITORIUM ETC.			

STUDENT HOUSING	No.	Area (sm)	Total
Single Occupancy	84	9	773
Double Occupancy	95	23	2,174
Tripple Occupancy	49	28	1,352
Subtotal	228		4,299
Circulation			1,505
TOTAL STUDENT HOUSING			5,803

FACULTY / STAFF HOUSING	No.	Area (sm)	Total
Faculty-Studio Apartment	10	37	372
Faculty/ Staff-1BHK	13	74	966
Faculty/ Staff-2BHK-S	8	111	891
Faculty/ Staff-2BHK-L	10	139	1,394
Faculty/ Staff-3BHK	16	186	2,973
Guest House			
Subtotal	57		6,596
Circulation			660
TOTAL FACULTY / STAFF HOUSING			7,255

UTILIZATION LEGEND

- 32% — 0% -32 % Low Utilization
- 65% — 33-66% Medium Utilization
- 99% — 67-100% High Utilization

2015 PROGRAM SUMMARY

The student enrollment at the campus goes up almost three (3) times from the 2014 numbers. This indicates a fairly robust building program will be necessary and construction will likely be ongoing while the first batch is attending the university. Note that utilization of teaching spaces has gone up significantly and close to half of the spaces have a utilization of greater than 50%. Compare this to the 2014 numbers where there were no instructional spaces with greater than 50% utilization.

POPULATION	NO
Students	1,260
Faculty	86
Non Academic Staff	63
TOTAL	1,409

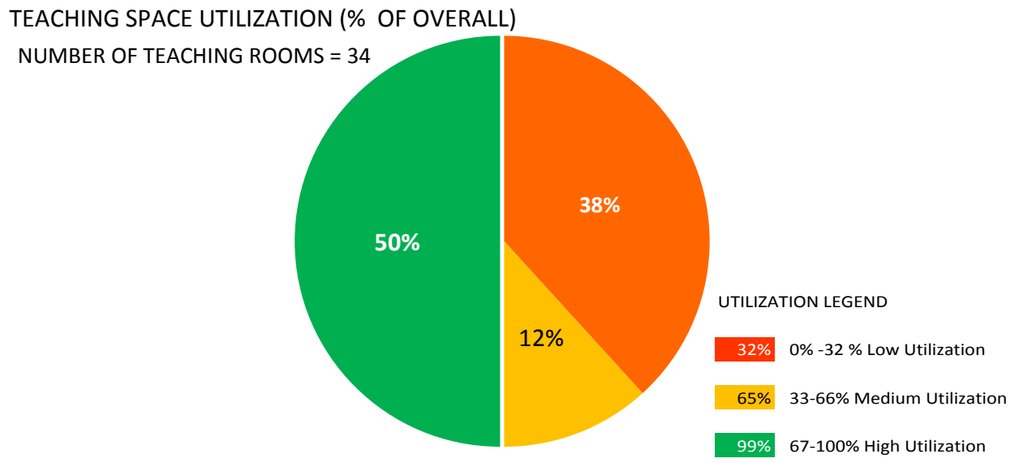
AREAS		SM
ACADEMIC AREAS		7,056
NON ACADEMIC AREAS		
Non Academic Areas		
Auditorium Etc.		
OFFICES AND SUPPORT		1,862
Faculty Offices	1,386	
Non Academic Staff Offices	476	
Administrative Support Spaces		
HOUSING		27,353
Student Housing	17,410	
Faculty / Staff Housing	9,943	
Staff Housing		
TOTAL		36,271

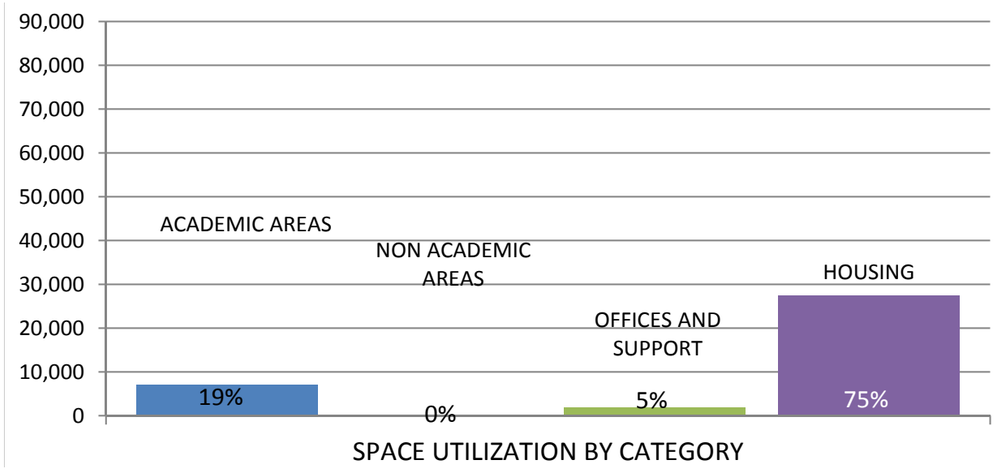
FSI CALCULATIONS	SM
Site Area available at FSI 1.0	145,357
FSI of existing school	(9,089)
Available Area	136,268
Area Consumed	36,271
FSI Consumed	0.27

Top 5 Most Used Spaces		No.
1 Computer Lab	100%	2
2 Typical Classroom	85%	7
3 Basic Electrical & Electr	83%	2
4 Tutorial Room	83%	6
5 Mtech Lab - Generic	53%	2

Top 5 Built Spaces	No.
1 Typical Classroom	7
2 Tutorial Room	6
3 Basic Electrical & Electronics Lab	2
4 Computer Lab	2
5 Physics Lab	2

Least Used Space		No.
1 Drawing	3%	1





2015 PROGRAM AREAS

ACADEMIC AREAS	%	No.	Area (sm)	Total
Analog Lab				
Basic Electrical & Electronics Lab	83%	2	180	360
CAD - CAM Lab				
Chemistry Lab	23%	1	180	180
Civil Engineering				
Communication Systems	20%	1	180	180
Computer Lab	100%	2	150	300
Control System Lab				
Drawing	3%	1	300	300
Electrical Drives				
Electrical Engineering				
Engineering Mechanics	20%	1	180	180
Environmental Engg	7%	1	180	180
Fluid Mechanics Lab	13%	1	180	180
Hydrology & Hydraulics	13%	1	180	180
Internal Combustion Engines Lab				
Machine Tool Engineering Lab	13%	1	330	330
Material Sciences	40%	1	180	180
Networks Lab				
Physics Lab	27%	2	180	360
Power Electronics Lab				
Survey Lab	13%	1	60	60
Thermodynamics	27%	1	180	180
Workshop	33%	1	330	330
Typical Classroom	85%	7	120	840
Tutorial Room	83%	6	60	360
Architectural Studio				
Generic Laboratory	30%	1	180	180
Mock Court				
Subtotal		34		5,040
Circulation				2,016
TOTAL ACADEMIC AREAS				7,056

FACULTY OFFICES	No.	Area (sm)	Total
Vice Chancellors	1	23	23
Directors	2	14	28
Professors	11	11	121
Associate Professors	18.5	11	204
Assistant Professors	53	11	585
Mtech	15	13	193
Subtotal	101		1,155
Circulation			231
TOTAL FACULTY OFFICES			1,386

NON ACADEMIC STAFF OFFICES	No.	Area (sm)	Total
Lab Assistant	11	14	149
Librarian	11	3	33
Admin Staff	11	8	83
Computer Staff	11	4	39
Placement Officer	11	6	66
Physical Education Instructor	11	1	14
Registrar	14	1	14
Subtotal	80		397
Circulation			79
TOTAL NON ACADEMIC STAFF OFFICES			476

NON ACADEMIC AREAS	No.	Area (sm)	Total
Library	1		
Recreation Centre + Gym + Pool	1		
Café	1		
Hostel Dining Hall	1		
Shopping / Convenience / ATM	1		
Health Centre	1		
Materials Handling Facility / Maintenance	1		
Nursery			
Subtotal	7		
Circulation			
TOTAL NON ACADEMIC AREAS			

ADMINISTRATIVE SUPPORT SPACES	No.	Area (sm)	Total
Campus Administration Offices	1		
Reprographic Facility (printers/copy/fax/scanners)	1		
Campus Security	1		
IT / Support Department	1		
Facilities Management (Real Estate) Dept	1		
Subtotal	5		
Circulation			
TOTAL ADMINISTRATIVE SUPPORT SPACES			

AUDITORIUM ETC.	No.	Area (sm)	Total
Auditorium	1		
Subtotal	1		
Circulation			
TOTAL AUDITORIUM ETC.			

STUDENT HOUSING	No.	Area (sm)	Total
Single Occupancy	252	9	2,318
Double Occupancy	284	23	6,521
Tripple Occupancy	147	28	4,057
Subtotal	683		12,896
Circulation			4,514
TOTAL STUDENT HOUSING			17,410

FACULTY / STAFF HOUSING	No.	Area (sm)	Total
Faculty-Studio Apartment	15	37	558
Faculty/ Staff-1BHK	18	74	1,337
Faculty/ Staff-2BHK-S	12	111	1,337
Faculty/ Staff-2BHK-L	15	139	2,091
Faculty/ Staff-3BHK	20	186	3,716
Guest House			
Subtotal	80		9,039
Circulation			904
TOTAL FACULTY / STAFF HOUSING			9,943

UTILIZATION LEGEND

32%	0% -32 % Low Utilization
65%	33-66% Medium Utilization
99%	67-100% High Utilization

2016 PROGRAM SUMMARY

The student enrollment at the campus is almost twice 2) times from the 2015 and five (5) times the 2014 numbers. numbers. Utilization continues to improve due to the higher enrollment numbers. Utilization of teaching spaces has gone up significantly and now close to half of the spaces have a utilization of greater than 66%.

POPULATION	NO
Students	2,440
Faculty	144
Non Academic Staff	80
TOTAL	2,664

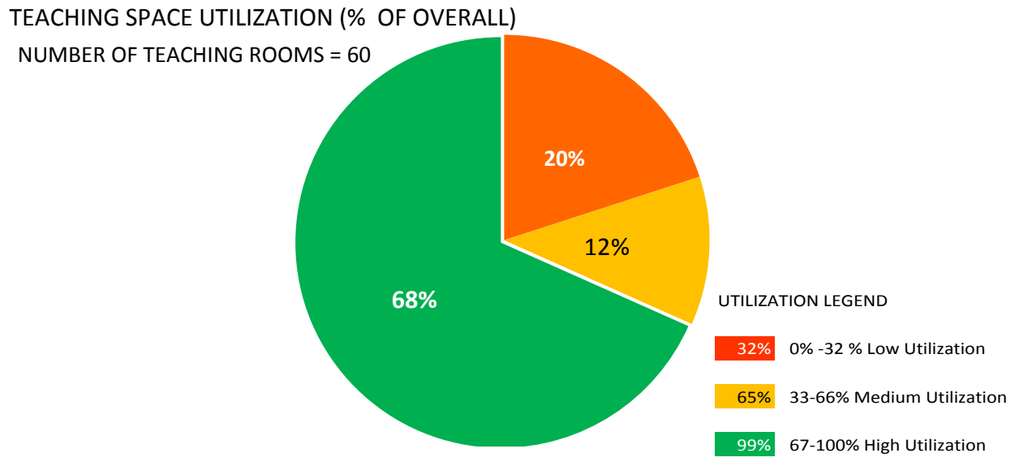
AREAS		SM
ACADEMIC AREAS		11,550
NON ACADEMIC AREAS		7,084
Non Academic Areas	5,152	
Auditorium Etc.	1,932	
OFFICES AND SUPPORT		4,591
Faculty Offices	2,631	
Non Academic Staff Offices	608	
Administrative Support Spaces	1,352	
HOUSING		46,264
Student Housing	33,714	
Faculty / Staff Housing	12,550	
Staff Housing		
TOTAL		69,489

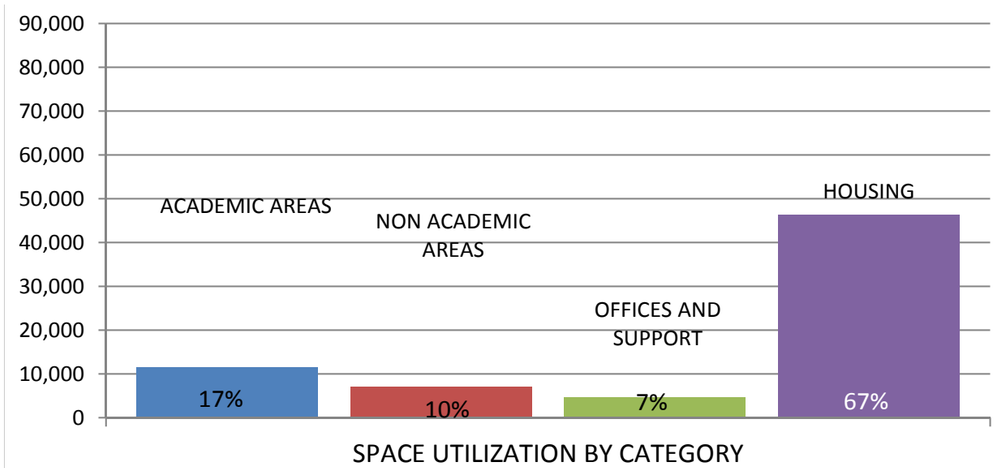
FSI CALCULATIONS	SM
Site Area available at FSI 1.0	145,357
FSI of existing school	(9,089)
Available Area	136,268
Area Consumed	69,489
FSI Consumed	0.51

Top 5 Most Used Spaces		No.
1 Computer Lab	94%	4
2 Typical Classroom	92%	14
3 Tutorial Room	91%	12
4 Mtech Lab - Generic	85%	5
5 Thermodynamics	80%	1

Top 5 Built Spaces	No.
1 Typical Classroom	14
2 Tutorial Room	12
3 Mtech Lab - Generic	5
4 Basic Electrical & Electronics Lab	4
5 Computer Lab	4

Least Used Space		No.
1 Drawing	3%	1





2016 PROGRAM AREAS

ACADEMIC AREAS	%	No.	Area (sm)	Total
Analog Lab				
Basic Electrical & Electronics Lab	72%	4	180	720
CAD - CAM Lab				
Chemistry Lab	23%	1	180	180
Civil Engineering				
Communication Systems	67%	1	180	180
Computer Lab	94%	4	150	600
Control System Lab	7%	1	180	180
Drawing	3%	1	300	300
Electrical Drives				
Electrical Engineering				
Engineering Mechanics	40%	1	180	180
Environmental Engg	7%	1	180	180
Fluid Mechanics Lab	40%	1	180	180
Hydrology & Hydraulics	27%	1	180	180
Internal Combustion Engines Lab	13%	1	180	180
Machine Tool Engineering Lab	27%	1	330	330
Material Sciences	53%	2	180	360
Networks Lab				
Physics Lab	27%	2	180	360
Power Electronics Lab	7%	1	180	180
Survey Lab	13%	1	60	60
Thermodynamics	80%	1	180	180
Workshop	48%	1	330	330
Typical Classroom	92%	14	120	1,680
Tutorial Room	91%	12	60	720
Architectural Studio	30%	1	180	180
Generic Laboratory	57%	2	180	360
Mock Court				
Subtotal		60		8,250
Circulation				3,300
TOTAL ACADEMIC AREAS				11,550

FACULTY OFFICES	No.	Area (sm)	Total
Vice Chancellors	1	23	23
Directors	4	14	55
Professors	17	11	188
Associate Professors	32	11	353
Assistant Professors	90	11	994
Mtech	45	13	580
Subtotal	189		2,192
Circulation			438
TOTAL FACULTY OFFICES			2,631

NON ACADEMIC STAFF OFFICES	No.	Area (sm)	Total
Lab Assistant	11	17	182
Librarian	11	4	39
Admin Staff	11	10	105
Computer Staff	11	5	50
Placement Officer	11	8	91
Physical Education Instructor	11	3	28
Registrar	14	1	14
Subtotal	80		506
Circulation			101
TOTAL NON ACADEMIC STAFF OFFICES			608

NON ACADEMIC AREAS	No.	Area (sm)	Total
Library	1	1,380	1,380
Recreation Centre + Gym + Pool	1	920	920
Café	1	736	736
Hostel Dining Hall	1	460	460
Shopping / Convenience / ATM	1	92	92
Health Centre	1	92	92
Materials Handling Facility / Maintenance	1		
Nursery			
Subtotal	7		3,680
Circulation			1,472
TOTAL NON ACADEMIC AREAS			5,152

ADMINISTRATIVE SUPPORT SPACES	No.	Area (sm)	Total
Campus Administration Offices	1	184	184
Reprographic Facility (printers/copy/fax/scanners)	1	55	55
Campus Security	1	580	580
IT / Support Department	1	55	55
Facilities Management (Real Estate) Dept	1	92	92
Subtotal	5		966
Circulation			386
TOTAL ADMINISTRATIVE SUPPORT SPACES			1,352

AUDITORIUM ETC.	No.	Area (sm)	Total
Auditorium	1	1,380	1,380
Subtotal	1		1,380
Circulation			552
TOTAL AUDITORIUM ETC.			1,932

STUDENT HOUSING	No.	Area (sm)	Total
Single Occupancy	488	9	4,490
Double Occupancy	549	23	12,627
Tripple Occupancy	285	28	7,857
Subtotal	1,322		24,973
Circulation			8,741
TOTAL STUDENT HOUSING			33,714

FACULTY / STAFF HOUSING	No.	Area (sm)	Total
Faculty-Studio Apartment	20	37	744
Faculty/ Staff-1BHK	23	74	1,709
Faculty/ Staff-2BHK-S	12	111	1,337
Faculty/ Staff-2BHK-L	20	139	2,788
Faculty/ Staff-3BHK	24	186	4,459
Guest House	10	37	372
Subtotal	109		11,409
Circulation			1,141
TOTAL FACULTY / STAFF HOUSING			12,550

UTILIZATION LEGEND

- 32% — 0% -32 % Low Utilization
- 65% — 33-66% Medium Utilization
- 99% — 67-100% High Utilization

2018 PROGRAM SUMMARY

Campus enrollment is close to twice the 2016 levels and six (6) times the first year levels. Utilization is greatly improved. Most of the housing required in the program is completed and almost three quarters of the allowable Floor Space Index (FSI) is consumed.

POPULATION	NO
Students	4,200
Faculty	238
Non Academic Staff	103
TOTAL	4,541

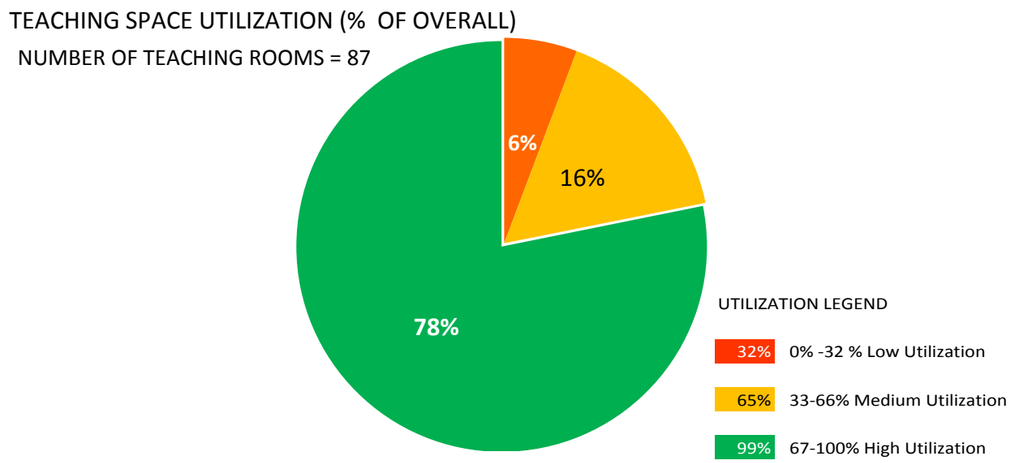
AREAS		SM
ACADEMIC AREAS		16,086
NON ACADEMIC AREAS		7,084
Non Academic Areas	5,152	
Auditorium Etc.	1,932	
OFFICES AND SUPPORT		6,239
Faculty Offices	4,115	
Non Academic Staff Offices	772	
Administrative Support Spaces	1,352	
HOUSING		70,582
Student Housing	58,032	
Faculty / Staff Housing	12,549	
Staff Housing		
TOTAL		99,991

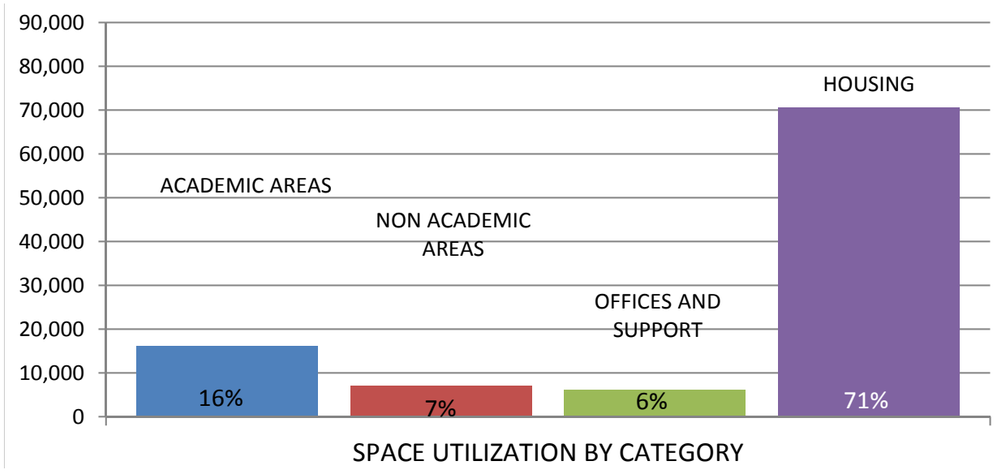
FSI CALCULATIONS	SM
Site Area available at FSI 1.0	145,357
FSI of existing school	(9,089)
Available Area	136,268
Area Consumed	99,991
FSI Consumed	0.73

Top 5 Most Used Spaces		No.
1 Typical Classroom	99%	21
2 Tutorial Room	97%	21
3 Computer Lab	90%	8
4 Basic Electrical & Electr	88%	5
5 Mtech Lab - Generic	83%	5

Top 5 Built Spaces	No.
1 Typical Classroom	21
2 Tutorial Room	21
3 Computer Lab	8
4 Basic Electrical & Electronics Lab	5
5 Mtech Lab - Generic	5

Least Used Space		No.
1 Drawing	7%	1





2018 PROGRAM AREAS

ACADEMIC AREAS	%	No.	Area (sm)	Total
Analog Lab				
Basic Electrical & Electronics Lab	88%	5	180	900
CAD - CAM Lab				
Chemistry Lab	27%	1	180	180
Civil Engineering	53%	1	180	180
Communication Systems	60%	2	180	360
Computer Lab	90%	8	150	1,200
Control System Lab	67%	1	180	180
Drawing	7%	1	300	300
Electrical Drives				
Electrical Engineering				
Engineering Mechanics	50%	2	180	360
Environmental Engg	40%	1	180	180
Fluid Mechanics Lab	40%	1	180	180
Hydrology & Hydraulics	40%	1	180	180
Internal Combustion Engines Lab	27%	1	180	180
Machine Tool Engineering Lab	27%	1	330	330
Material Sciences	67%	2	180	360
Networks Lab				
Physics Lab	33%	2	180	360
Power Electronics Lab	33%	1	180	180
Survey Lab	27%	1	60	60
Thermodynamics	53%	2	180	360
Workshop	55%	1	330	330
Typical Classroom	99%	21	120	2,520
Tutorial Room	97%	21	60	1,260
Architectural Studio	81%	2	180	360
Generic Laboratory	77%	3	180	540
Mock Court				
Subtotal		87		11,490
Circulation				4,596
TOTAL ACADEMIC AREAS				16,086

FACULTY OFFICES	No.	Area (sm)	Total
Vice Chancellors	1	23	23
Directors	6	14	83
Professors	24	11	265
Associate Professors	51	11	563
Assistant Professors	156	11	1,722
Mtech	60	13	773
Subtotal	298		3,429
Circulation			686
TOTAL FACULTY OFFICES			4,115

NON ACADEMIC STAFF OFFICES	No.	Area (sm)	Total
Lab Assistant	11	20	223
Librarian	11	4	44
Admin Staff	11	15	165
Computer Staff	11	6	61
Placement Officer	11	8	91
Physical Education Instructor	11	4	46
Registrar	14	1	14
Subtotal	80		643
Circulation			129
TOTAL NON ACADEMIC STAFF OFFICES			772

NON ACADEMIC AREAS	No.	Area (sm)	Total
Library	1	1,380	1,380
Recreation Centre + Gym + Pool	1	920	920
Café	1	736	736
Hostel Dining Hall	1	460	460
Shopping / Convenience / ATM	1	92	92
Health Centre	1	92	92
Materials Handling Facility / Maintenance	1		
Nursery			
Subtotal	7		3,680
Circulation			1,472
TOTAL NON ACADEMIC AREAS			5,152

ADMINISTRATIVE SUPPORT SPACES	No.	Area (sm)	Total
Campus Administration Offices	1	184	184
Reprographic Facility (printers/copy/fax/scanners)	1	55	55
Campus Security	1	580	580
IT / Support Department	1	55	55
Facilities Management (Real Estate) Dept	1	92	92
Subtotal	5		966
Circulation			386
TOTAL ADMINISTRATIVE SUPPORT SPACES			1,352

AUDITORIUM ETC.	No.	Area (sm)	Total
Auditorium	1	1,380	1,380
Subtotal	1		1,380
Circulation			552
TOTAL AUDITORIUM ETC.			1,932

STUDENT HOUSING	No.	Area (sm)	Total
Single Occupancy	840	9	7,728
Double Occupancy	945	23	21,735
Tripple Occupancy	490	28	13,524
Subtotal	2,275		42,987
Circulation			15,045
TOTAL STUDENT HOUSING			58,032

FACULTY / STAFF HOUSING	No.	Area (sm)	Total
Faculty-Studio Apartment	20	37	744
Faculty/ Staff-1BHK	28	74	2,080
Faculty/ Staff-2BHK-S	12	111	1,337
Faculty/ Staff-2BHK-L	20	139	2,788
Faculty/ Staff-3BHK	24	186	4,459
Guest House			
Subtotal	104		11,408
Circulation			1,141
TOTAL FACULTY / STAFF HOUSING			12,549

UTILIZATION LEGEND

- 32% — 0% -32 % Low Utilization
- 65% — 33-66% Medium Utilization
- 99% — 67-100% High Utilization

2020 PROGRAM SUMMARY

Campus enrollment has more than doubled from 2016 levels and utilization continues to improve. Only a small portion of the housing may be added at this phase if the university has not already chosen to complete the housing program by 2018.

POPULATION	NO
Students	6,000
Faculty	336
Non Academic Staff	137
TOTAL	6,473

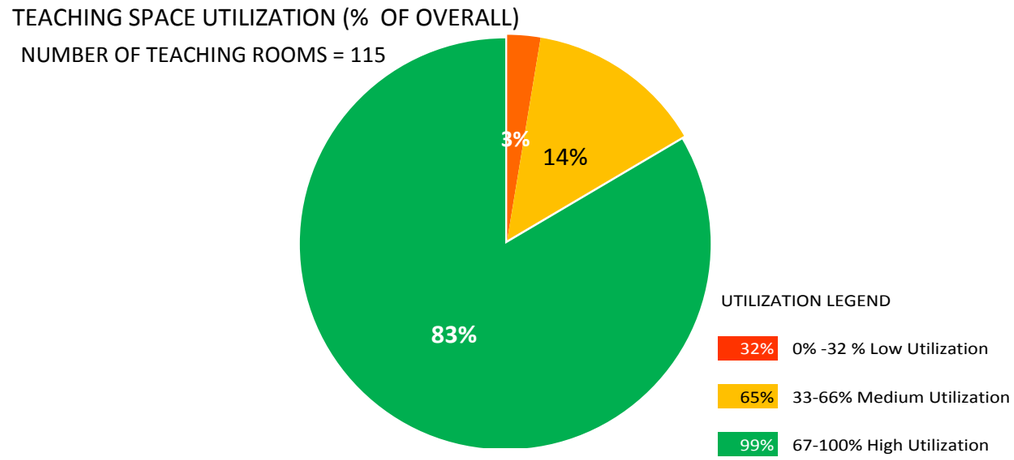
AREAS		SM
ACADEMIC AREAS		21,294
NON ACADEMIC AREAS		9,209
Non Academic Areas	7,277	
Auditorium Etc.	1,932	
OFFICES AND SUPPORT		8,448
Faculty Offices	5,648	
Non Academic Staff Offices	1,010	
Administrative Support Spaces	1,790	
HOUSING		81,536
Student Housing	68,987	
Faculty / Staff Housing	12,549	
Staff Housing		
TOTAL		120,488

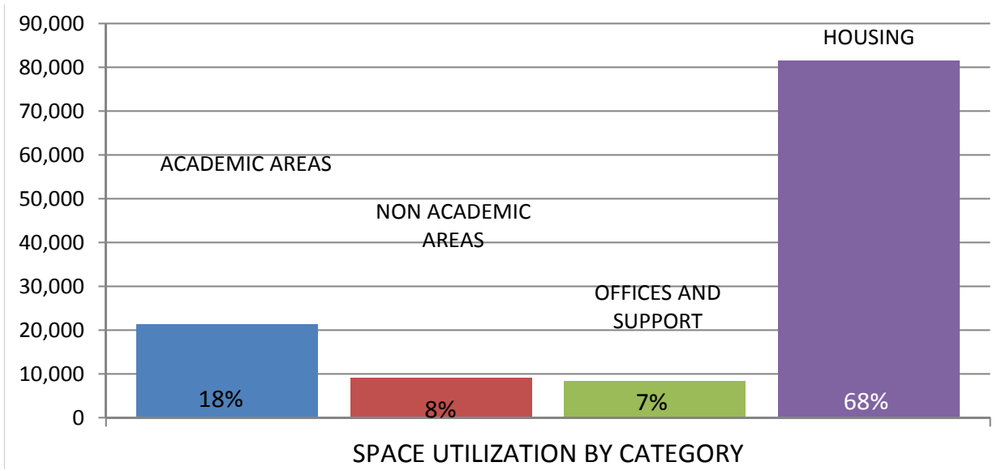
FSI CALCULATIONS	SM
Site Area available at FSI 1.0	145,357
FSI of existing school	(9,089)
Available Area	136,268
Area Consumed	120,488
FSI Consumed	0.88

Top 5 Most Used Spaces		No.
1 Typical Classroom	98%	29
2 Tutorial Room	98%	28
3 Basic Electrical & Electr	93%	7
4 Computer Lab	92%	10
5 Communication Systen	90%	2

Top 5 Built Spaces	No.
1 Typical Classroom	29
2 Tutorial Room	28
3 Computer Lab	10
4 Basic Electrical & Electronics Lab	7
5 Mtech Lab - Generic	6

Least Used Space		No.
1 Mock Court	4%	1





2020 PROGRAM AREAS

ACADEMIC AREAS	%	No.	Area (sm)	Total
Analog Lab				
Basic Electrical & Electronics Lab	93%	7	180	1,260
CAD - CAM Lab				
Chemistry Lab	53%	1	180	180
Civil Engineering	53%	2	180	360
Communication Systems	90%	2	180	360
Computer Lab	92%	10	150	1,500
Control System Lab	67%	1	180	180
Drawing	10%	1	300	300
Electrical Drives				
Electrical Engineering				
Engineering Mechanics	60%	2	180	360
Environmental Engg	47%	1	180	180
Fluid Mechanics Lab	33%	2	180	360
Hydrology & Hydraulics	67%	1	180	180
Internal Combustion Engines Lab	27%	1	180	180
Machine Tool Engineering Lab	40%	1	330	330
Material Sciences	80%	2	180	360
Networks Lab				
Physics Lab	42%	3	180	540
Power Electronics Lab	40%	1	180	180
Survey Lab	40%	1	60	60
Thermodynamics	67%	2	180	360
Workshop	51%	2	330	660
Typical Classroom	98%	29	120	3,480
Tutorial Room	98%	28	60	1,680
Architectural Studio	70%	3	180	540
Generic Laboratory	83%	5	180	900
Mock Court	4%	1	180	180
Subtotal		115		15,210
Circulation				6,084
TOTAL ACADEMIC AREAS				21,294

FACULTY OFFICES	No.	Area (sm)	Total
Vice Chancellors	1	23	23
Directors	7	14	97
Professors	32	11	353
Associate Professors	73	11	806
Assistant Professors	223	11	2,462
Mtech	75	13	966
Subtotal	411		4,707
Circulation			941
TOTAL FACULTY OFFICES			5,648

NON ACADEMIC STAFF OFFICES	No.	Area (sm)	Total
Lab Assistant	11	30	330
Librarian	11	5	50
Admin Staff	11	20	220
Computer Staff	11	7	72
Placement Officer	11	8	91
Physical Education Instructor	11	6	66
Registrar	14	1	14
Subtotal	80		842
Circulation			168
TOTAL NON ACADEMIC STAFF OFFICES			1,010

NON ACADEMIC AREAS	No.	Area (sm)	Total
Library	1	1,840	1,840
Recreation Centre + Gym + Pool	1	1,380	1,380
Café	1	920	920
Hostel Dining Hall	1	736	736
Shopping / Convenience / ATM	1	184	184
Health Centre	1	138	138
Materials Handling Facility / Maintenance	1		
Nursery			
Subtotal	7		5,198
Circulation			2,079
TOTAL NON ACADEMIC AREAS			7,277

ADMINISTRATIVE SUPPORT SPACES	No.	Area (sm)	Total
Campus Administration Offices	1	368	368
Reprographic Facility (printers/copy/fax/scanners)	1	55	55
Campus Security	1	580	580
IT / Support Department	1	92	92
Facilities Management (Real Estate) Dept	1	184	184
Subtotal	5		1,279
Circulation			512
TOTAL ADMINISTRATIVE SUPPORT SPACES			1,790

AUDITORIUM ETC.	No.	Area (sm)	Total
Auditorium	1	1,380	1,380
Subtotal	1		1,380
Circulation			552
TOTAL AUDITORIUM ETC.			1,932

STUDENT HOUSING	No.	Area (sm)	Total
Single Occupancy	988	9	9,090
Double Occupancy	1109	23	25,507
Tripple Occupancy	598	28	16,505
Subtotal	2,695		51,101
Circulation			17,885
TOTAL STUDENT HOUSING			68,987

FACULTY / STAFF HOUSING	No.	Area (sm)	Total
Faculty-Studio Apartment	20	37	744
Faculty/ Staff-1BHK	28	74	2,080
Faculty/ Staff-2BHK-S	12	111	1,337
Faculty/ Staff-2BHK-L	20	139	2,788
Faculty/ Staff-3BHK	24	186	4,459
Guest House			
Subtotal	104		11,408
Circulation			1,141
TOTAL FACULTY / STAFF HOUSING			12,549

UTILIZATION LEGEND

- 32% — 0% -32 % Low Utilization
- 65% — 33-66% Medium Utilization
- 99% — 67-100% High Utilization

2022 PROGRAM SUMMARY

Campus enrollment has more than doubled from 2018 levels and utilization continues to improve. Housing program is completed

POPULATION	NO
Students	9,665
Faculty	536
Non Academic Staff	194
TOTAL	10,395

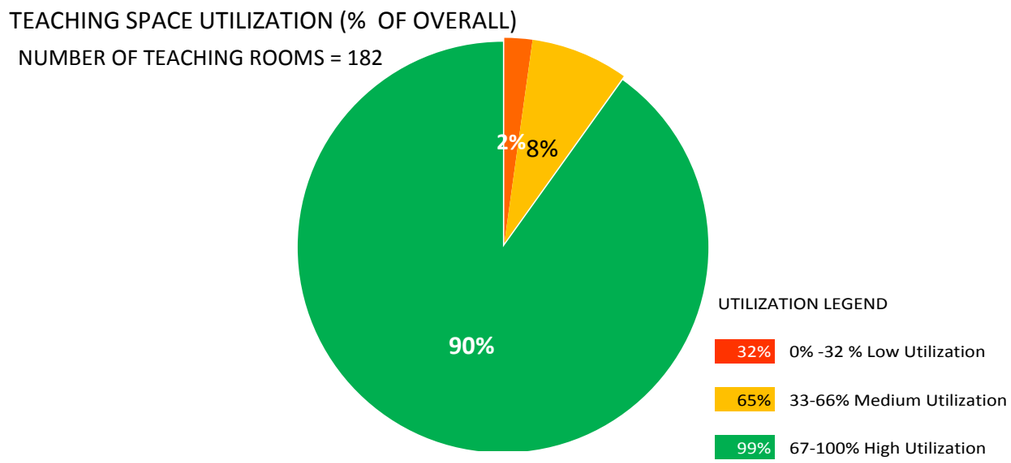
AREAS		SM
ACADEMIC AREAS		33,180
NON ACADEMIC AREAS		9,209
Non Academic Areas	7,277	
Auditorium Etc.	1,932	
OFFICES AND SUPPORT		12,424
Faculty Offices	9,225	
Non Academic Staff Offices	1,409	
Administrative Support Spaces	1,790	
HOUSING		81,536
Student Housing	68,987	
Faculty / Staff Housing	12,549	
Staff Housing		
TOTAL		136,349

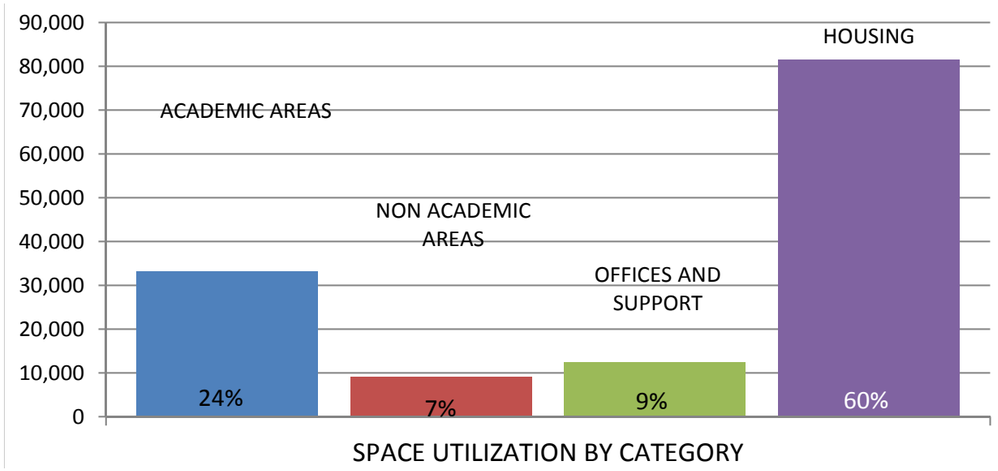
FSI CALCULATIONS	SM
Site Area available at FSI 1.0	145,357
FSI of existing school	(9,089)
Available Area	136,268
Area Consumed	136,349
FSI Consumed	1.00

Top 5 Most Used Spaces		No.
1 Tutorial Room	99%	46
2 Typical Classroom	98%	49
3 Mtech Lab - Generic	97%	10
4 Generic Laboratory	97%	10
5 Computer Lab	96%	15

Top 5 Built Spaces	No.
1 Typical Classroom	49
2 Tutorial Room	46
3 Computer Lab	15
4 Basic Electrical & Electronics Lab	10
5 Generic Laboratory	10

Least Used Space		No.
1 Mock Court	4%	1





2022 PROGRAM AREAS

ACADEMIC AREAS	%	No.	Area (sm)	Total
Analog Lab				
Basic Electrical & Electronics Lab	91%	10	180	1,800
CAD - CAM Lab				
Chemistry Lab	57%	1	180	180
Civil Engineering	80%	2	180	360
Communication Systems	82%	4	180	720
Computer Lab	96%	15	150	2,250
Control System Lab	73%	2	180	360
Drawing	10%	1	300	300
Electrical Drives				
Electrical Engineering				
Engineering Mechanics	68%	3	180	540
Environmental Engg	60%	1	180	180
Fluid Mechanics Lab	36%	3	180	540
Hydrology & Hydraulics	80%	1	180	180
Internal Combustion Engines Lab	27%	2	180	360
Machine Tool Engineering Lab	33%	2	330	660
Material Sciences	87%	3	180	540
Networks Lab				
Physics Lab	47%	3	180	540
Power Electronics Lab	67%	1	180	180
Survey Lab	40%	1	60	60
Thermodynamics	80%	3	180	540
Workshop	62%	3	330	990
Typical Classroom	98%	49	120	5,880
Tutorial Room	99%	46	60	2,760
Architectural Studio	81%	5	180	900
Generic Laboratory	97%	10	180	1,800
Mock Court	4%	1	180	180
	Subtotal	182		23,700
	Circulation			9,480
	TOTAL ACADEMIC AREAS			33,180

FACULTY OFFICES	No.	Area (sm)	Total
Vice Chancellors	1	23	23
Directors	7	14	97
Professors	53	11	585
Associate Professors	117	11	1,292
Assistant Professors	358	11	3,952
Mtech	135	13	1,739
Subtotal	671		7,688
Circulation			1,538
TOTAL FACULTY OFFICES			9,225

NON ACADEMIC STAFF OFFICES	No.	Area (sm)	Total
Lab Assistant	11	42	462
Librarian	11	5	55
Admin Staff	11	33	358
Computer Staff	11	8	88
Placement Officer	11	8	91
Physical Education Instructor	11	10	107
Registrar	14	1	14
Subtotal	80		1,174
Circulation			235
TOTAL NON ACADEMIC STAFF OFFICES			1,409

NON ACADEMIC AREAS	No.	Area (sm)	Total
Library	1	1,840	1,840
Recreation Centre + Gym + Pool	1	1,380	1,380
Café	1	920	920
Hostel Dining Hall	1	736	736
Shopping / Convenience / ATM	1	184	184
Health Centre	1	138	138
Materials Handling Facility / Maintenance	1		
Nursery			
Subtotal	7		5,198
Circulation			2,079
TOTAL NON ACADEMIC AREAS			7,277

ADMINISTRATIVE SUPPORT SPACES	No.	Area (sm)	Total
Campus Administration Offices	1	368	368
Reprographic Facility (printers/copy/fax/scanners)	1	55	55
Campus Security	1	580	580
IT / Support Department	1	92	92
Facilities Management (Real Estate) Dept	1	184	184
Subtotal	5		1,279
Circulation			512
TOTAL ADMINISTRATIVE SUPPORT SPACES			1,790

AUDITORIUM ETC.	No.	Area (sm)	Total
Auditorium	1	1,380	1,380
Subtotal	1		1,380
Circulation			552
TOTAL AUDITORIUM ETC.			1,932

STUDENT HOUSING	No.	Area (sm)	Total
Single Occupancy	988	9	9,090
Double Occupancy	1109	23	25,507
Tripple Occupancy	598	28	16,505
Subtotal	2,695		51,101
Circulation			17,885
TOTAL STUDENT HOUSING			68,987

FACULTY / STAFF HOUSING	No.	Area (sm)	Total
Faculty-Studio Apartment	20	37	744
Faculty/ Staff-1BHK	28	74	2,080
Faculty/ Staff-2BHK-S	12	111	1,337
Faculty/ Staff-2BHK-L	20	139	2,788
Faculty/ Staff-3BHK	24	186	4,459
Guest House			
Subtotal	104		11,408
Circulation			1,141
TOTAL FACULTY / STAFF HOUSING			12,549

UTILIZATION LEGEND

- 32% 0% -32 % Low Utilization
- 65% 33-66% Medium Utilization
- 99% 67-100% High Utilization

2024 PROGRAM SUMMARY

All construction activity on campus is complete and close to 90% of the instructional spaces have a utilization greater than 66%

Top 5 Most Used Spaces		No.
1 Typical Classroom	99%	54
2 Generic Laboratory	99%	13
3 Tutorial Room	99%	55
4 Computer Lab	97%	17
5 Architectural Studio	92%	6

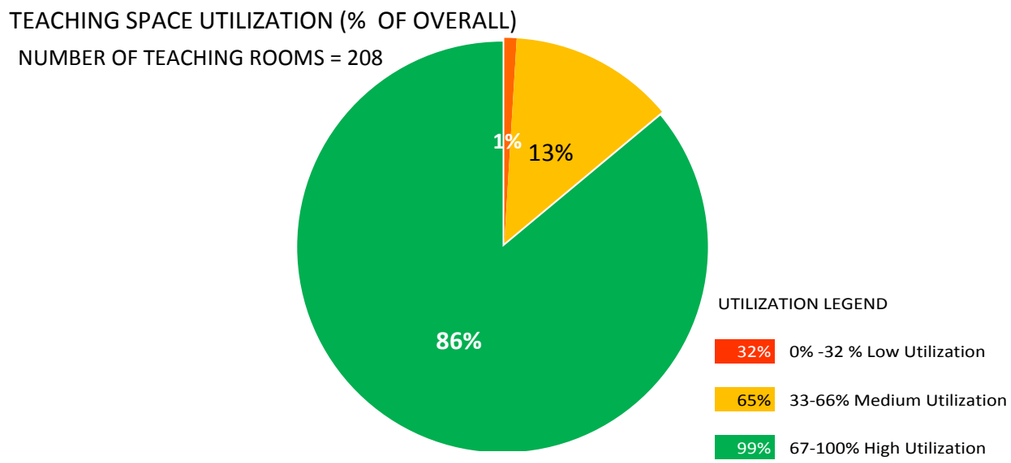
Top 5 Built Spaces	No.
1 Tutorial Room	55
2 Typical Classroom	54
3 Computer Lab	17
4 Generic Laboratory	13
5 Basic Electrical & Electronics Lab	11

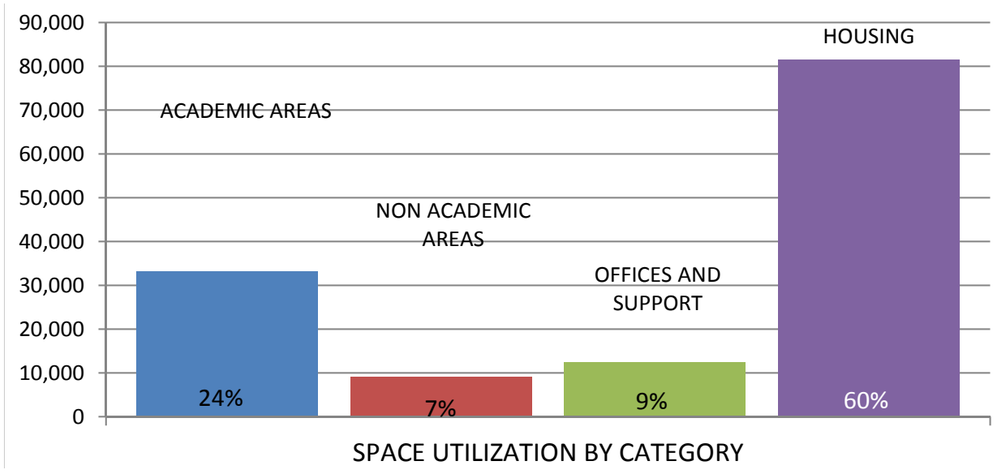
Least Used Space		No.
1 Drawing	10%	1

POPULATION	NO
Students	11,330
Faculty	630
Non Academic Staff	217
TOTAL	12,177

AREAS		SM
ACADEMIC AREAS		37,590
NON ACADEMIC AREAS		9,209
Non Academic Areas	7,277	
Auditorium Etc.	1,932	
OFFICES AND SUPPORT		14,059
Faculty Offices	10,702	
Non Academic Staff Offices	1,566	
Administrative Support Spaces	1,790	
HOUSING		81,536
Student Housing	68,987	
Faculty / Staff Housing	12,549	
Staff Housing		
TOTAL		142,394

FSI CALCULATIONS	SM
Site Area available at FSI 1.0	145,357
FSI of existing school	(9,089)
Available Area	136,268
Area Consumed	142,394
FSI Consumed	1.04





2024 PROGRAM AREAS

ACADEMIC AREAS	%	No.	Area (sm)	Total
Analog Lab				
Basic Electrical & Electronics Lab	92%	11	180	1,980
CAD - CAM Lab				
Chemistry Lab	57%	1	180	180
Civil Engineering	80%	2	180	360
Communication Systems	88%	4	180	720
Computer Lab	97%	17	150	2,550
Control System Lab	83%	3	180	540
Drawing	10%	1	300	300
Electrical Drives				
Electrical Engineering				
Engineering Mechanics	76%	4	180	720
Environmental Engg	60%	2	180	360
Fluid Mechanics Lab	36%	3	180	540
Hydrology & Hydraulics	80%	1	180	180
Internal Combustion Engines Lab	33%	2	180	360
Machine Tool Engineering Lab	33%	2	330	660
Material Sciences	87%	3	180	540
Networks Lab				
Physics Lab	47%	3	180	540
Power Electronics Lab	63%	2	180	360
Survey Lab	40%	1	60	60
Thermodynamics	89%	3	180	540
Workshop	68%	3	330	990
Typical Classroom	99%	54	120	6,480
Tutorial Room	99%	55	60	3,300
Architectural Studio	92%	6	180	1,080
Generic Laboratory	99%	13	180	2,340
Mock Court	13%	1	180	180
Subtotal		208		26,850
Circulation				10,740
TOTAL ACADEMIC AREAS				37,590

FACULTY OFFICES	No.	Area (sm)	Total
Vice Chancellors	1	23	23
Directors	7	14	97
Professors	64	11	707
Associate Professors	137	11	1,512
Assistant Professors	421	11	4,648
Mtech	150	13	1,932
Subtotal	780		8,918
Circulation			1,784
TOTAL FACULTY OFFICES			10,702

NON ACADEMIC STAFF OFFICES	No.	Area (sm)	Total
Lab Assistant	11	46	503
Librarian	11	5	55
Admin Staff	11	38	418
Computer Staff	11	10	105
Placement Officer	11	8	91
Physical Education Instructor	11	11	120
Registrar	14	1	14
Subtotal	80		1,305
Circulation			261
TOTAL NON ACADEMIC STAFF OFFICES			1,566

NON ACADEMIC AREAS	No.	Area (sm)	Total
Library	1	1,840	1,840
Recreation Centre + Gym + Pool	1	1,380	1,380
Café	1	920	920
Hostel Dining Hall	1	736	736
Shopping / Convenience / ATM	1	184	184
Health Centre	1	138	138
Materials Handling Facility / Maintenance	1		
Nursery			
Subtotal	7		5,198
Circulation			2,079
TOTAL NON ACADEMIC AREAS			7,277

ADMINISTRATIVE SUPPORT SPACES	No.	Area (sm)	Total
Campus Administration Offices	1	368	368
Reprographic Facility (printers/copy/fax/scanners)	1	55	55
Campus Security	1	580	580
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UTILIZATION LEGEND

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- 99% — 67-100% High Utilization

Stating the Problem

The logical culmination of a programming exercise if to state the problem with clarity so the next stage of design can begin.

The programming exercise has yielded some interesting aspects and concepts that will now form the basis of concept design development. The problem statement has the following key points.

Campus Growth

- Campus will start operations in 2014. (see *"2014 Program Summary"*)
- Construction will be continuous until 2024 due to high student enrollment numbers.
- The first phase of project will require building more space than programmed for 2014. (see *"Phasing Strategy - FY 2014"*)

Flexibility and adaptability

- Detailed program list of spaces has been provided and should be followed as a guide. (see *"2014 Program Areas"*)
- There is enough flexibility designed in the programming and campus phasing build out that a certain amount of additional flexible space will always be available.
- Existing hospital building will remain in operation until 2020 and will be adapted for different purposes during that period (see page *B-35*)
- Instructional spaces should remain flexible to the extent possible. Detailed room data sheets have been provided for each instructional space (see page *D-01*)
- It will not be necessary to build all spaces out to its full technical requirements as features (such as fume hoods, special data, power and other technology) can be added over time. (see *"From Simple to Complex"*)

Challenges:

- Constant construction on campus will require careful planning to keep university and construction operations separated. The building placement addresses this issue through phasing construction of buildings in a manner to reduce such disruptions.
- Existing infrastructure condition should be established, particularly for existing services to the hospital and school building.
- New infrastructure pathways should be coordinated with existing and be provided in a manner they can be scaled up as the university grows. (See page *C-29*)

Benchmarks

- The BMU has been benchmarking against a variety of other technical universities. Only relevant benchmarks have been considered and where necessary they have been adapted to suit local and regional conditions.

Sustainability:

- Mature trees to be protected. This will be a challenge due to heavy construction activities and must be regulated.
- Instructional spaces shall be designed with minimal reliance on artificial air conditioning. Concept design should explore both passive and active systems in the strategies to be adopted.

master plan

Master Plan Summary

Through the master planning exercise, the design team tested a variety of iterations exploring various ways in which student life can be organized on the campus.

The main challenge was to maintain the principles of flexibility and modularity while paying careful attention to the existing conditions of the site. The site is well suited for an educational campus and has a network of mature trees. The site also includes a functioning school building and a decommissioned hospital which had to be incorporated in the master plan.

The Master plan ideas ranged from *tabula rasa* approaches that explored the maximum potential of the site to ones that were pragmatic and built around the memory of the place. Each of the options however had the common thread of creating a lively student environment with a hierarchy of open spaces for student interaction.

Various clustering options were explored and the key ones have been documented in the following pages.

Gurgaon is the second largest city in the Indian state of Haryana. Gurgaon is the industrial and financial center of Haryana. It is located 30 km south of national capital New Delhi, about 10 kilometers from Dwarka Sub City and 268 km south of Chandigarh, the state capital for Haryana. Gurgaon is one of Delhi's four major satellite cities and is part of the National Capital Region (NCR).Gurgaon is within commuting distance of Delhi via an expressway and Delhi Metro.

Gurgaon has the 3rd highest per capita income in India after Chandigarh and Mumbai. Over the past 25 years the city has undergone rapid development and construction. A wave of multinational companies have chosen to locate their operations in Gurgaon after GE did so in 1997. The presence of large domestic and international firms have made Gurgaon an important financial center of India, as well as one of India's major outsourcing hubs.

Gurgaon is home to one of India's top business schools as well as other engineering institutions .

(Source: http://en.wikipedia.org/wiki/Gurgaon)

Gurgaon - Uniquely positioned near the National Capital

Gurgaon is a major Industrial town in Haryana in the National Capital Region. It is strategically located in the state of Haryana to the South of Delhi. Its strategic location within the NCR has led to a robust industrial growth in and around the city. The major Indian industries of Gurgaon are Maruti, Hero MotoCorp and their ancillary companies. The Industrial units are spread in Udyog Vihar, Railway Road, National Highway 8, Manesar, Sohna Road and Khandsa Road.

Gurgaon - An Industrial and IT Hub

LIST OF INDUSTRIES IN GURGAON AREA

(Source: http://en.wikipedia.org/wiki/List_of_companies_in_Gurgaon)

Information Technology (IT)

Organization
Amdocs
Nortel
Aegis
Ibibo
Ixigo.com
Dell
ThoughtWorks
Cincom
Ericsson
Nokia Siemens Networks
Navteq
Alcatel-Lucent
Ciena Corporation
Cognizant Technology Solutions
Motorola
Avanade
HP
Satyam Computers
HCL Technologies
IBM
Google Inc[2]
KLG Systel
Microsoft
NIIT
Dell Inc
Aricent
NaviSite
Sapient
i-flex Solutions
Hughes Systique Corporation
SAP
NCR
TCS
Wipro Technologies
Royal Bank of Scotland
Oracle Corporation
Capital IQ
CareerBuilder
Accenture
Fidelity Investments
United Health Group
McAfee Inc.
Orange Business Services
Agilent Technologies
AMD
Capgemini
Convergys
24/7 Customer
Genpact
Honeywell
HSBC
iGate
Keane
Qualcomm
Sitel
Brocade Communications
Comviva Technologies
COWI
Panasonic Corporation
Stryker Corporation
Hexaware Technologies
Ranbaxy Laboratories
Bank of America
InterGlobe Technologies

Engineering, Procurement & Construction

Organization
A2Z Group
Dlf
Emaar Properties
Bechtel India Private Limited
Fluor Daniel India Private Limited
Golder Associates Consulting India Pvt. Ltd.
Punj Lloyd Limited
GS E&C India Private Limited
Hatch Associates India Private Limited
Foster Wheeler India Private Limited
Siemens Power Engineering Pvt. Ltd
UOP LLC
Chicago Bridge & Iron Company
Maruti Suzuki India Limited
Delphi India
HMSI
Hero MotoCorp
Senior India Pvt. Ltd.

Management Consulting and Business Advisory Companies

Organization
AbsolutData Research & Analytics
Amrop
BMR Advisors
Bain & Company
Corporate Executive Board
Deloitte
Dunnhumby India
Egon Zehnder International
Ernst & Young
Franklin Covey India & South Asia
Gerson Lehrman Group
Kroll Inc.
LexisNexis India
Mercer India
PriceWaterHouseCoopers
Louis Berger Group
McKinsey & Company
Recon
Towers Watson

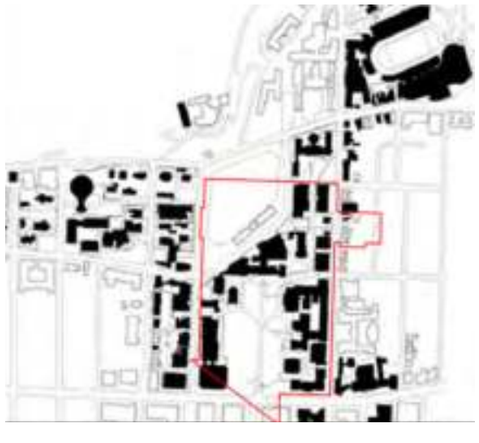
Existing hospital building and road network

View of existing school playground

View of fields along south-west corner of site

College of Charleston, USA

Total Student Population:	11, 617
Faculty Population:	600
Staff Population:	500
Total Campus Population:	12, 717
Land Area:	52 Acres

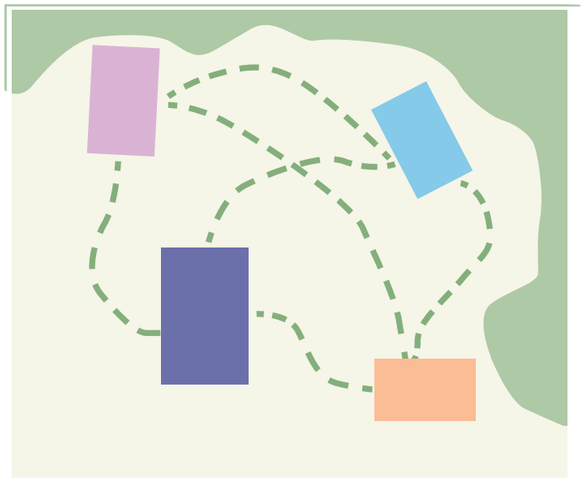


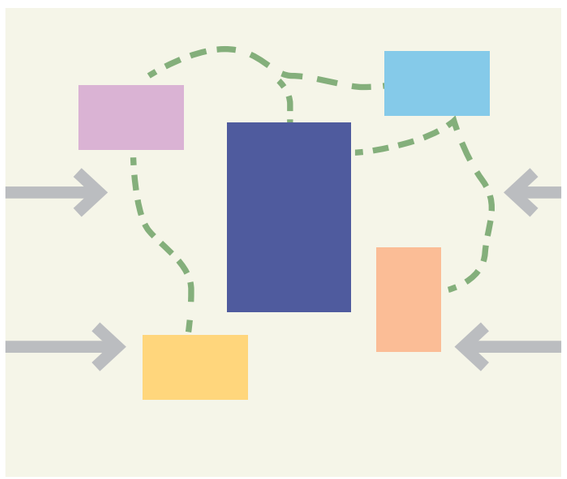
McGill University, Canada

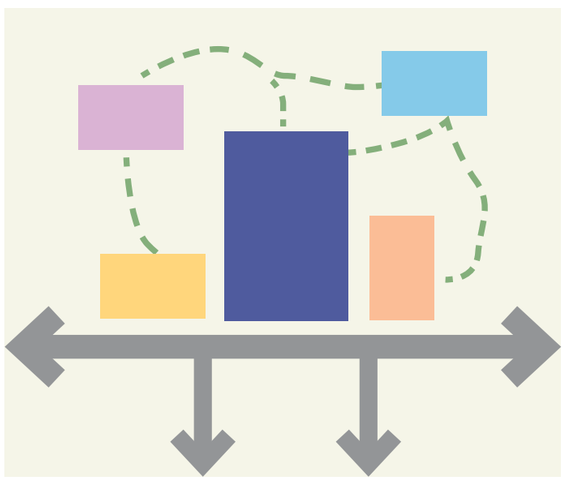
Total Student Population:	20, 909
Faculty Population:	1,851
Staff Population:	2, 552
Total Campus Population:	25, 312
Land Area:	80 Acres

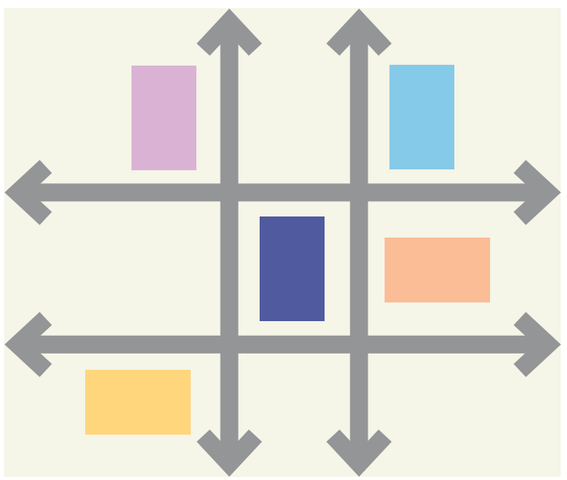
Georgia State University, USA

Total Student Population:	21, 291
Faculty Population:	1,175
Staff Population:	4, 257
Total Campus Population:	26, 723
Land Area:	28 Acres









Organic Campus

Usually set amidst a natural environment that defines the physical character and lends strongly to the identity of the university.

Buildings are in small groupings, with an emphasis on pedestrian path connections. Group activity is secondary due to an environment promoting introspection.

Traditional Campus

Quadrangles organize the campus, which is comprised of colleges enclosing numerous significant open spaces. While surrounding colleges have their own facilities, some central core area pulls together the campus and centralizes activity and shared facilities.

Campus Town

Like the “Classic Campus” with a stronger emphasis on “Town and Gown” relations. The town community blends with the campus community to create a vibrant area of social and intellectual interaction typically on the campus perimeter.

Urban Campus

The urban fabric of the surrounding area permeates the campus, whose facilities are spread within a geographic locus but without an abundance of focused centrality. The lack of campus activity per se is compensated by the liveliness and goings on of the city.

A campus is made of elements that makes it work and foster an inter-disciplinary learning environment. Some of the key elements of a typical campus include:

Identity

Elements such as a clock tower, an iconic building on campus or even public spaces, plazas, etc can provide a unique identity for a campus.

Placemaking

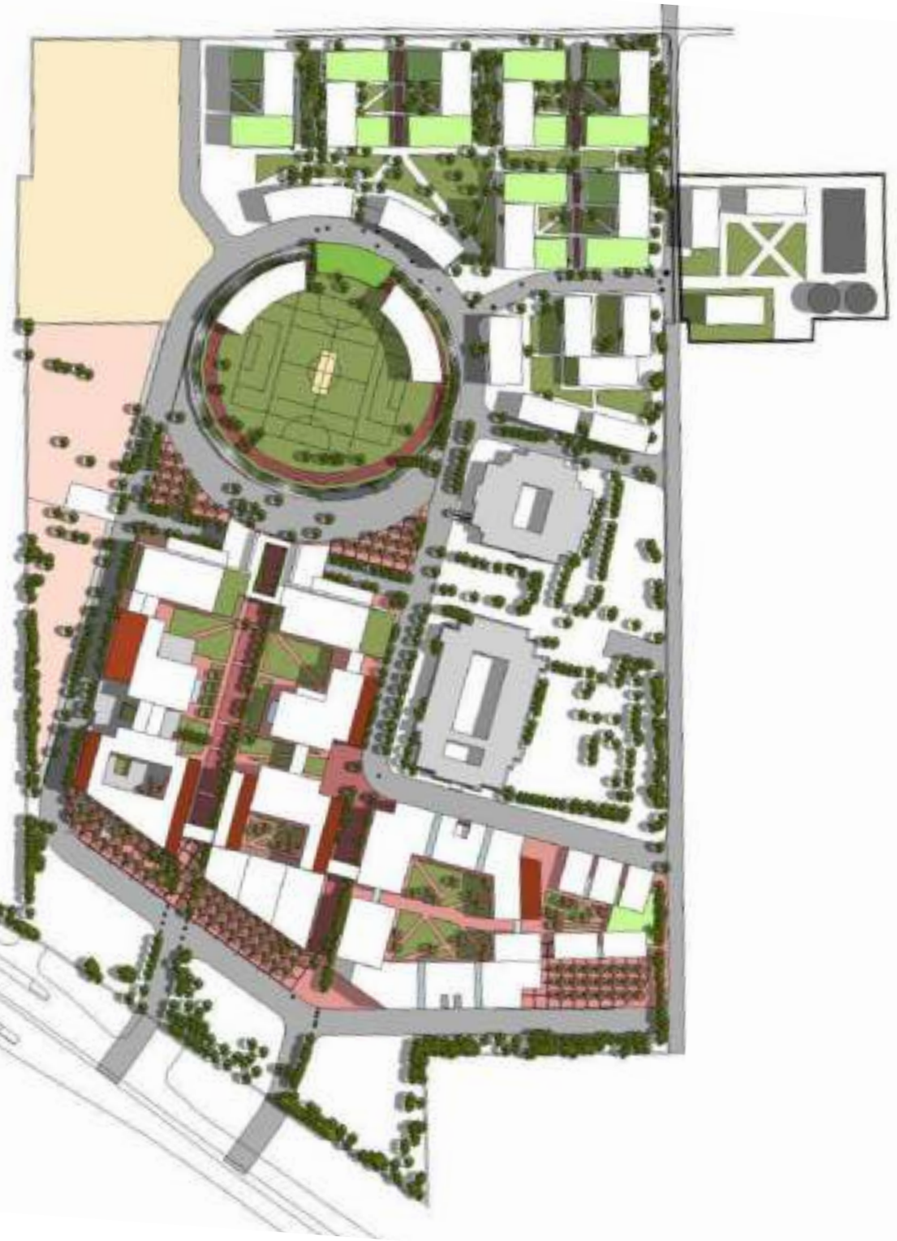
A campus should have unique interior spaces and places for students to congregate. This can be achieved by unique placements of buildings within the layout.

Synergies

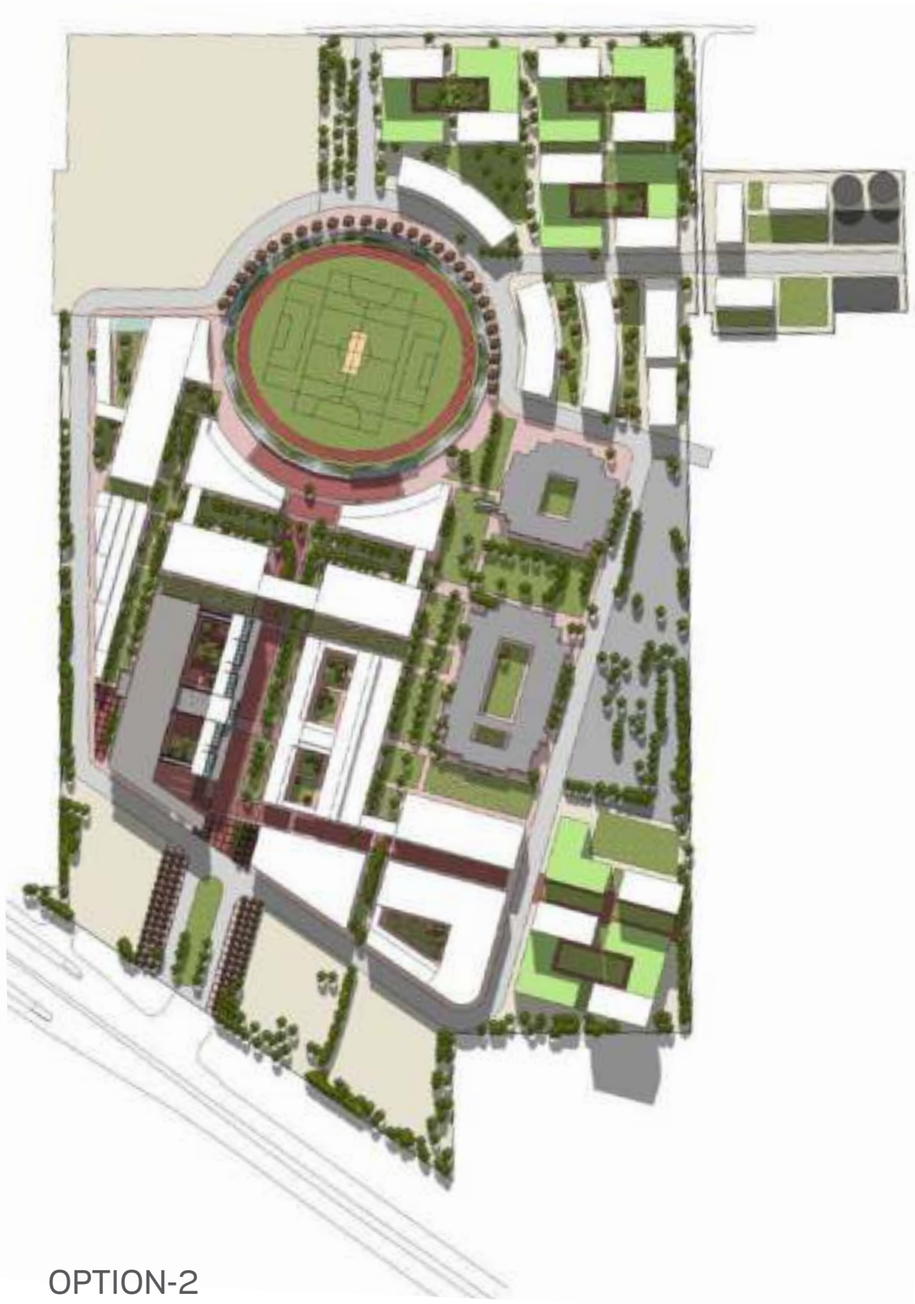
Synergies within the campus elements, departments and sub-districts are critical to create a cohesive campus feel.

Community

Community interface of the campus is essential for it to become a part of the larger context.



OPTION-1



OPTION-2

Pedestrian Spine

Covered Walkways

Informal learning Spaces

Intimate shaded courtyards

Bridges between buildings

OPTION-1

OPTION-2

OPTION-3

MASTER PLAN

1. University Main Entrance
2. Administration + Welcome Centre
3. Typical Academic Block + Faculty Offices
4. Typical Hostel Blocks
5. Student Commons + Library
6. Sports and Recreation Centre
7. Faculty Housing
8. Parking Underneath Raised Courtyard
9. Staff Housing
10. Campus Utilities

The master plan explored the idea of slicing the site into 3 phases going from East to West. Each phase contain ed a mix of residential and academic uses whilst utilizing least amount of land area. An East-West forest buffer separated the residential and academic zones. The academic buildings were arranged in such a way as to open into open space on every side as well as enclose an internal courtyard.

MASTER PLAN

1. University Main Entrance
2. Administration
3. Security + Maintenance
4. Visitor / Information Center
5. Faculty + Visitor Parking Garage
6. Temporary + Bus Parking
7. University Beacon
8. Academic - Business + Technology Wing
9. Academic - Art + Architecture Wing
10. Raised Courtyards with Parking Below
11. Auditorium
12. Library
13. Student Center
14. Library Courtyard
15. Central Green
16. Recreation Center
17. Dining Hall
18. Cafeteria
19. Workshop
20. Playground
21. Student Housing
22. Faculty Housing
23. Temporary Parking + Loading
24. Utility Building
25. Infrastructure Parcel

The master plan created a large central green that formed the heart of the campus. The academic zone was placed closer to the highway on the east and the residential area occupied the more private zone along the west. The academic zone was divided into a north and south blocks. East- West spines containing common functions weaved together department buildings that branched of the spine at regular intervals. The 'jewel' of the campus, a multiuse building was located in the centre of the main green area and becomes the focus of the campus.

MASTER PLAN

1. University Main Entrance
2. Auditorium and Welcome Centre
3. Administration and Student Centre
4. Typical Academic Blocks
5. Typical Hostel Blocks
6. R&D Centre and Workshops
7. Faculty Housing
8. Common Amenities Under Raised Courtyard
9. Land Bank for Future Expansion
10. Staff Housing
11. Campus Utilities

The master plan explored the idea of compacting academic and residential uses into a single block. This block would function as a module that could be repeated according to the needs of the growing campus. The blocks would be arranged around a central podium building that would house all the common functions. The strategy here was to occupy the least possible area of land as well as to bring the academic and residential together so as to increase the efficiency and utilization of the buildings by allowing a sharing of space.

MASTER PLAN

1. University Main Entrance
2. Auditorium and Welcome Centre
3. Administration and Student Centre
4. Typical Academic Blocks
5. Typical Hostel Blocks
6. R&D Centre and Workshops
7. Faculty Housing
8. Raised Podium with Parking Underneath
9. Common Amenities - Library, Student Rec Ctr., etc.
10. Staff Housing
11. Campus Utilities

The master plan was a variation of the earlier courtyard block. However rather than creating individual silos of department buildings, it created linear East-West blocks that could be shared between different departments. Each phase contained a mix of residential and academic uses. This strategy would reserve land in each phase by using the minimum area required. Residential and Academic zones were separated by a forest buffer with common buildings bridging across.

MASTER PLAN

1. University Main Entrance
2. Auditorium, Welcome Centre
3. Administration and Student Centre
4. Typical Academic Blocks
5. Typical Hostel Blocks
6. R&D Centre and Workshops
7. Faculty Housing
8. Multi-Level Car Parking Structure
9. Common Amenities - Library, Student Rec Ctr., etc.
10. Staff Housing
11. Campus Utilities

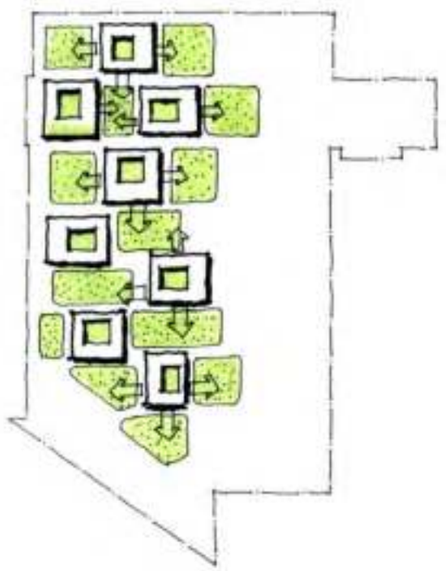
The master plan was a hybrid of the courtyard block idea and the earlier idea of creating a pedestrian spine. The blocks were oriented towards true north.

MASTER PLAN

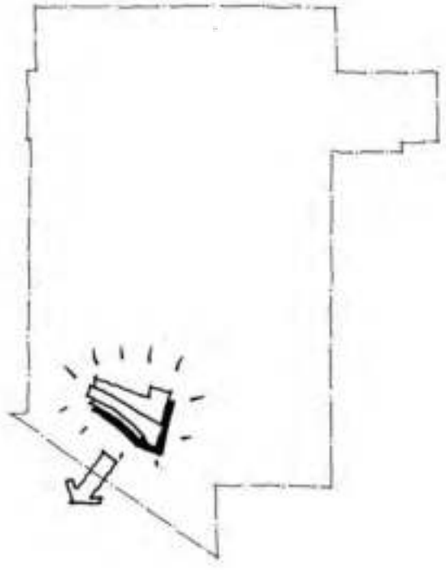
1. University Main Entrance
2. Auditorium, Welcome Centre
3. Administration and Student Centre
4. Typical Academic Blocks
5. Typical Hostel Blocks
6. R&D Centre and Workshops
7. Faculty Housing
8. Multi-Level Car Parking Structure
9. Common Amenities - Library, Student Rec Ctr., etc.
10. Staff Housing
11. Campus Utilities

The master plan attempted to bring together the idea of linear courtyard blocks along a central spine and the idea of bringing housing closer to the highway. Here too land was utilized judiciously by conserving more and building only as much as needed.

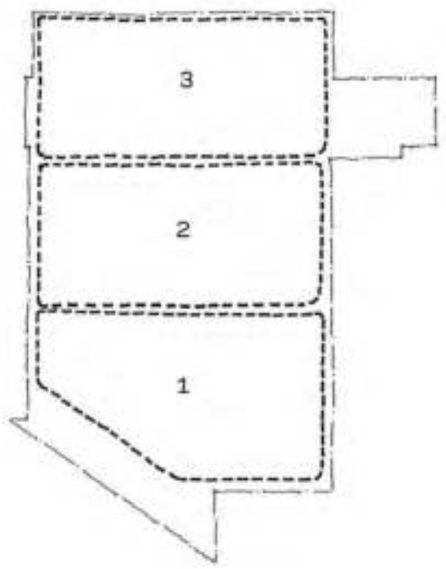
From the intensive master planning exercise emerged guiding principles that would broadly influence the growth of the campus over the next 25 years.



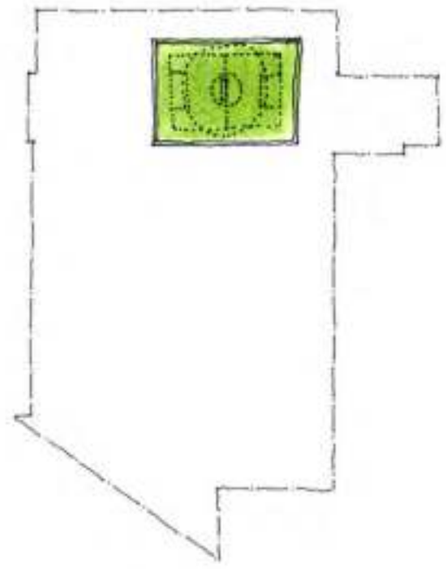
Open space surrounding every block



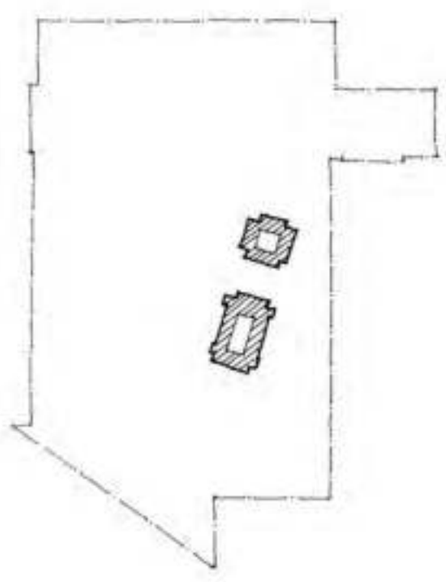
Iconic building at the entrance



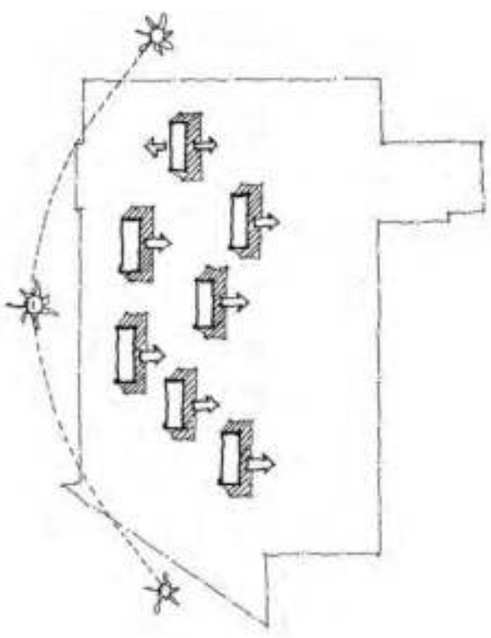
Consistent phasing of academic and residential program so each phase looks complete



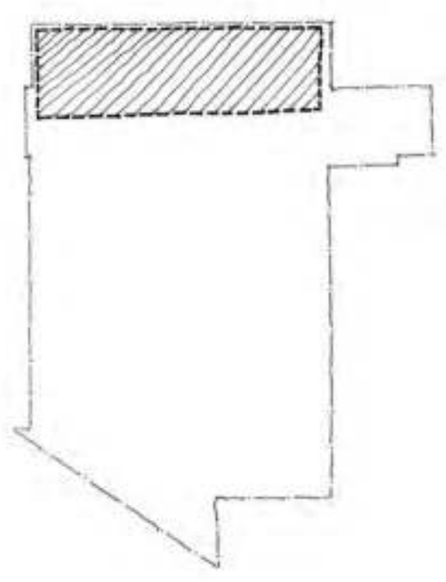
Provide for a large, open recreational field



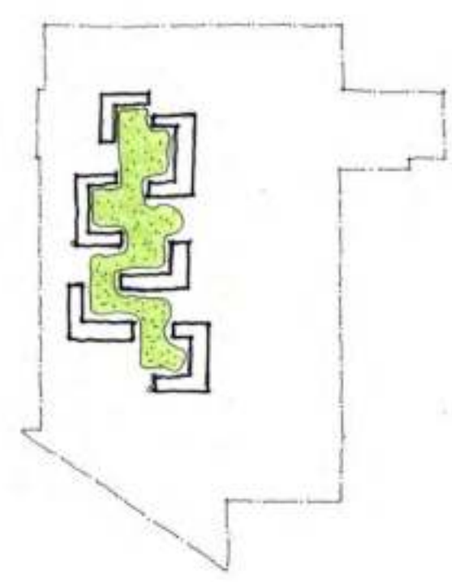
Existing school to be maintained in Phase 1



Maintain East-west orientation of buildings for maximum exposure to north



Create land bank for future expansion



Maintain interdisciplinary learning environment by design and avoid creating insular departmental buildings

Hostels: These are located along the north-western edge of the plot at a 5 minute walking distance from the academic core. Buildings are arranged in the form of a courtyard block ideally suited to provide shade and enclosure in the arid climate of Gurgaon. The bar and tower typology has been used for the hostels since the differential scales help in maintaining a intimate scale of the court while at the same time accommodating the density required for a campus of this size.

The water body: This is a retention pond that could form the main public space of the campus. It forms the termination to the pedestrian spine and the heart of student social life. Located between the academic and residential areas it is framed on one side with the Student Centre and on the other by hostels affording great views to the pond. In addition to being a public amenity it also serves to lower the ambient temperature by way of evaporative cooling as the north-western winds blow into the academic zone.

Vehicular Loop: A 12 m Right of way vehicular loop allows for the flow of traffic without impeding pedestrian movement on campus.

Avenue of Innovation: This is one of three avenues on campus created by preserving the existing row of mature trees. It runs parallel to the main campus spine and is bordered on one side by the workshop buildings. It is envisioned to form a staging area for various exhibition and innovation fests that are a part of campus life.

Library/Student Commons/Cafeteria: This is a multiuse 24 hour public building that forms the hinge between the academic core and the hostel areas. On one side it bookends the pedestrian spine and on the other it frames the water body with an amphitheater.

Main Campus Drag: is an active shaded quadrangle space framed by classroom buildings on either side. It is bordered on either side with a colonnaded walkway which provides a shaded promenade in the heart of the academic core.

Typical Academic Blocks: Two courtyard blocks frame the north and south side of the main quadrangle area and house the bulk of the academic areas including classrooms, laboratories and tutorial rooms.

Gateway Building: This complex of buildings forms the front door of the campus. Seen from the highway it establishes the campus identity and the character. The building program includes administrative and office uses as well as the common classroom functions that are shared between all departments of the campus. It forms a hinge between the academic and research zones.

Recreation facility building as culmination point of academic spine

Avenue of Innovation

Monumental landmark at the end of processional spine

Student Hide-out

Central courtyard space within academic building

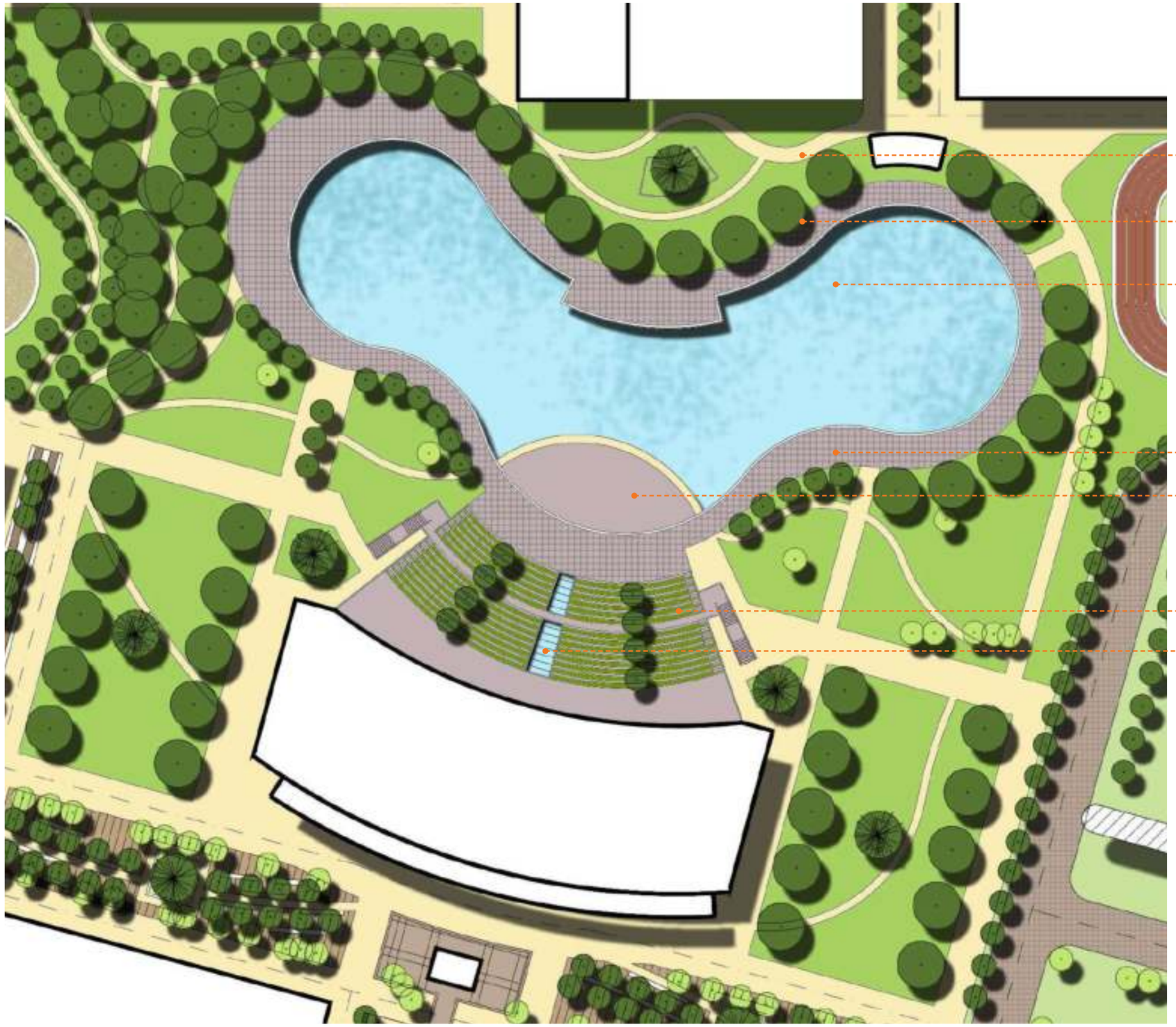
Processional pathway for graduation ceremony

Vehicular access route around existing school building

Large plaza acting as hinge for Central Campus Drag and Research Drag

Avenue of Discovery

Entrance Plaza



Trail network connecting residential and academic zone

Dense tree plantation as backdrop for lake

Water body as central recreational space within the campus

Boardwalk along the water body

Stage for amphitheater

Amphitheater

Water cascade located centrally along amphitheater seating


Millingtonic hortensic


Alstonia Scholaris


Azardiracta Indica


Callistemon Lanceolatum


Mimusop Elengi


Delonix Regia


Acacia Quriculiformis


Albizzia Lebbeck


Bauhinia Purpuria


Melia Azedarach


Cassia Fistula


Grevillea Robusta


Pongamia Glabra


Tamaniridus Arjuna


Kigelia Pinnata


Cassia Siamea


Eucalyptus Citnidora


Phyllanthus Emblica


Tamaniridus Indica


Parkinsonia Aculeacta

The paving strategy within the campus should provide visual clues to a hierarchy of pedestrian and bicycle movement, highlight the edges of pedestrian areas, and also support the signage and wayfinding guidelines. All hardscape materials should be of high quality manufacturer and strive to integrate with the surrounding natural environment.

The character of the hardscape strategy should reflect the land use type of the development. For land uses such as Administration, Academic Buildings, and Residential vibrant and bold design gestures are appropriate. Also using more durable paving materials is suggested since greater volumes of foot traffic is to be expected. It is more appropriate in for academic areas to have design gestures that are more balanced and harmonic, although still active and reflecting upon the Indian culture, for example through richness in red and orange colours, patterns taken from nature, and rich ornamentation where aesthetically fitting. In children's play areas also bold, distinct colours and geometric shapes are appropriate. Patterns of youth games may also serve as a creative approach to paving to accommodate and attract the younger audience.

Paving Types for the project would consist but are not limited to the following types:

Permeable/Semi-Permeable Paving: This type of the paving should be used as much as possible to allow the water discharge in the ground. They should be mainly used within motor courts, surface parking lots or driveways.

Formal Paving: As the name suggests these pavings should be designed in a formal manner with clean lines and smooth finish so as to give importance to strategic pedestrian areas. This type of paving should be used within heavily trafficked areas, important pedestrian plazas and sidewalks. Although formal, wherever possible they should be fixed so as allow rain water percolation in the ground. These paving could be out of smooth finished stone or heavy duty brick.

Informal Paving: As the name suggests these paving patterns shall be designed in the informal manner in the pathways, courtyards, motor courts. They should be designed in such a way that they allow the rain water discharge in the ground.

Hardscape materials should follow the criteria below:

1. Minimize large expanses of uniform paving materials.
2. Encourage planting areas between paved areas.
3. Use of unit pavers and materials similar in colour and texture to create continuity. Micro climate conditions are paramount in manipulating the landscape elements to provide shelter from rain and sun, to minimize heat gain during the day and release heat at night.
4. Use matching materials for paving, railings, water features and other landscape devices.
5. Hard landscape materials should, wherever possible be either locally or regionally occurring (stone, gravel, etc.) or locally manufactured (concrete products etc.)
6. Provide good quality, robust materials, which are hard wearing, reflect local traditions and are easy to maintain.
7. Wherever feasible grade hard surfaces towards planting beds as a passive storm water infiltration technique.
8. Choose light colour materials to minimize the contribution to heat island effect. As a guideline materials should have a Solar Reflective Index (SRI) value of at least 29.

Permeable/ Semi Permeable

Formal

Informal

Micro climate considerations are paramount in manipulating the landscape elements to provide shelter from rain and sun, to minimize heat gain during the day, and to release heat during the night time. Low walls and broad ledges integrate into the landscape or architectural structure are good ways of amending the micro climate and providing good seating and social opportunities. Landscape canopy structures should be positioned as a continuous element providing interesting design gestures and refuge from the elements, especially rain.

The style of any site furnishing should reflect the overall architectural character and support the uses of the exterior program. Seating should be located in relation to shelter structures to invite sitting and promote community feeling and public interaction. A variety of seating types should be provided to accommodate myriad users of all age levels and physical abilities. Informal seating can take the form of seat walls, or wider ledges, while formal seating such as benches, with or without arms and backs. Any wood based site furnishings should be sourced from seasonably harvested forests and not contain wood from rare or endangered species. All site furnishings should be sourced from local suppliers and manufactures whenever possible. Site furnishings within the development plot should reflect the following criteria:

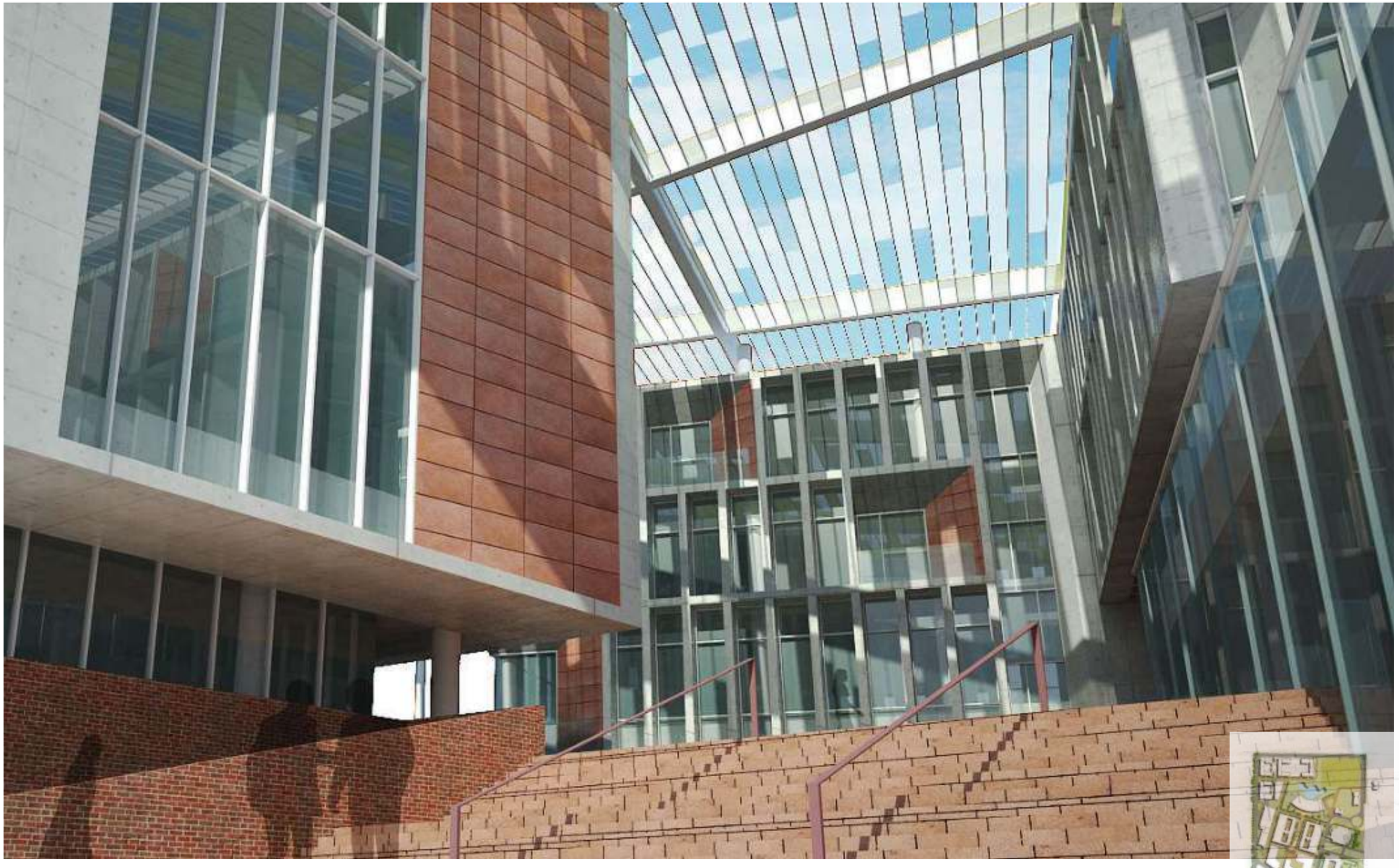
1. Site furnishings should include benches and other seating facilities, bicycle racks, trash receptacles, shelters, bollards, etc.
2. Sufficient and adequate site furnishings shall be used in all open spaces to encourage active use.
3. Site furnishings in the public realm shall reflect a consistent design, scale, form and complementary use of materials.
4. All site furnishings shall be of high quality design, durable and tolerant to extreme weather conditions relevant to the campus.
5. All site furnishings shall be in strict compliance with universal accessibility needs.
6. Where practicable, local manufacturers shall be sourced for site furniture.
7. Site furnishings should provide comfort and convenience in outdoor spaces and should be carefully selected to create a cohesive character and image.
8. Site furnishings shall be chosen for their design, durability, and tolerance to extreme weather conditions.
9. Site furnishings should be appropriately oriented to provide views to landmark locations and open spaces.
10. Design of all site furnishings should blend harmoniously with other site elements.

Seating

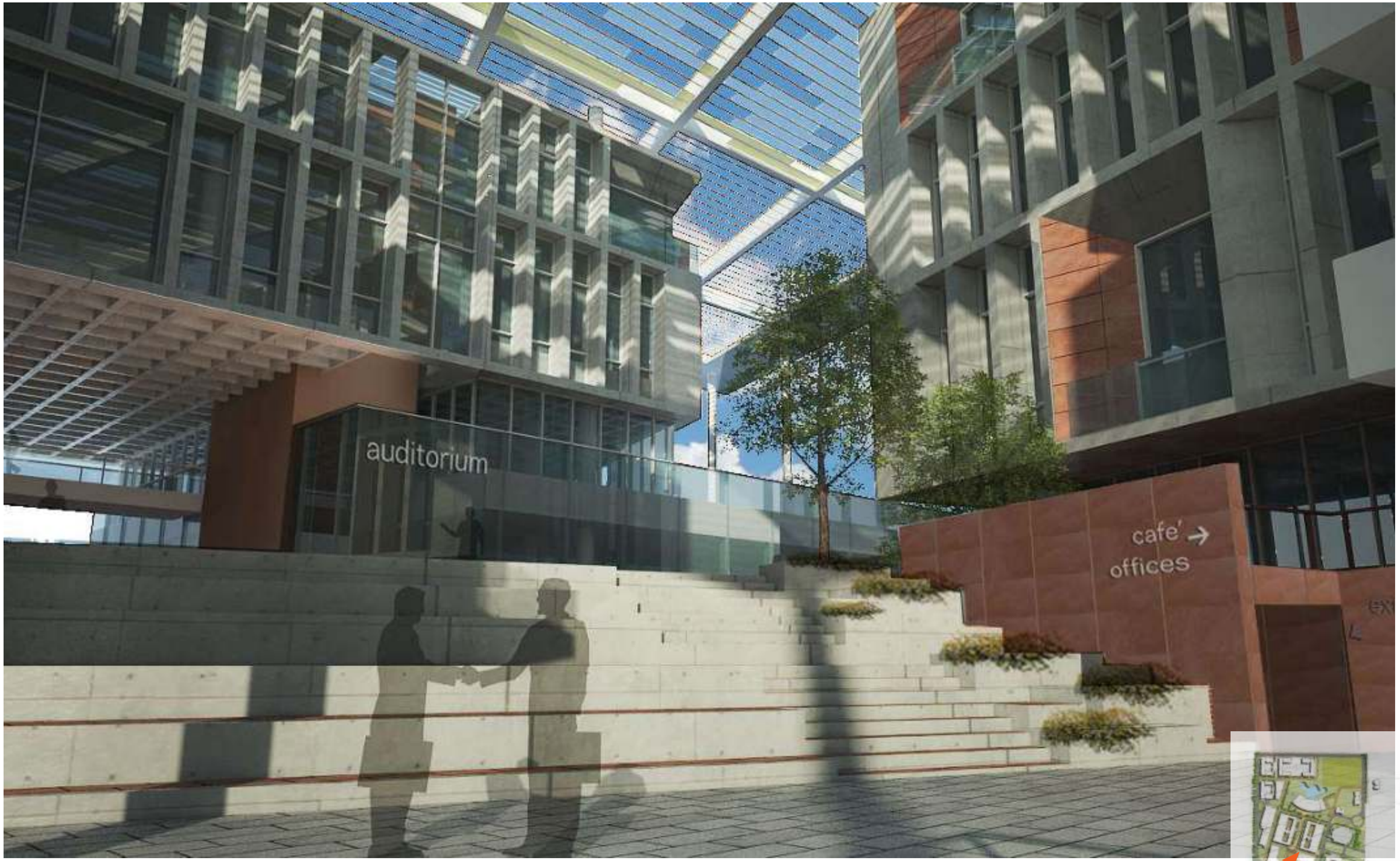
Trash Receptacles

Ceremonial entry leading to the gateway building

Ceremonial entry leading to the gateway building - Night View



Primary drop-off near the gateway building



Gateway building courtyard

Gateway building internal courtyard

Gateway building - North East Corner

Hostels - Typical Character

Hostels - Interior Courtyard

Hostels - Side View

Faculty Housing - Typical Building Character

Faculty Housing - Side View

Staff Housing - Typical Character

Staff Housing - Side View

Villa - View

Villa - Elevations

Villa - View

Villa - Interior - Dining

Villa - Interior - Living / Waiting

SECTION A - A

SECTION B - B

appendix

LAB TYPES		PAGE NO.
Type 1 - General	Classroom	*D-02*
Type 1 - General	Tutorial Room	D-03
Type 1 - General	Drawing Studio	D-04
Type 1 - General	Survey Lab	D-05
Type 1 - General	Mock Court	
Type 2 - Computer Lab	Computer	D-06
Type 2 - Computer Lab	Generic Lab	D-07
Type 2 - Computer Lab	M Tech Lab	
Type 2 - Computer Lab	CAD/CAM Lab	D-09
Type 3 - Electronics Lab	Basic Electrical & Electronics Lab	D-10
Type 3 - Electronics Lab	Electrical & Electronics Measurement Lab	D-11
Type 3 - Electronics Lab	Communication Systems Lab	D-12
Type 3 - Electronics Lab	Networks Lab	D-13
Type 3 - Electronics Lab	Power Electronics Lab	D-13
Type 3 - Electronics Lab	Control Systems Lab	D-14
Type 3 - Electronics Lab	Electric Drives Lab	D-14
Type 4 - Physics Lab	Physics	D-15
Type 4 - Physics Lab	Engineering Mechanics Lab	D-16
Type 5 - Wet Lab	Chemistry	D-17
Type 5 - Wet Lab	Environmental Engineering	D-18
Type 6 - Equipment Intensive Lab	Engineering Workshop	D-19
Type 6 - Equipment Intensive Lab	Fluid Mechanics	D-20
Type 6 - Equipment Intensive Lab	I.C. Engines Lab	D-21
Type 6 - Equipment Intensive Lab	Machine Tools Lab	D-22
Type 6 - Equipment Intensive Lab	Heat Transfer & Thermodynamics Lab	D-25
Type 6 - Equipment Intensive Lab	Highway Engineering	D-27

Room Data Sheets

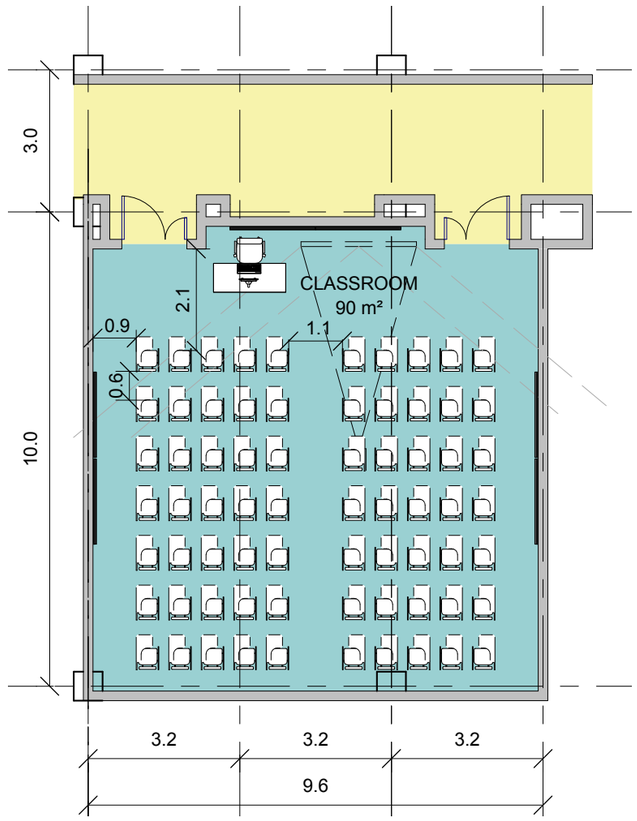
The table on page *B-25* organized all instructional spaces by Types. Type 1 being the most simple and Type 6 being the most expensive. All spaces are programmed in a manner that the simple spaces can be outfitted with additional features to allow them to serve as specialized instructional spaces.

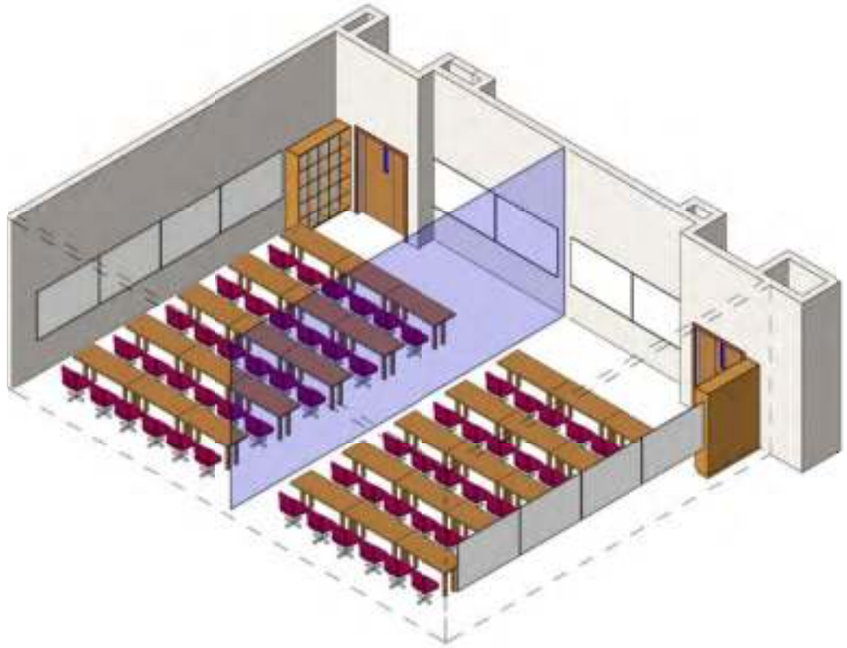
The concept of Adaptive design (see page *B-22*) shows how the university can adapt their learning spaces over time by providing flexibility of services and ensuring utility pathways are identified, thought through and incorporated into the design.

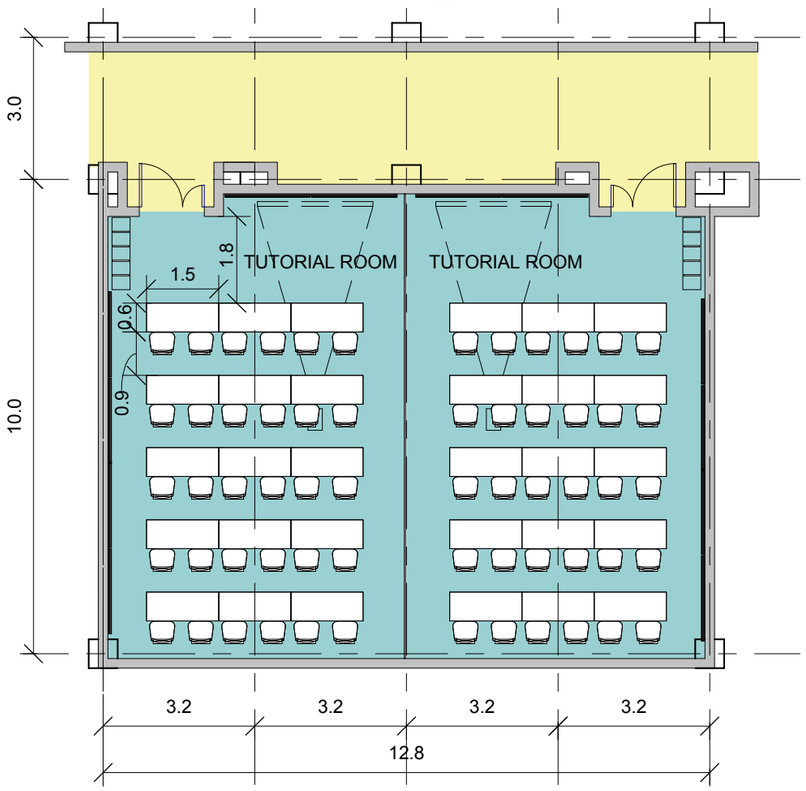
The Room Data sheets that follow on next page are organized from the simplest to the more complex types and furnished for the client's benefit.

It is recommended that where possible the client should choose the simpler types of instructional spaces at first and add features as the needs are firmed up. Our analysis on effective room distribution and utilization for year 2025 is shown on "The table to the left shows the total quantities of each unique lab (also totaled on the table below) and the utilization for 2025 . It was interesting to note that only 20% of the labs were of the most complex type. Majority of the classes could be held in standard classrooms. In fact more than 75% of the classes could be held in (Type 1 and Type 2) labs" on page B-26

See "The table to the left shows the total quantities of each unique lab (also totaled on the table below) and the utilization for 2025 . It was interesting to note that only 20% of the labs were of the most complex type. Majority of the classes could be held in standard classrooms. In fact more than 75% of the classes could be held in (Type 1 and Type 2) labs" on page B-26 for utilization of different types of labs and quantities for the year 2025.







TYPE 1 (General)

SPACE NAME: CLASSROOM

SUBJECTS TAUGHT:

OCCUPANCY: CLASSROOM

UTILIZATION

Hours of Use (hours/day)	8
Hours of Use (hours/week)	40
Capacity (students/lab session)	60

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	
Humidity	
50% ± 20% (Typical)	
Natural Ventilation	X
Artificial Ventilation (A/C)	

PLUMBING

Laboratory Vacuum (LV)	
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	
Laboratory Gas (LG)	
Carbon Dioxide (C02)	
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	
Hot Water (HW)	
Cold Water (CW)	
High Purity Water /(DI)	
Chilled Water (CHW S/R)	
Floor Drain (FD)	
Eyewash (EW)	
Safety Shower (SS)	

LABORATORY EQUIPMENT

Vibration Sensitive	
Light Sensitive	
Vibration Producing	
Heat Producing	
Noise Producing	

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	
208V, 30A, 3 Phase	
Isolated Ground Outlet	
Emergency Power	
Phone	X
Data - Wired/ Wireless	X

LIGHTING

Lighting Level	
100 fc at bench/desk	
60 fc at bench/desk	X
Task Lighting	
"In Use" Light	
Zoned Lighting	
Dimmable	
Natural Daylight	X

HOODS

Chemical Fume Hood	
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	
Acids	
Solvents	
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	X
Sealed Concrete	
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling	
Height	3.0M OR MORE
Open	
Acoustic Tile	X
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	X
Vision Panel	X

CASEWORK / FURNITURE

_OPTION 1 - MOVABLE TABLES & CHAIRS

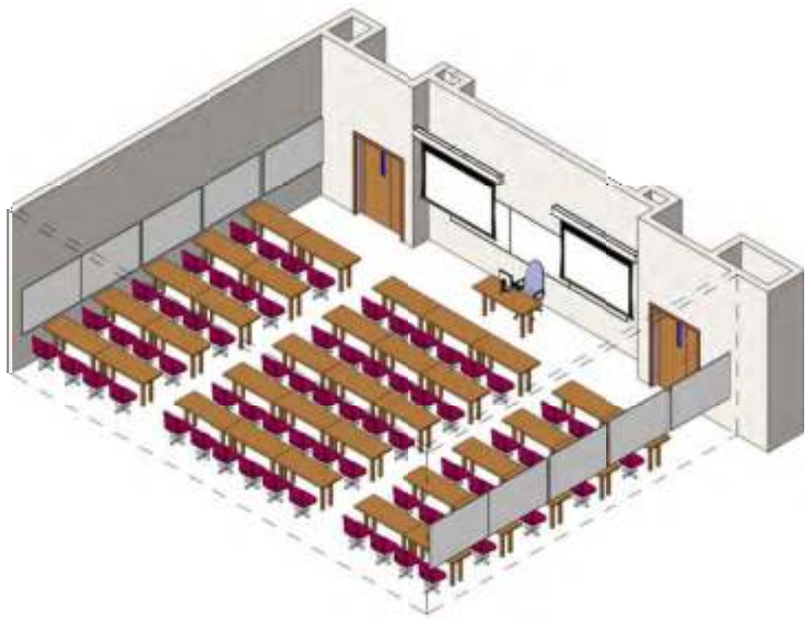
_OPTION 2 - MOVABLE CHAIRS WITH TABLET ARMS

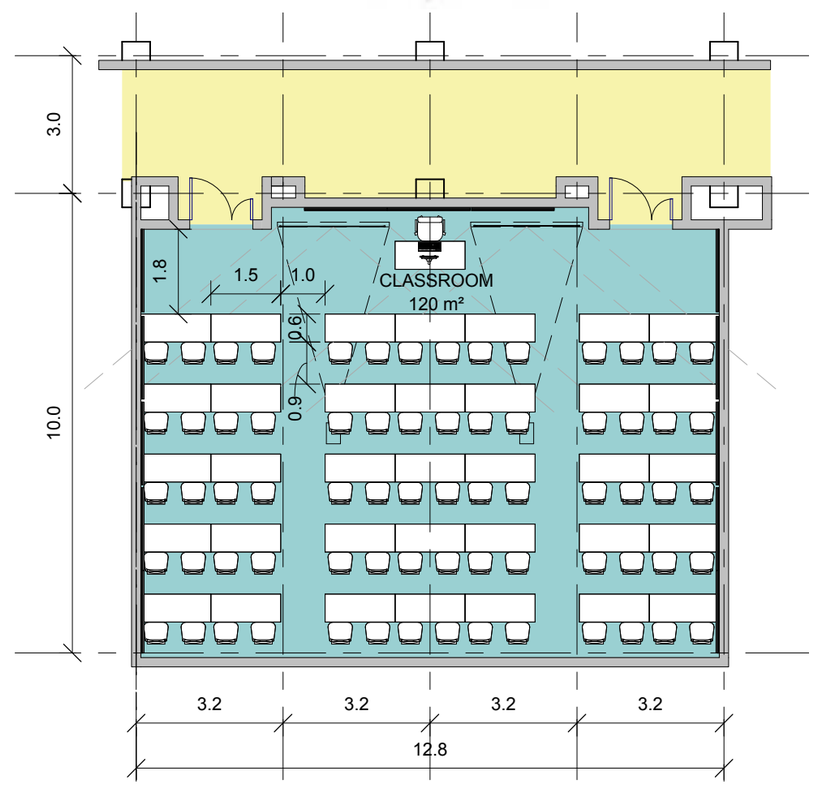
MISCELLANEOUS EQUIPMENT

Control Station (AV)	
Video Projector (Clng. Mounted)	X
Projector Screen	X
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	
Bulletin Board	
Other	

REMARKS:

KEY PLAN:





TYPE 1 (General)

SPACE NAME: DRAWING STUDIO
SUBJECTS TAUGHT:

OCCUPANCY: STUDIO

UTILIZATION

Hours of Use (hours/day)	8
Hours of Use (hours/week)	40
Capacity (students/lab session)	35

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	
Humidity	
50% ± 20% (Typical)	
Natural Ventilation	X
Artificial Ventilation (A/C)	

PLUMBING

Laboratory Vacuum (LV)	
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	
Laboratory Gas (LG)	
Carbon Dioxide (C02)	
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	
Hot Water (HW)	
Cold Water (CW)	
High Purity Water /(DI)	
Chilled Water (CHW S/R)	
Floor Drain (FD)	
Eyewash (EW)	
Safety Shower (SS)	

LABORATORY EQUIPMENT

Vibration Sensitive	
Light Sensitive	
Vibration Producing	
Heat Producing	
Noise Producing	

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	
208V, 30A, 3 Phase	
Isolated Ground Outlet	
Emergency Power	
Phone	X
Data - Wired/ Wireless	X

LIGHTING

Lighting Level	
100 fc at bench/desk	
60 fc at bench/desk	X
Task Lighting	
"In Use" Light	
Zoned Lighting	
Dimmable	
Natural Daylight	X

HOODS

Chemical Fume Hood	
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	
Acids	
Solvents	
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	
Sealed Concrete	X
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling	3.0M OR MORE
Height	
Open	X
Acoustic Tile	
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	X
Vision Panel	X

CASEWORK / FURNITURE

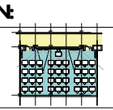
_DRAWING TABLES & STOOLS

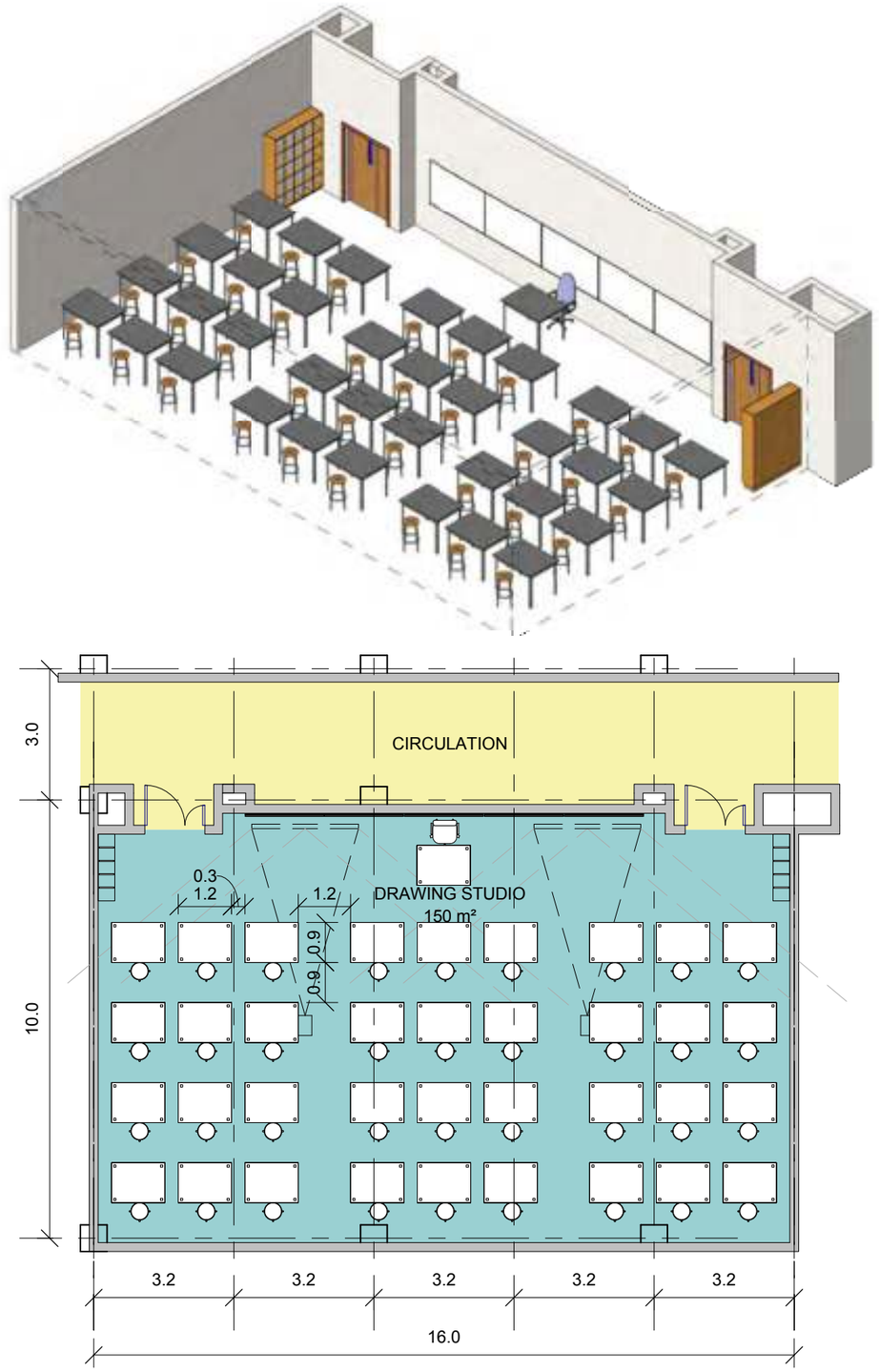
MISCELLANEOUS EQUIPMENT

Control Station (AV)	
Video Projector (Clng. Mounted)	X
Projector Screen	X
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	
Bulletin Board	
Other	

REMARKS:

KEY PLAN:





TYPE 1 (General)

SPACE NAME: SURVEY LAB

SUBJECTS TAUGHT: SURVEY LAB I & II (CE)

OCCUPANCY: UNDERGRADUATE TEACHING LAB

UTILIZATION

Hours of Use (hours/day)	6
Hours of Use (hours/week)	30
Capacity (students/lab session)	60

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	
Humidity	
50% ± 20% (Typical)	
Natural Ventilation	X
Artificial Ventilation (A/C)	

PLUMBING

Laboratory Vacuum (LV)	
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	
Laboratory Gas (LG)	
Carbon Dioxide (C02)	
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	
Hot Water (HW)	
Cold Water (CW)	
High Purity Water /(DI)	
Chilled Water (CHWS/R)	
Floor Drain (FD)	
Eyewash (EW)	
Safety Shower (SS)	

LABORATORY EQUIPMENT

Vibration Sensitive	
Light Sensitive	
Vibration Producing	
Heat Producing	
Noise Producing	

_TOTAL STATIONS

_THEODOLITES

_PLANE TABLES WITH ALL ACCESSORIES

_DUMPY LEVELS WITH SURVEYING COMPASS

_GLASS FIBER TAPES

_SURVEY CHAINS

_PEGS & ARROWS

_ALUMINUM LEVELLING STAFF

_RANGING RODS WITH SPECIAL STANDS

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	
208V, 30A, 3 Phase	
Isolated Ground Outlet	
Emergency Power	
Phone	X
Data - Wired/ Wireless	X

LIGHTING

Lighting Level	
100 fc at bench/desk	
60 fc at bench/desk	X
Task Lighting	
"In Use" Light	
Zoned Lighting	
Dimmable	
Natural Daylight	X

HOODS

Chemical Fume Hood	
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	
Acids	
Solvents	
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	
Sealed Concrete	X
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling	
Height	3.0M OR MORE
Open	X
Acoustic Tile	
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	X
Vision Panel	X

CASEWORK / FURNITURE

_TALL STORAGE CABINETS

_MOVABLE, ADJUSTABLE LAB TABLES WITH LAB STOOLS

_COUNTER WITH BASE & O.H. STORAGE CABINETS

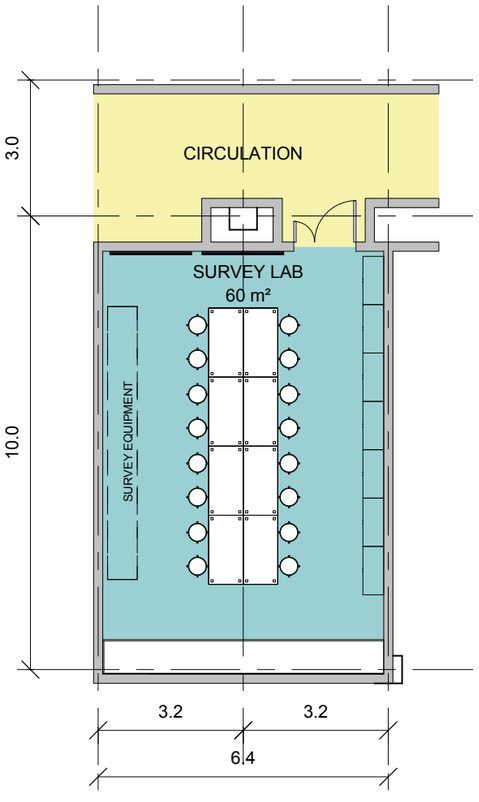
EQUIPMENT WALL WITH ADJUSTABLE SHELVING

MISCELLANEOUS EQUIPMENT

Control Station (AV)	
Video Projector (Clng. Mounted)	
Projector Screen	
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	
Bulletin Board	
Other	

REMARKS:

KEY PLAN:



TYPE 1 (General)

SPACE NAME: COMPUTER LAB
SUBJECTS TAUGHT: MULTIPLE COMPUTER ENGINEERING COURSES

OCCUPANCY: TEACHING LAB

UTILIZATION

Hours of Use (hours/day)	8
Hours of Use (hours/week)	40
Capacity (students/lab session)	60

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	X
Humidity	
50% ± 20% (Typical)	X
Natural Ventilation	
Artificial Ventilation (A/C)	X

PLUMBING

Laboratory Vacuum (LV)	
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	
Laboratory Gas (LG)	
Carbon Dioxide (C02)	
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	
Hot Water (HW)	
Cold Water (CW)	
High Purity Water /(DI)	
Chilled Water (CHW S/R)	
Floor Drain (FD)	
Eyewash (EW)	
Safety Shower (SS)	

LABORATORY EQUIPMENT

Vibration Sensitive	
Light Sensitive	
Vibration Producing	
Heat Producing	X
Noise Producing	
_COMPUTERS (DESKTOPS OR LAP TOPS)	
_PRINTER/ SCANNER/ COPIER	

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	
208V, 30A, 3 Phase	
Isolated Ground Outlet	
Emergency Power	X
Phone	X
Data - Wired/ Wireless	X

LIGHTING

Lighting Level	
100 fc at bench/desk	
60 fc at bench/desk	X
Task Lighting	
"In Use" Light	
Zoned Lighting	
Dimmable	
Natural Daylight	X

HOODS

Chemical Fume Hood	
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	
Acids	
Solvents	
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	X
Sealed Concrete	
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling	
Height	3.0M OR MORE
Open	
Acoustic Tile	X
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	X
Vision Panel	X

CASEWORK / FURNITURE

_MOVABLE COMPUTER DESKS & CHAIRS

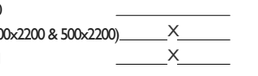
_LAB ASSISTANTS' DESKS & CHAIRS

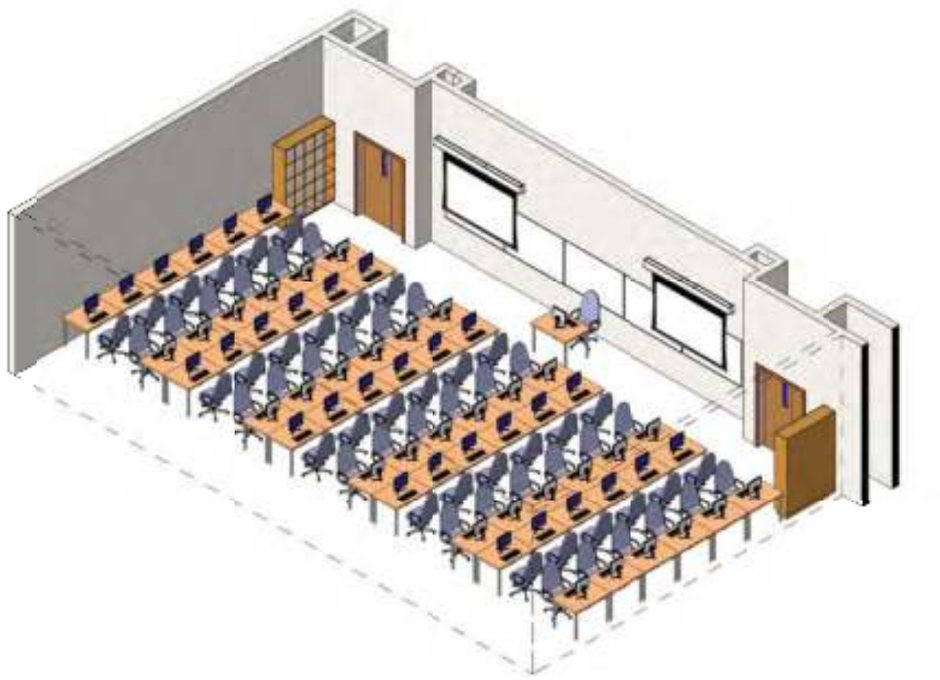
MISCELLANEOUS EQUIPMENT

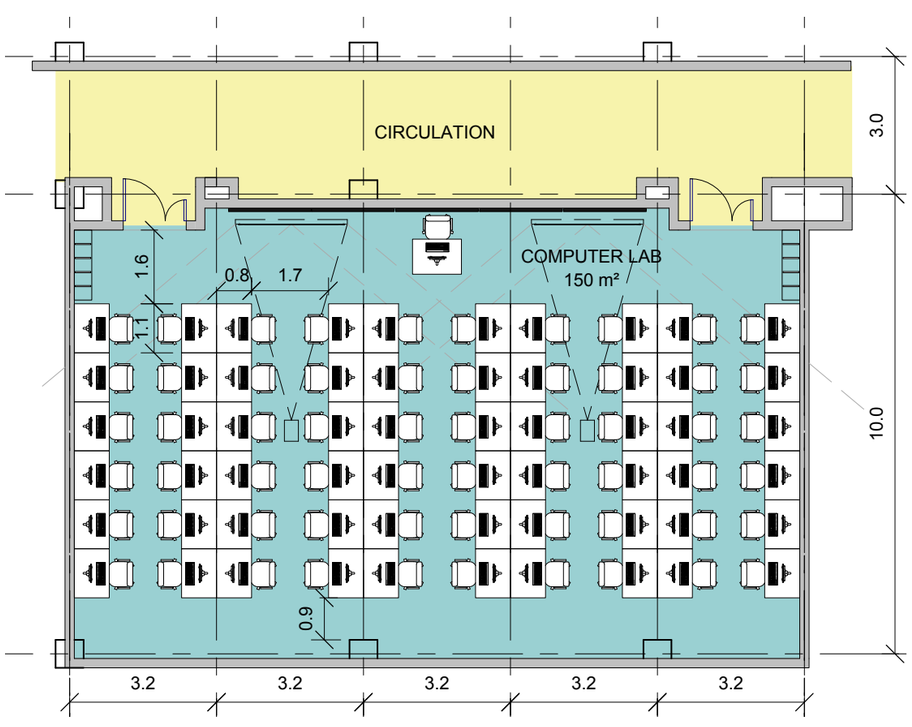
Control Station (AV)	
Video Projector (Clng. Mounted)	X
Projector Screen	X
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	
Bulletin Board	
Other	

REMARKS:

KEY PLAN:







TYPE 2 (Computer Lab)

SPACE NAME: FLEXIBLE COMPUTER LAB
SUBJECTS TAUGHT: FLEXIBLE LAB FOR MULTIPLE COURSES

OCCUPANCY: TEACHING LAB

UTILIZATION

Hours of Use (hours/day)	8
Hours of Use (hours/week)	40
Capacity (students/lab session)	60

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	X
Humidity	
50% ± 20% (Typical)	X
Natural Ventilation	
Artificial Ventilation (A/C)	X

PLUMBING

Laboratory Vacuum (LV)	
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	
Laboratory Gas (LG)	
Carbon Dioxide (C02)	
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	
Hot Water (HW)	
Cold Water (CW)	
High Purity Water /(DI)	
Chilled Water (CHWS/R)	
Floor Drain (FD)	
Eyewash (EW)	
Safety Shower (SS)	

LABORATORY EQUIPMENT

Vibration Sensitive	
Light Sensitive	
Vibration Producing	
Heat Producing	X
Noise Producing	
_COMPUTERS (DESKTOPS OR LAP TOPS)	
_PRINTER/ SCANNER/ COPIER	

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	
208V, 30A, 3 Phase	
Isolated Ground Outlet	
Emergency Power	X
Phone	X
Data - Wired/ Wireless	X

LIGHTING

Lighting Level	
100 fc at bench/desk	
60 fc at bench/desk	X
Task Lighting	
"In Use" Light	
Zoned Lighting	
Dimmable	
Natural Daylight	X

HOODS

Chemical Fume Hood	
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	
Acids	
Solvents	
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	X
Sealed Concrete	
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling	
Height	3.0M OR MORE
Open	
Acoustic Tile	X
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	X
Vision Panel	X

CASEWORK / FURNITURE

_MOVABLE COMPUTER DESKS & CHAIRS

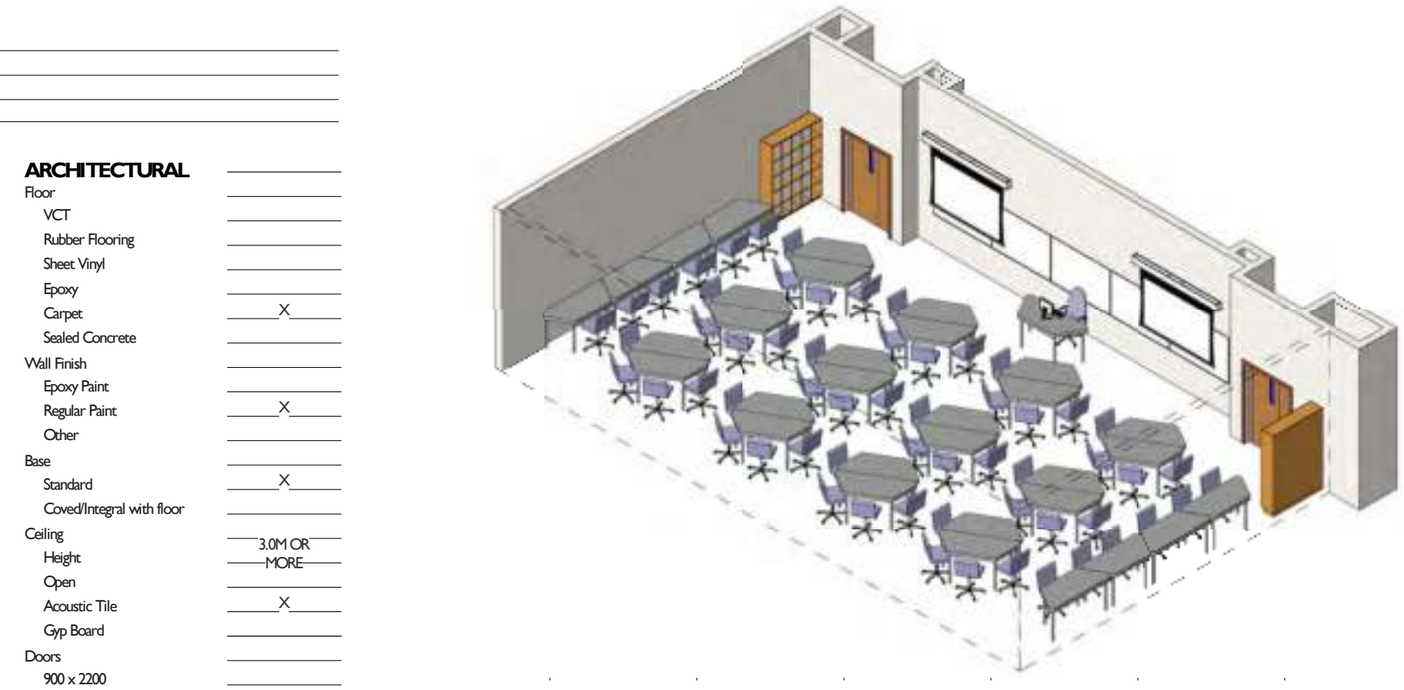
_LAB ASSISTANTS' DESKS & CHAIRS

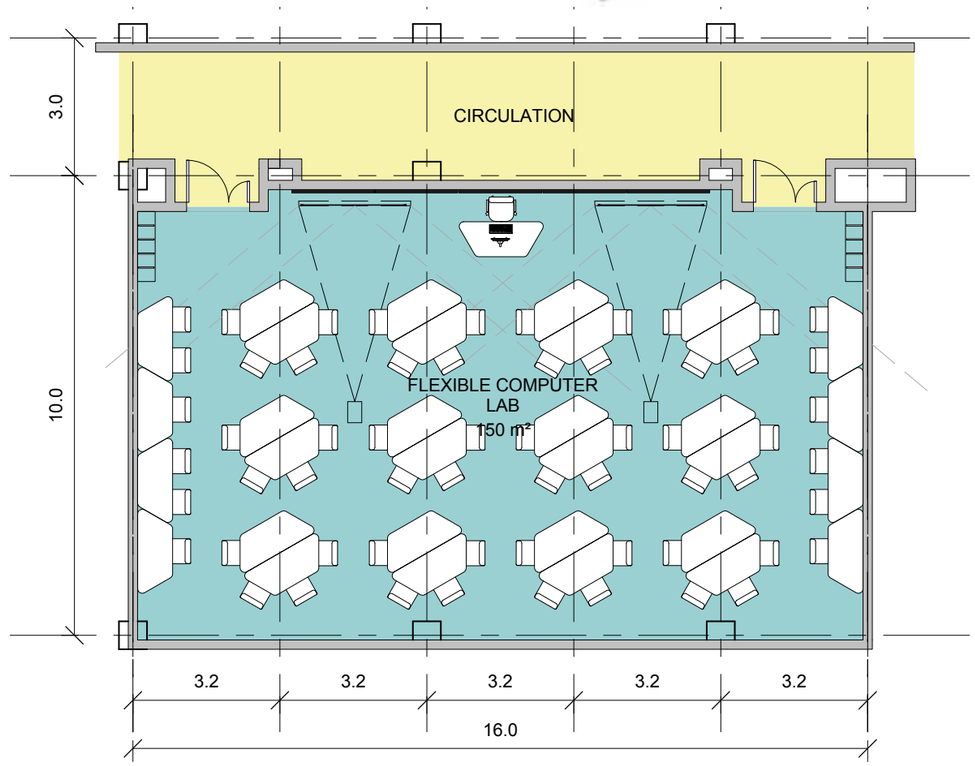
MISCELLANEOUS EQUIPMENT

Control Station (AV)	
Video Projector (Clng. Mounted)	X
Projector Screen	X
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	
Bulletin Board	
Other	

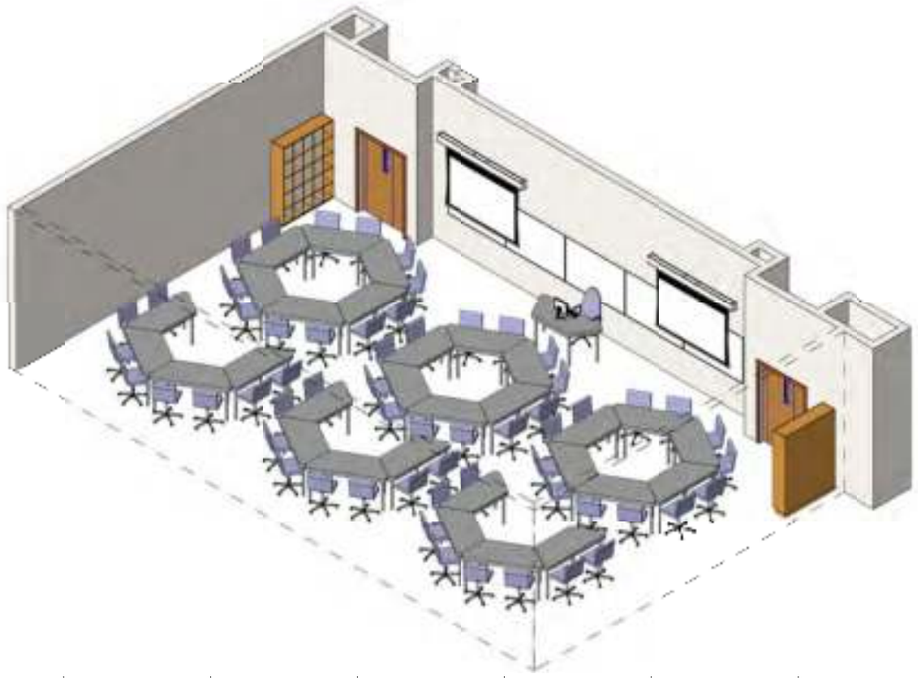
REMARKS:

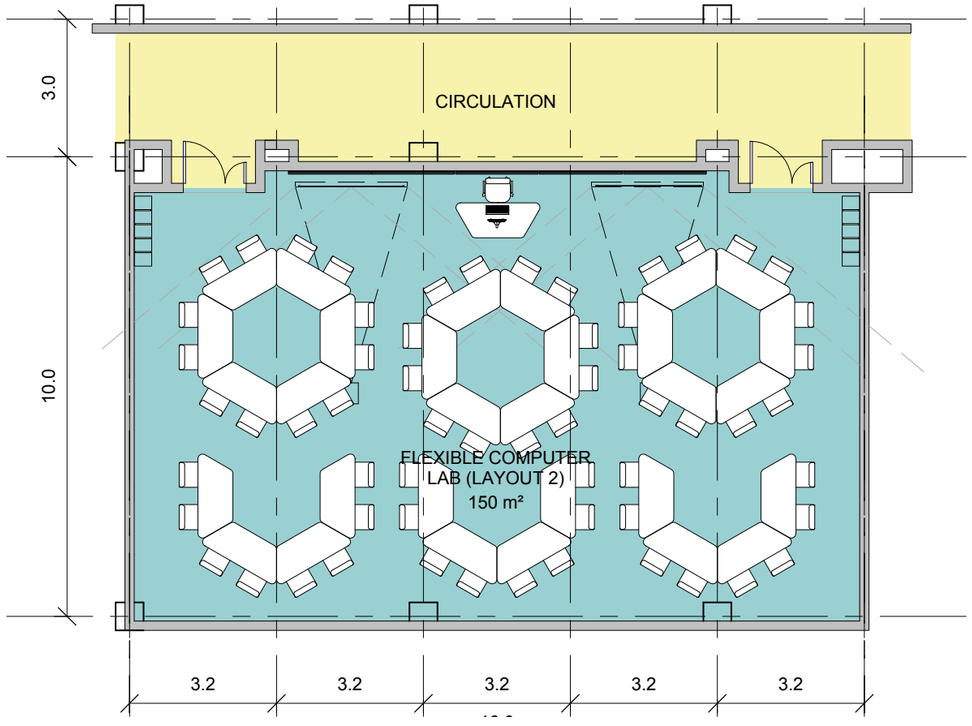
KEY PLAN:

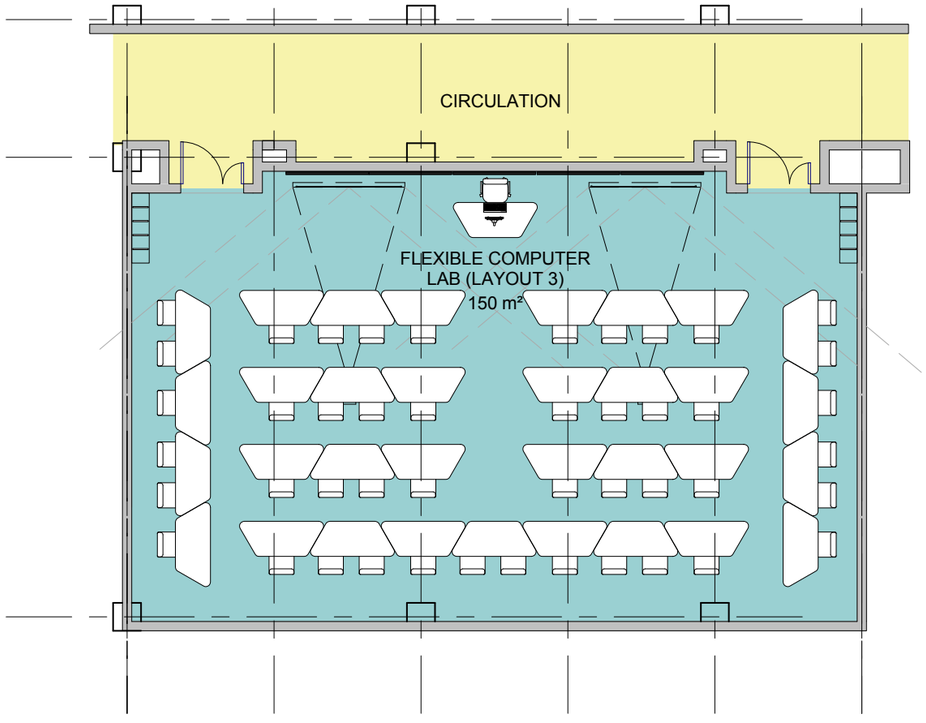




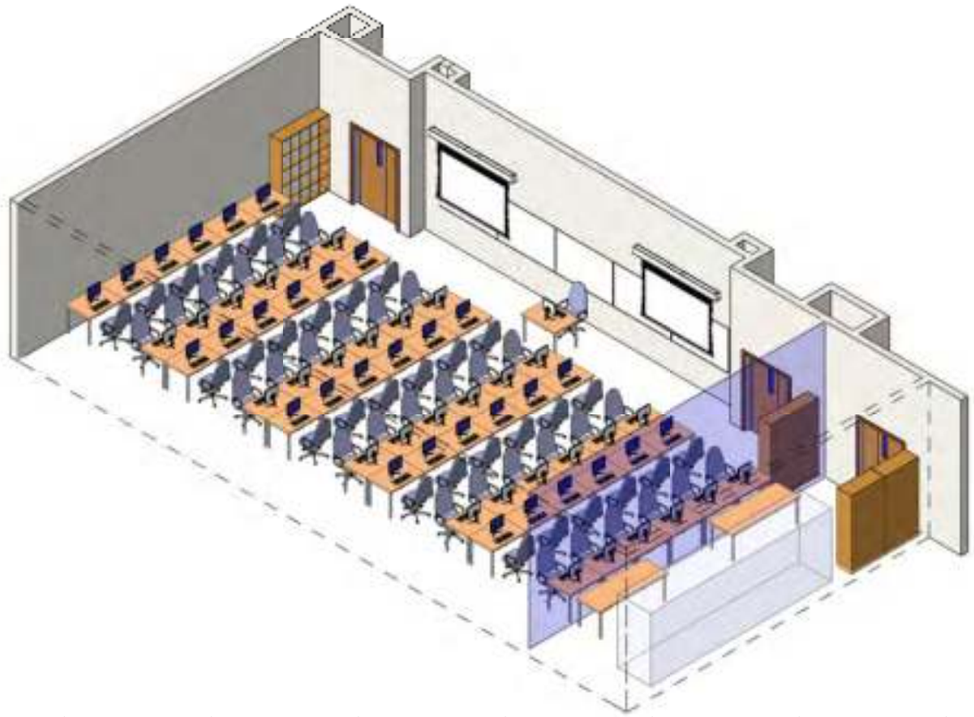
TYPE 2 (Computer Lab)

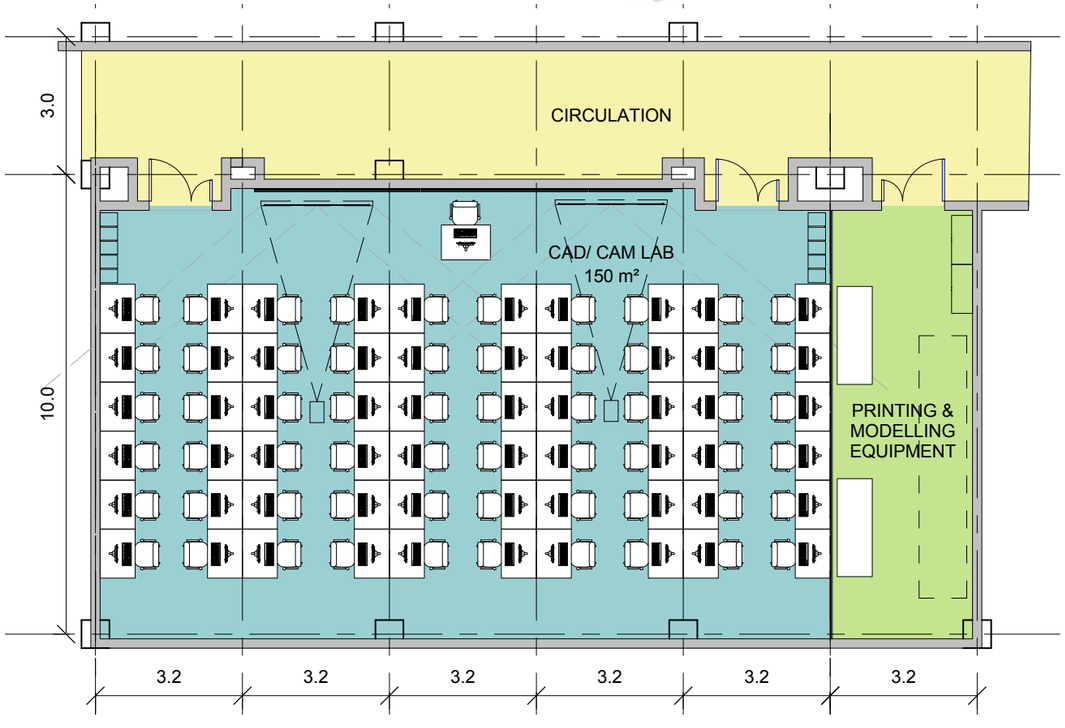






TYPE 2 (Computer Lab)





TYPE 2 (Computer Lab)

SPACE NAME: CAD/ CAM LAB

SUBJECTS TAUGHT: ADVANCED MECHANICAL DESIGN (ME), CAD/ CAM LAB, DESIGN CONCEPTS, DESIGN OF MACHINE ELEMENTS LAB, CNC MACHINES & PROGRAMMING (ME)

OCCUPANCY: TEACHING LAB

UTILIZATION

Hours of Use (hours/day)	8
Hours of Use (hours/week)	40
Capacity (students/lab session)	60

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	X
Humidity	
50% ± 20% (Typical)	X
Natural Ventilation	
Artificial Ventilation (A/C)	X

PLUMBING

Laboratory Vacuum (LV)	
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	
Laboratory Gas (LG)	
Carbon Dioxide (C02)	
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	
Hot Water (HW)	
Cold Water (CW)	
High Purity Water /(DI)	
Chilled Water (CHWS/R)	
Floor Drain (FD)	
Eyewash (EW)	
Safety Shower (SS)	

LABORATORY EQUIPMENT

Vibration Sensitive	
Light Sensitive	
Vibration Producing	
Heat Producing	X
Noise Producing	

_COMPUTERS (DESKTOPS OR LAP TOPS)

_PRINTER/ SCANNER/ COPIER

_CNC MACHINE

_A0 SIZE PLOTTER

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	
208V, 30A, 3 Phase	
Isolated Ground Outlet	
Emergency Power	X
Phone	X
Data - Wired/ Wireless	X

LIGHTING

Lighting Level	
100 fc at bench/desk	
60 fc at bench/desk	X
Task Lighting	
"In Use" Light	
Zoned Lighting	
Dimmable	
Natural Daylight	X

HOODS

Chemical Fume Hood	
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	
Acids	
Solvents	
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	X
Sealed Concrete	
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling	
Height	3.0M OR MORE
Open	
Acoustic Tile	X
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	X
Vision Panel	X

CASEWORK / FURNITURE

_MOVABLE COMPUTER DESKS & CHAIRS

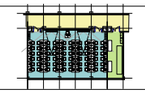
_LAB ASSISTANTS' DESKS & CHAIRS

MISCELLANEOUS EQUIPMENT

Control Station (AV)	
Video Projector (Clng. Mounted)	X
Projector Screen	X
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	
Bulletin Board	
Other	

REMARKS:

KEY PLAN:



SPACE NAME: BASIC ELECTRICAL & ELECTRONICS LAB

SUBJECTS TAUGHT: Basic Electrical & Electronics Lab (Core), Devices & Circuit Simulation lab (EC), Electrical Circuits Analysis Lab (CS, EC), Electrical Engineering Lab (EE, EC), Analogue Electronics (EE, EC)

OCCUPANCY: UNDERGRADUATE TEACHING LAB

UTILIZATION

Hours of Use (hours/day)	6
Hours of Use (hours/week)	30
Capacity (students/lab session)	60

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	X
Humidity	
50% ± 20% (Typical)	X
Natural Ventilation	
Artificial Ventilation (A/C)	X

PLUMBING

Laboratory Vacuum (LV)	
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	
Laboratory Gas (LG)	
Carbon Dioxide (C02)	
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	
Hot Water (HW)	
Cold Water (CW)	
High Purity Water /(DI)	
Chilled Water (CHW S/R)	
Floor Drain (FD)	
Eyewash (EW)	
Safety Shower (SS)	

LABORATORY EQUIPMENT

Vibration Sensitive	
Light Sensitive	
Vibration Producing	
Heat Producing	X
Noise Producing	

_SIGNAL GENERATORS
_CATHODE RAY OSCILLOSCOPES
_DIGITAL MULTIMETERS
_DIGITAL STORAGE OSCILLOSCOPES
_POWER SUPPLY
_AMPLIFIERS
_CLIPPING & CLAMPING CIRCUITS
_TV, VCR, RADIO, VCD, COMPUTERS
_FUNCTION GENERATORS

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	X
208V, 30A, 3 Phase	X
Isolated Ground Outlet	
Emergency Power	X
Phone	X
Data - Wired/ Wireless	X

LIGHTING

Lighting Level	
100 fc at bench/desk	
60 fc at bench/desk	X
Task Lighting	
"In Use" Light	
Zoned Lighting	
Dimmable	
Natural Daylight	X

HOODS

Chemical Fume Hood	
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	
Acids	
Solvents	
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	X
Sealed Concrete	
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling	
Height	3.0M OR MORE
Open	
Acoustic Tile	X
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	2
Vision Panel	X

CASEWORK / FURNITURE

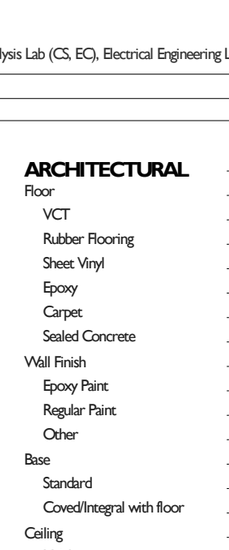
_MOVABLE ELECTRONICS LAB TABLES WITH ATTACHED SHELVING & LAB STOOLS
_LAB ASSISTANTS' DESKS & CHAIRS
_TALL STORAGE CABINETS
_BOOK SHELVING ALONG WINDOW WALL

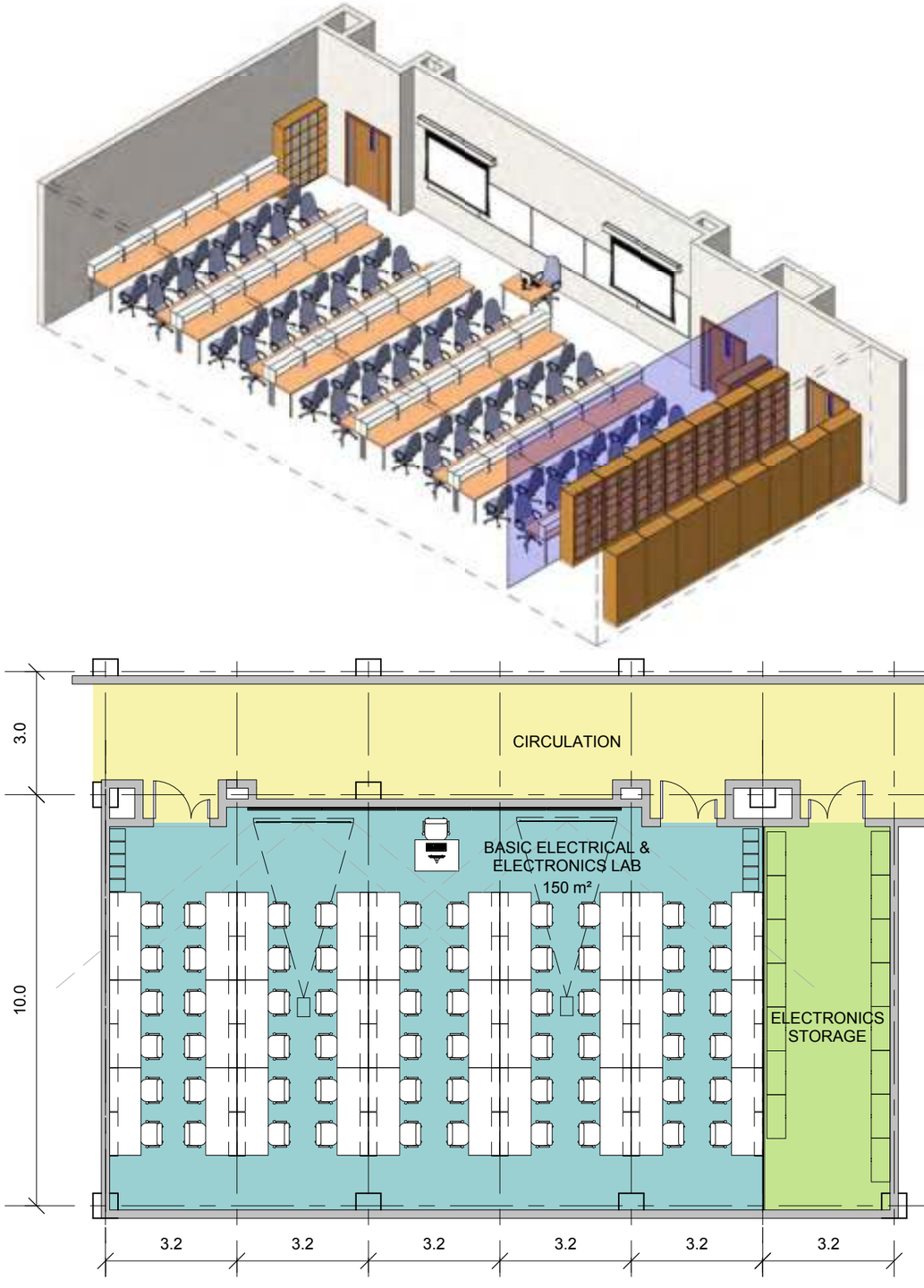
MISCELLANEOUS EQUIPMENT

Control Station (AV)	
Video Projector (Clng. Mounted)	X
Projector Screen	X
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	
Bulletin Board	
Other	

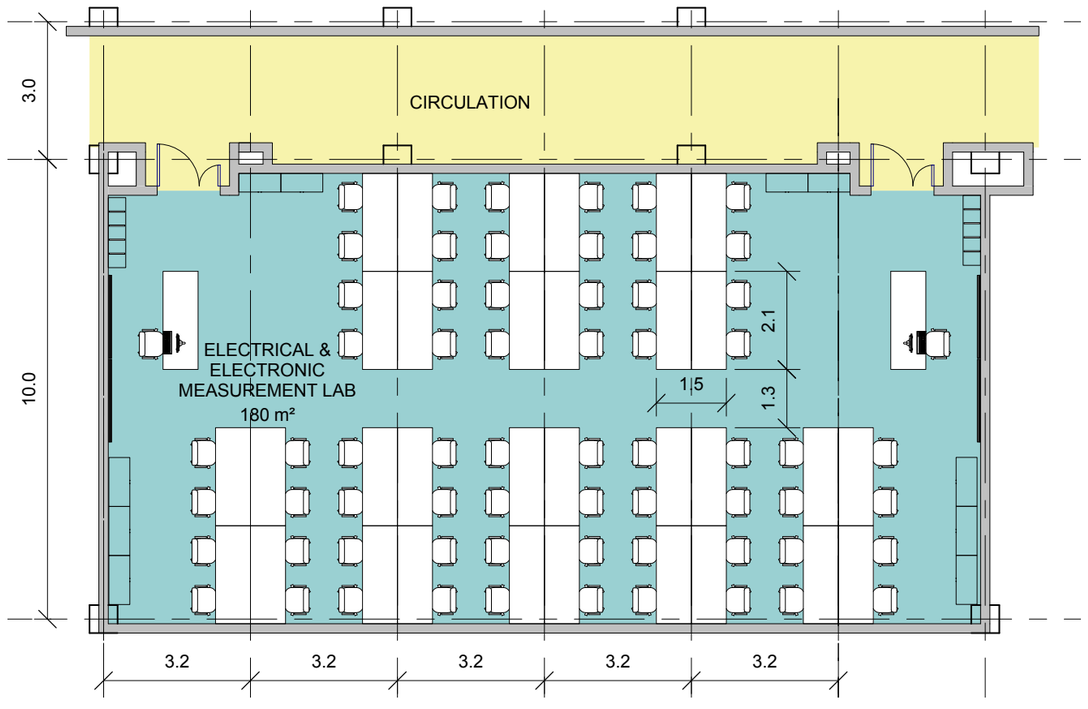
REMARKS:

KEY PLAN:





TYPE 3 (Electronics Lab)



SPACE NAME: ELECTRICAL & ELECTRONIC MEASUREMENT LAB

SUBJECTS TAUGHT: Measurement Lab (EE)

OCCUPANCY: UNDERGRADUATE TEACHING LAB

UTILIZATION

Hours of Use (hours/day)	6
Hours of Use (hours/week)	30
Capacity (students/lab session)	60

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	X
Humidity	
50% ± 20% (Typical)	X
Natural Ventilation	
Artificial Ventilation (A/C)	X

PLUMBING

Laboratory Vacuum (LV)	
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	
Laboratory Gas (LG)	
Carbon Dioxide (C02)	
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	
Hot Water (HW)	
Cold Water (CW)	
High Purity Water /(DI)	
Chilled Water (CHW S/R)	
Floor Drain (FD)	
Eyewash (EW)	
Safety Shower (SS)	

LABORATORY EQUIPMENT

Vibration Sensitive	
Light Sensitive	
Vibration Producing	
Heat Producing	X
Noise Producing	

_WHEATSTONE'S BRIDGE
_MAXWELL BRIDGE, KELVIN'S DOUBLE BRIDGE
_MULTIMETERS, GALVANOMETER
_POWER SUPPLIES
_RESISTORS
_RESISTANCE BOX
_WATTMETER, VOLTMETER, AMMETER
_FUNCTION GENERATOR
_CRO TRAINER KIT
_BREAD BOARDS

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	X
208V, 30A, 3 Phase	X
Isolated Ground Outlet	
Emergency Power	X
Phone	X
Data - Wired/ Wireless	X

LIGHTING

Lighting Level	
100 fc at bench/desk	
60 fc at bench/desk	X
Task Lighting	
"In Use" Light	
Zoned Lighting	
Dimmable	
Natural Daylight	X

HOODS

Chemical Fume Hood	
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	
Acids	
Solvents	
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	X
Sealed Concrete	
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling	
Height	3.0M OR MORE
Open	
Acoustic Tile	X
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	2
Vision Panel	X

CASEWORK / FURNITURE

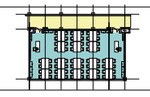
_MOVABLE ELECTRONICS LAB TABLES & LAB STOOLS
_LAB ASSISTANTS' DESKS & CHAIRS
_TALL STORAGE CABINETS
_BOOK SHELVING ALONG WINDOW WALL

MISCELLANEOUS EQUIPMENT

Control Station (AV)	
Video Projector (Clng. Mounted)	X
Projector Screen	X
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	
Bulletin Board	
Other	

REMARKS:

KEY PLAN:



TYPE 3 (Electronics Lab)

SPACE NAME: COMMUNICATION SYSTEMS LAB

SUBJECTS TAUGHT: RF & Microwave Engineering (EC), Digital Electronics & Communication Systems (CS, EC), Digital Signal Processing Lab (EC), Digital Systems Lab (EE), Signals & Systems Lab (CS, EC), Telecommunication Networks Lab (EC)

OCCUPANCY: UNDERGRADUATE TEACHING LAB

UTILIZATION

Hours of Use (hours/day)	6
Hours of Use (hours/week)	30
Capacity (students/lab session)	60

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	X
Humidity	
50% ± 20% (Typical)	X
Natural Ventilation	
Artificial Ventilation (A/C)	X

PLUMBING

Laboratory Vacuum (LV)	
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	
Laboratory Gas (LG)	
Carbon Dioxide (C02)	
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	
Hot Water (HW)	
Cold Water (CW)	
High Purity Water /(DI)	
Chilled Water (CHW S/R)	
Floor Drain (FD)	
Eyewash (EW)	
Safety Shower (SS)	

LABORATORY EQUIPMENT

Vibration Sensitive	
Light Sensitive	
Vibration Producing	
Heat Producing	X
Noise Producing	

- DIGITAL STORAGE OSCILLOSCOPES
- HIGH FREQUENCY ANALOGUE OSCILLOSCOPES
- POWER SUPPLIES
- KLYSTRON
- GUNN OSCILLATOR
- MICROWAVE BENCH
- TRAINING KITS FOR COMMUNICATION TECHNIQUES: SATELLITE COMMUNICATION, ANTENNA, LAN, CDMA, PCM TRAINER KITS
- FUNCTION GENERATORS
- SIGNAL GENERATORS

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	X
208V, 30A, 3 Phase	X
Isolated Ground Outlet	
Emergency Power	X
Phone	X
Data - Wired/ Wireless	X

LIGHTING

Lighting Level	
100 fc at bench/desk	
60 fc at bench/desk	X
Task Lighting	
"In Use" Light	
Zoned Lighting	
Dimmable	
Natural Daylight	X

HOODS

Chemical Fume Hood	
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	
Acids	
Solvents	
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	X
Sealed Concrete	
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling Height	3.0M OR MORE
Open	
Acoustic Tile	X
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	X
Vision Panel	X

CASEWORK / FURNITURE

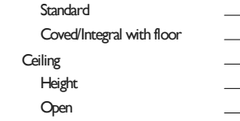
- MOVABLE ELECTRONICS LAB TABLES WITH ATTACHED SHELVING & LAB STOOLS
- LAB ASSISTANTS' DESKS & CHAIRS
- TALL STORAGE CABINETS
- BOOK SHELVING ALONG WINDOW WALL

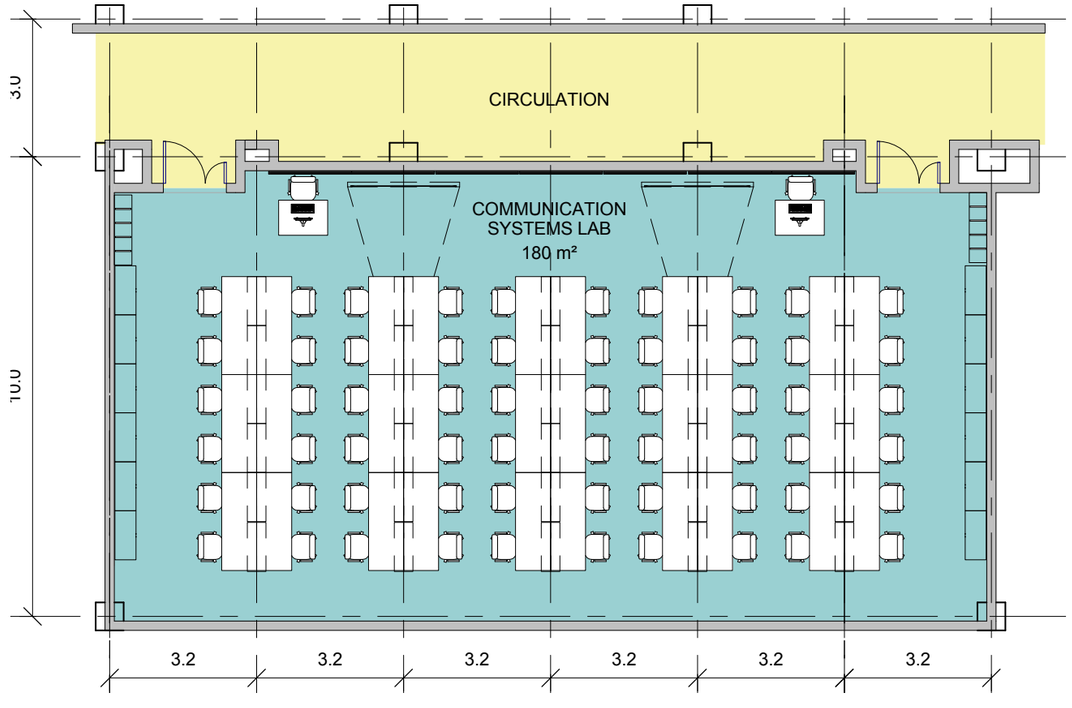
MISCELLANEOUS EQUIPMENT

Control Station (AV)	
Video Projector (Clng. Mounted)	X
Projector Screen	X
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	
Bulletin Board	
Other	

REMARKS:

KEY PLAN:





TYPE 3 (Electronics Lab)

SPACE NAME: POWER ELECTRONICS LAB
SUBJECTS TAUGHT: POWER ELECTRONICS

OCCUPANCY: UNDERGRADUATE TEACHING LAB

UTILIZATION

Hours of Use (hours/day)	6
Hours of Use (hours/week)	30
Capacity (students/lab session)	60

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	X
Humidity	
50% ± 20% (Typical)	X
Natural Ventilation	
Artificial Ventilation (A/C)	X

PLUMBING

Laboratory Vacuum (LV)	
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	
Laboratory Gas (LG)	
Carbon Dioxide (C02)	
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	
Hot Water (HW)	
Cold Water (CW)	
High Purity Water /(DI)	
Chilled Water (CHWS/R)	
Floor Drain (FD)	
Eyewash (EW)	
Safety Shower (SS)	

LABORATORY EQUIPMENT

Vibration Sensitive	
Light Sensitive	
Vibration Producing	
Heat Producing	X
Noise Producing	

_POWER SCOPE
_DISTORTION FACTOR METER
_SPEED CONTROL FOR DC BRUSH MOTOR
_3-PHASE INDUCTION MOTOR SPEED CONTROLLED
_RECTIFIER
_INVERTERS
_3-PHASE FIRING UNIT
_3-PHASE CONVERTER

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	X
208V, 30A, 3 Phase	X
Isolated Ground Outlet	
Emergency Power	X
Phone	X
Data - Wired/ Wireless	X

LIGHTING

Lighting Level	
100 fc at bench/desk	
60 fc at bench/desk	X
Task Lighting	
"In Use" Light	
Zoned Lighting	
Dimmable	
Natural Daylight	X

HOODS

Chemical Fume Hood	
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	
Acids	
Solvents	
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	X
Sealed Concrete	
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling	
Height	3.0M OR MORE
Open	
Acoustic Tile	X
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	2
Vision Panel	X

CASEWORK / FURNITURE

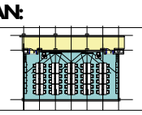
_MOVABLE ELECTRONICS LAB TABLES WITH ATTACHED SHELVING & LAB STOOLS
_LAB ASSISTANTS' DESKS & CHAIRS
_TALL STORAGE CABINETS
_BOOK SHELVING ALONG WINDOW WALL

MISCELLANEOUS EQUIPMENT

Control Station (AV)	
Video Projector (Clng. Mounted)	X
Projector Screen	X
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	
Bulletin Board	
Other	

REMARKS:

KEY PLAN:



SPACE NAME: NETWORKS LAB
SUBJECTS TAUGHT: ADVANCED NETWORKS, COMPUTER NETWORKS, N.A.C.P. LAB, NETWORK ANALYSIS LAB

OCCUPANCY: UNDERGRADUATE TEACHING LAB

UTILIZATION

Hours of Use (hours/day)	6
Hours of Use (hours/week)	30
Capacity (students/lab session)	60

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	X
Humidity	
50% ± 20% (Typical)	X
Natural Ventilation	
Artificial Ventilation (A/C)	X

PLUMBING

Laboratory Vacuum (LV)	
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	
Laboratory Gas (LG)	
Carbon Dioxide (C02)	
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	
Hot Water (HW)	
Cold Water (CW)	
High Purity Water /(DI)	
Chilled Water (CHWS/R)	
Floor Drain (FD)	
Eyewash (EW)	
Safety Shower (SS)	

LABORATORY EQUIPMENT

Vibration Sensitive	
Light Sensitive	
Vibration Producing	
Heat Producing	X
Noise Producing	

_SIGNAL GENERATORS
_CATHODE RAY OSCILLOSCOPES
_DIGITAL MULTIMETERS
_DIGITAL STORAGE OSCILLOSCOPES
_POWER SUPPLIES
_FUNCTION GENERATORS
_COMPUTERS, ROUTERS, SERVERS
_CISCO TRAINING KITS
_ISDN SIMULATOR KITS
_GPS MODULE

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	X
208V, 30A, 3 Phase	X
Isolated Ground Outlet	
Emergency Power	X
Phone	X
Data - Wired/ Wireless	X

LIGHTING

Lighting Level	
100 fc at bench/desk	
60 fc at bench/desk	X
Task Lighting	
"In Use" Light	
Zoned Lighting	
Dimmable	
Natural Daylight	X

HOODS

Chemical Fume Hood	
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	
Acids	
Solvents	
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	X
Sealed Concrete	
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling	
Height	3.0M OR MORE
Open	
Acoustic Tile	X
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	X
Vision Panel	X

CASEWORK / FURNITURE

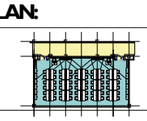
_MOVABLE ELECTRONICS LAB TABLES WITH ATTACHED SHELVING & LAB STOOLS
_LAB ASSISTANTS' DESKS & CHAIRS
_TALL STORAGE CABINETS
_BOOK SHELVING ALONG WINDOW WALL

MISCELLANEOUS EQUIPMENT

Control Station (AV)	
Video Projector (Clng. Mounted)	X
Projector Screen	X
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	
Bulletin Board	
Other	

REMARKS:

KEY PLAN:



For views please see *Communication Systems Lab* on page *D-12*

TYPE 3 (Electronics Lab)

SPACE NAME: ELECTRIC DRIVES LAB
SUBJECTS TAUGHT: ELECTRIC DRIVES

OCCUPANCY: UNDERGRADUATE TEACHING LAB

UTILIZATION

Hours of Use (hours/day)	6
Hours of Use (hours/week)	30
Capacity (students/lab session)	60

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	X
Humidity	
50% ± 20% (Typical)	X
Natural Ventilation	
Artificial Ventilation (A/C)	X

PLUMBING

Laboratory Vacuum (LV)	
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	
Laboratory Gas (LG)	
Carbon Dioxide (C02)	
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	
Hot Water (HW)	
Cold Water (CW)	
High Purity Water /(DI)	
Chilled Water (CHWS/R)	
Floor Drain (FD)	
Eyewash (EW)	
Safety Shower (SS)	

LABORATORY EQUIPMENT

Vibration Sensitive	
Light Sensitive	
Vibration Producing	
Heat Producing	X
Noise Producing	

- SIGNAL GENERATORS
- CATHODE RAY OSCILLOSCOPES
- DIGITAL MULTIMETERS
- DIGITAL STORAGE OSCILLOSCOPES
- POWER SUPPLY
- AMPLIFIERS
- CLIPPING & CLAMPING CIRCUITS
- FUNCTION GENERATORS

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	X
208V, 30A, 3 Phase	X
Isolated Ground Outlet	
Emergency Power	X
Phone	X
Data - Wired/ Wireless	X

LIGHTING

Lighting Level	
100 fc at bench/desk	
60 fc at bench/desk	X
Task Lighting	
"In Use" Light	
Zoned Lighting	
Dimmable	
Natural Daylight	X

HOODS

Chemical Fume Hood	
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	
Acids	
Solvents	
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	X
Sealed Concrete	
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling	
Height	3.0M OR MORE
Open	
Acoustic Tile	X
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	X
Vision Panel	X

CASEWORK / FURNITURE

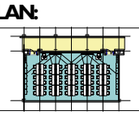
- MOVABLE ELECTRONICS LAB TABLES WITH ATTACHED SHELVING & LAB STOOLS
- LAB ASSISTANTS' DESKS & CHAIRS
- TALL STORAGE CABINETS
- BOOK SHELVING ALONG WINDOW WALL

MISCELLANEOUS EQUIPMENT

Control Station (AV)	
Video Projector (Clng. Mounted)	X
Projector Screen	X
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	
Bulletin Board	
Other	

REMARKS:

KEY PLAN:



SPACE NAME: CONTROL SYSTEMS LAB
SUBJECTS TAUGHT: CONTROL SYSTEMS ENGINEERING

OCCUPANCY: UNDERGRADUATE TEACHING LAB

UTILIZATION

Hours of Use (hours/day)	6
Hours of Use (hours/week)	30
Capacity (students/lab session)	60

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	X
Humidity	
50% ± 20% (Typical)	X
Natural Ventilation	
Artificial Ventilation (A/C)	X

PLUMBING

Laboratory Vacuum (LV)	
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	
Laboratory Gas (LG)	
Carbon Dioxide (C02)	
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	
Hot Water (HW)	
Cold Water (CW)	
High Purity Water /(DI)	
Chilled Water (CHWS/R)	
Floor Drain (FD)	
Eyewash (EW)	
Safety Shower (SS)	

LABORATORY EQUIPMENT

Vibration Sensitive	
Light Sensitive	
Vibration Producing	
Heat Producing	X
Noise Producing	

- NETWROKED PC WORKSTATIONS
- TRAINING KITS FOR AUTOMATED ACCESS CONTROL DEVICES
- STANDARD ELECTRONIC TEST & MEASUREMENT INSTRUMENTS (OSCILLOSCOPES, SIGNAL GENERATORS, POWER SUPPLIES)
- SPEED CONTROL TRAINER
- TEMPERATURE CONTROL TRAINER
- MODULAR ROBOT ASSEMBLY KITS FOR ROBOTIC APPLICATIONS
- TRAINING KITS FOR COMPUTER CONTROLLED SYSTEMS - TRAFFIC LIGHT, WASHING MACHINES, THERMAL SYSTEMS

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	X
208V, 30A, 3 Phase	X
Isolated Ground Outlet	
Emergency Power	X
Phone	X
Data - Wired/ Wireless	X

LIGHTING

Lighting Level	
100 fc at bench/desk	
60 fc at bench/desk	X
Task Lighting	
"In Use" Light	
Zoned Lighting	
Dimmable	
Natural Daylight	X

HOODS

Chemical Fume Hood	
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	
Acids	
Solvents	
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	X
Sealed Concrete	
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling	
Height	3.0M OR MORE
Open	
Acoustic Tile	X
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	X
Vision Panel	X

CASEWORK / FURNITURE

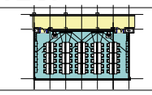
- MOVABLE ELECTRONICS LAB TABLES WITH ATTACHED SHELVING & LAB STOOLS
- LAB ASSISTANTS' DESKS & CHAIRS
- TALL STORAGE CABINETS
- BOOK SHELVING ALONG WINDOW WALL

MISCELLANEOUS EQUIPMENT

Control Station (AV)	
Video Projector (Clng. Mounted)	X
Projector Screen	X
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	
Bulletin Board	
Other	

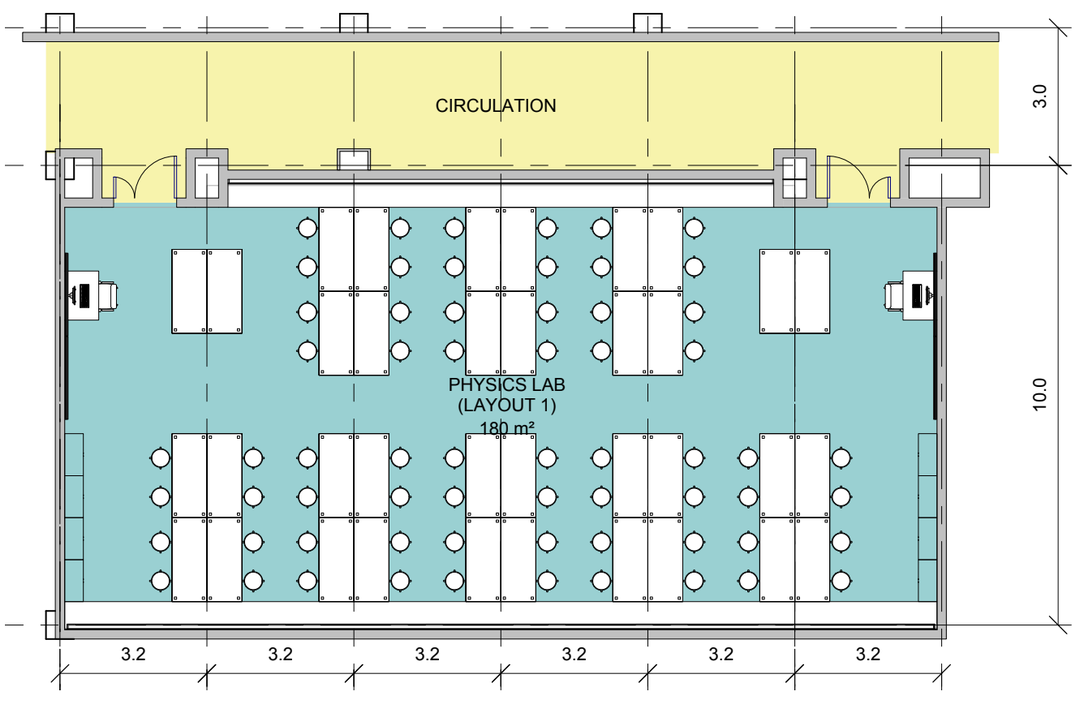
REMARKS:

KEY PLAN:



For views please see *Communication Systems Lab* on page *D-12*

TYPE 3 (Electronics Lab)



TYPE 4 (Physics Lab)

SPACE NAME: PHYSICS LAB
SUBJECTS TAUGHT: PHYSICS (CORE)

OCCUPANCY: TEACHING LAB

UTILIZATION

Hours of Use (hours/day)	6
Hours of Use (hours/week)	30
Capacity (students/lab session)	60

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	
Humidity	
50% ± 20% (Typical)	
Natural Ventilation	X
Artificial Ventilation (A/C)	

PLUMBING

Laboratory Vacuum (LV)	
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	
Laboratory Gas (LG)	
Carbon Dioxide (C02)	
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	
Hot Water (HW)	
Cold Water (CW)	
High Purity Water /(DI)	
Chilled Water (CHWS/R)	
Floor Drain (FD)	
Eyewash (EW)	
Safety Shower (SS)	

LABORATORY EQUIPMENT

Vibration Sensitive	X
Light Sensitive	X
Vibration Producing	
Heat Producing	
Noise Producing	

_SPECTROSCOPY KITS
_FIBER OPTIC DESIGNER KITS
_NEWTON'S RING APPARATUS
_FRESNEL'S BIPRISM KIT
_LASER KITS
ELECTRICAL RESISTIVITY (4- PROBE METHOD KIT)
_PLANCK'S CONSTANT KIT
RHEOSTATS, SPECTROMETER, TANGENT
GALVANOMETERS
_MULTIMETERS, SONOMETERS, TRANSFORMERS

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	X
208V, 30A, 3 Phase	X
Isolated Ground Outlet	X
Emergency Power	X
Phone	X
Data - Wired/ Wireless	X

ELECTRICAL & DATA RACEWAYS ALL ALONG THE WALLS

DATA & ELECTRICAL OUTLET POINTS AT SEVERAL LOCATIONS ON THE FLOOR

LIGHTING

Lighting Level	
100 fc at bench/desk	X
60 fc at bench/desk	
Task Lighting	
"In Use" Light	X
Zoned Lighting	
Dimmable	X (NOT IN OPTICAL SECTION)
Natural Daylight	

HOODS

Chemical Fume Hood	
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	
Acids	
Solvents	
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	X
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	
Sealed Concrete	
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling	
Height	3.0M OR MORE
Open	X
Acoustic Tile	
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	X
Vision Panel	X

CASEWORK / FURNITURE

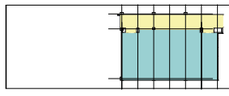
_MOVABLE, ADJUSTABLE LAB TABLES & LAB STOOLS
_TALL STORAGE CABINETS
_LAB ASSISTANT'S DESKS & CHAIRS

MISCELLANEOUS EQUIPMENT

Control Station (AV)	
Video Projector (Clng. Mounted)	
Projector Screen	
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	X (OPTICAL SECTION)
Bulletin Board	
Other	

REMARKS:

KEY PLAN:



SPACE NAME: ENGINEERING MECHANICS LAB

SUBJECTS TAUGHT: ENGINEERING MECHANICS, MECHANICAL VIBRATIONS LAB, PRODUCTION MANAGEMENT, THEORY OF MACHINES

OCCUPANCY: TEACHING LAB

UTILIZATION

Hours of Use (hours/day)	6
Hours of Use (hours/week)	30
Capacity (students/lab session)	60

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	
Humidity	
50% ± 20% (Typical)	
Natural Ventilation	X
Artificial Ventilation (A/C)	

PLUMBING

Laboratory Vacuum (LV)	
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	
Laboratory Gas (LG)	
Carbon Dioxide (C02)	
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	
Hot Water (HW)	
Cold Water (CW)	
High Purity Water /(DI)	
Chilled Water (CHW S/R)	
Floor Drain (FD)	
Eyewash (EW)	
Safety Shower (SS)	

LABORATORY EQUIPMENT

Vibration Sensitive	X
Light Sensitive	
Vibration Producing	
Heat Producing	
Noise Producing	

_INCLINED PLANE APPARATUS
_WORM & WORM WHEEL APPARATUS
_FLY WHEEL APPARATUS
_TRIANGLE AND PARALLELOGRAM OF FORCES APPARATUS
_JOINT ROOF TRUSS APPARATUS
_SIMPLE AND COMPOUND GEAR TRAIN APPARATUS
_TORSION APPARATUS
_DEFLECTION OF BEAM APPARATUS
_UNIVERSAL TESTING MACHINE (UTM)
_HARDNESS TESTING MACHINE

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	X
208V, 30A, 3 Phase	X
Isolated Ground Outlet	X
Emergency Power	X
Phone	X
Data - Wired/ Wireless	X

LIGHTING

Lighting Level	
100 fc at bench/desk	X
60 fc at bench/desk	X
Task Lighting	
"In Use" Light	
Zoned Lighting	
Dimmable	
Natural Daylight	X

HOODS

Chemical Fume Hood	
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	
Acids	
Solvents	
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	X
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	
Sealed Concrete	
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling	
Height	3.0M OR MORE
Open	X
Acoustic Tile	
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	X
Vision Panel	X

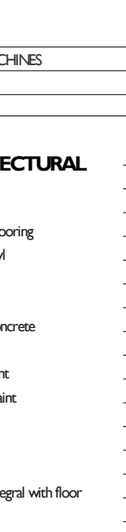
CASEWORK / FURNITURE

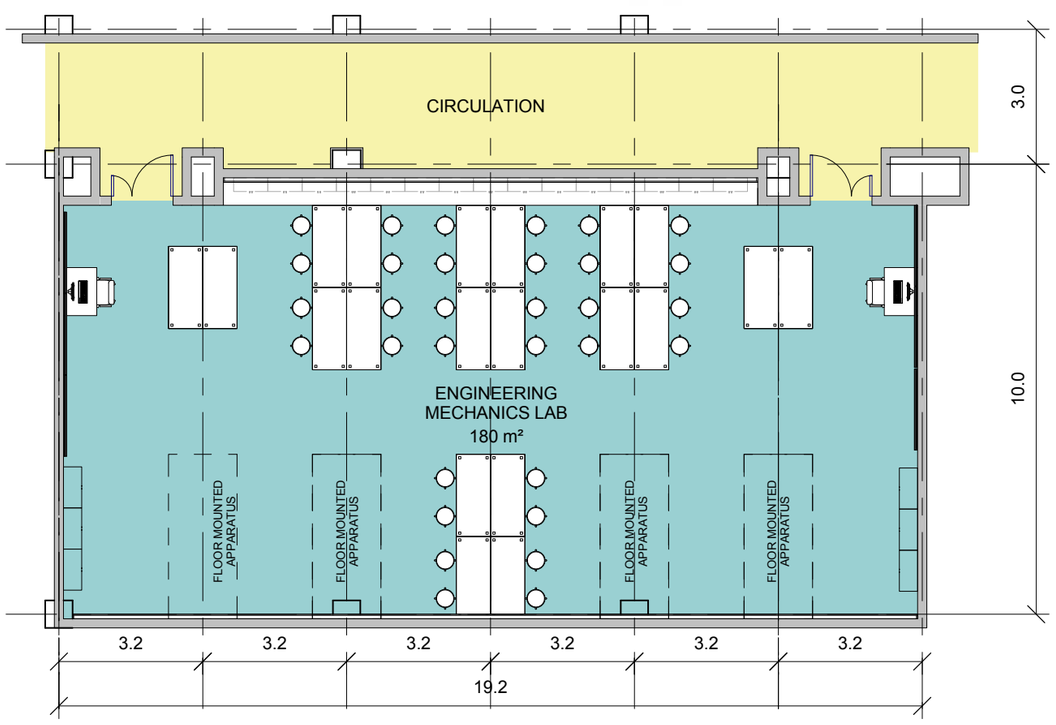
MISCELLANEOUS EQUIPMENT

Control Station (AV)	
Video Projector (Clng. Mounted)	
Projector Screen	
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	
Bulletin Board	
Other	

REMARKS:

KEY PLAN:





TYPE 4 (Physics Lab)

SPACE NAME: CHEMISTRY LAB
SUBJECTS TAUGHT: ENGINEERING CHEMISTRY (CORE)

OCCUPANCY: TEACHING LAB

UTILIZATION

Hours of Use (hours/day)	6
Hours of Use (hours/week)	30
Capacity (students/lab session)	60

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	X
Humidity	
50% ± 20% (Typical)	X
Natural Ventilation	
Artificial Ventilation (A/C)	X

PLUMBING

Laboratory Vacuum (LV)	X
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	X
Laboratory Gas (LG)	X
Carbon Dioxide (C02)	X
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	X
Hot Water (HW)	X
Cold Water (CW)	X
High Purity Water /(DI)	X
Chilled Water (CHW S/R)	
Floor Drain (FD)	X
Eyewash (EW)	X
Safety Shower (SS)	X

LABORATORY EQUIPMENT

Vibration Sensitive	
Light Sensitive	
Vibration Producing	
Heat Producing	
Noise Producing	

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	
208V, 30A, 3 Phase	
Isolated Ground Outlet	
Emergency Power	
Phone	X
Data - Wired/ Wireless	X

LIGHTING

Lighting Level	
100 fc at bench/desk	X
60 fc at bench/desk	
Task Lighting	
"In Use" Light	
Zoned Lighting	
Dimmable	
Natural Daylight	X

HOODS

Chemical Fume Hood	X
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	X
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	X
Acids	X
Solvents	X
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	X
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	
Sealed Concrete	
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling	
Height	3.0M OR MORE
Open	X
Acoustic Tile	
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	X
Vision Panel	X

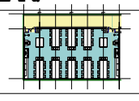
CASEWORK / FURNITURE

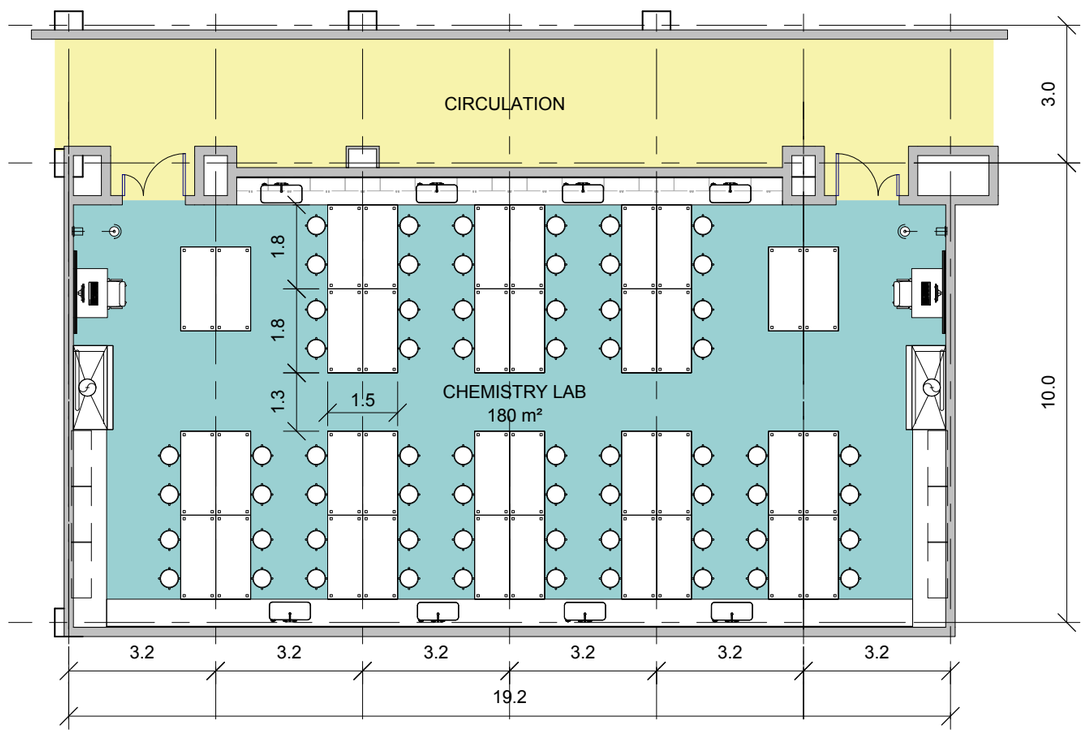
MISCELLANEOUS EQUIPMENT

Control Station (AV)	
Video Projector (Clng. Mounted)	
Projector Screen	
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	
Bulletin Board	
Other	

REMARKS:

KEY PLAN:





TYPE 5 (Wet Lab)

SPACE NAME: ENVIRONMENTAL ENGINEERING
SUBJECTS TAUGHT: ENVIRONMENTAL ENGINEERING (CE)

OCCUPANCY: TEACHING LAB

UTILIZATION

Hours of Use (hours/day)	6
Hours of Use (hours/week)	30
Capacity (students/lab session)	60

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	X
Humidity	
50% ± 20% (Typical)	X
Natural Ventilation	
Artificial Ventilation (A/C)	X

PLUMBING

Laboratory Vacuum (LV)	X
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	X
Laboratory Gas (LG)	
Carbon Dioxide (C02)	X
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	X
Hot Water (HW)	X
Cold Water (CW)	X
High Purity Water /(DI)	X
Chilled Water (CHW S/R)	
Floor Drain (FD)	X
Eyewash (EW)	X
Safety Shower (SS)	X

LABORATORY EQUIPMENT

Vibration Sensitive	X
Light Sensitive	
Vibration Producing	
Heat Producing	X
Noise Producing	

_SPECTROPHOTOMETER
_JAR TEST APPARATUS
_MUFFLE FURNACE
_FILTRATION ASSEMBLY W/ FLASK & DISTILLATION UNIT
_DISSOLVED OXYGEN ANALYSER
_DIGITAL CONDUCTIVITY METER
_PHOTOCALORIMETER, PH METER & TURBIDITY METER
_HOT AIR OVEN
_REFRIGERATORS
_B.O.D. (BIOCHEMICAL OXYGEN DEMAND) INCUBATOR

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	
208V, 30A, 3 Phase	
Isolated Ground Outlet	
Emergency Power	X
Phone	X
Data - Wired/ Wireless	X

LIGHTING

Lighting Level	
100 fc at bench/desk	
60 fc at bench/desk	X
Task Lighting	
"In Use" Light	
Zoned Lighting	
Dimmable	
Natural Daylight	X

HOODS

Chemical Fume Hood	
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	
Acids	
Solvents	
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	X
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	
Sealed Concrete	
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling	
Height	3.0M OR MORE
Open	X
Acoustic Tile	
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	X
Vision Panel	X

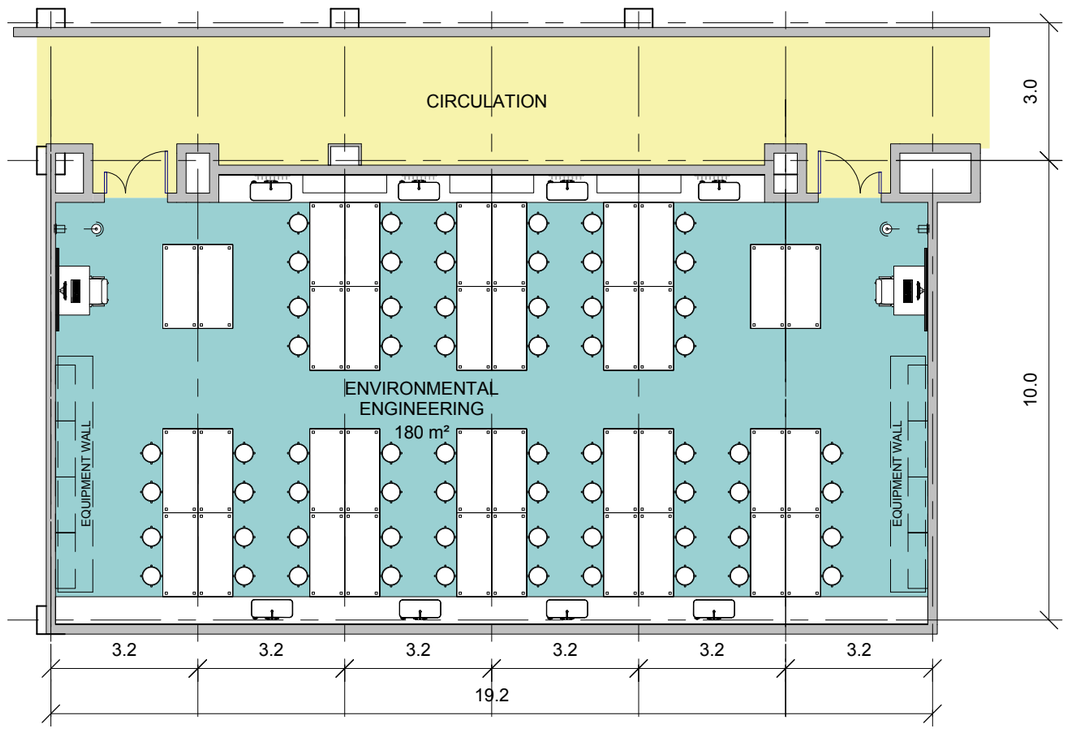
CASEWORK / FURNITURE

MISCELLANEOUS EQUIPMENT

Control Station (AV)	
Video Projector (Clng. Mounted)	
Projector Screen	
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	
Bulletin Board	
Other	

REMARKS:

KEY PLAN:



TYPE 5 (Wet Lab)

SPACE NAME: ENGINEERING WORKSHOP
SUBJECTS TAUGHT: WORKSHOP PRACTICE (CORE)

OCCUPANCY: TEACHING WORKSHOP

UTILIZATION

Hours of Use (hours/day)	6
Hours of Use (hours/week)	30
Capacity (students/lab session)	60 (2 OR 3 PER MACHINE)

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	
Humidity	
50% ± 20% (Typical)	
Natural Ventilation	X
Artificial Ventilation (A/C)	

PLUMBING

Laboratory Vacuum (LV)	
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	
Laboratory Gas (LG)	
Carbon Dioxide (C02)	
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	X
Hot Water (HW)	
Cold Water (CW)	X
High Purity Water /(DI)	
Chilled Water (CHWS/R)	
Floor Drain (FD)	
Eyewash (EW)	
Safety Shower (SS)	

LABORATORY EQUIPMENT

Vibration Sensitive	
Light Sensitive	
Vibration Producing	X
Heat Producing	
Noise Producing	X

_CARPENTRY WORKING TABLES & TOOLS
_IRON FITTING EQUIPMENT
_WELDING EQUIPMENT
_FOUNDRY EQUIPMENT
_SMITHY EQUIPMENT

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	
208V, 30A, 3 Phase	
Isolated Ground Outlet	X
Emergency Power	
Phone	X
Data - Wired/ Wireless	X

LIGHTING

Lighting Level	
100 fc at bench/desk	
60 fc at bench/desk	X
Task Lighting	
"In Use" Light	
Zoned Lighting	
Dimmable	
Natural Daylight	X

HOODS

Chemical Fume Hood	
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	
Acids	
Solvents	
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	
Sealed Concrete	X
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling	6.0 M OR MORE
Height	
Open	X
Acoustic Tile	
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	
Vision Panel	

ROLLING SHUTTERS OR GRILLES

CASEWORK / FURNITURE

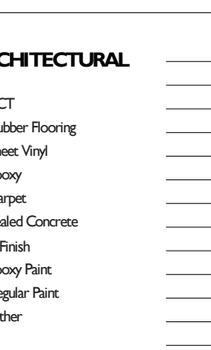
ADJUSTABLE, MOVABLE LAB TABLES AND CHAIRS
_TALL STORAGE CABINETS
_COUNTER WITH BASE STORAGE CABINETS &
_OVERHEAD SHELVING
_DESKS & CHAIRS FOR LAB ASSISTANTS

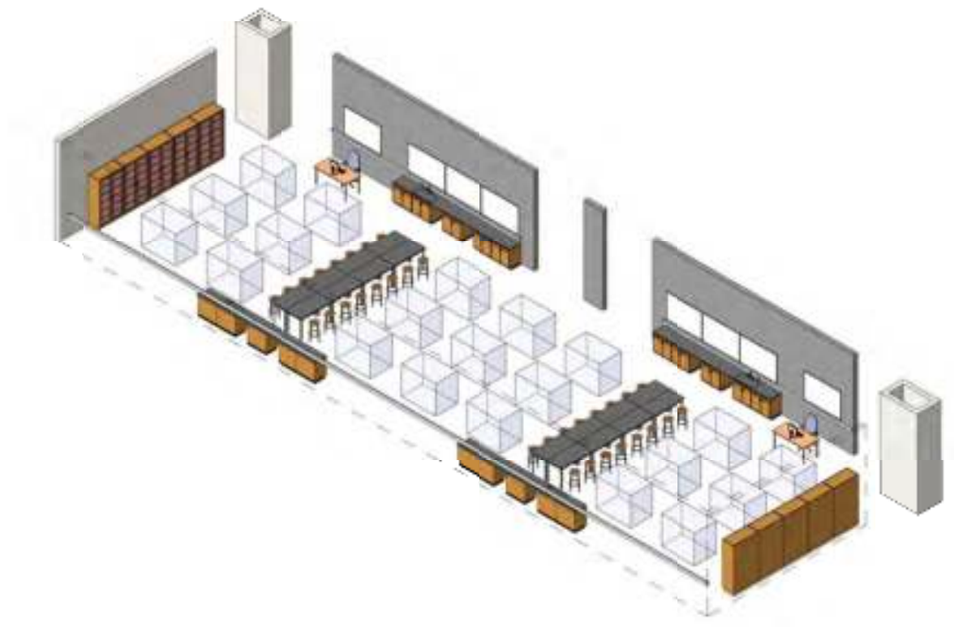
MISCELLANEOUS EQUIPMENT

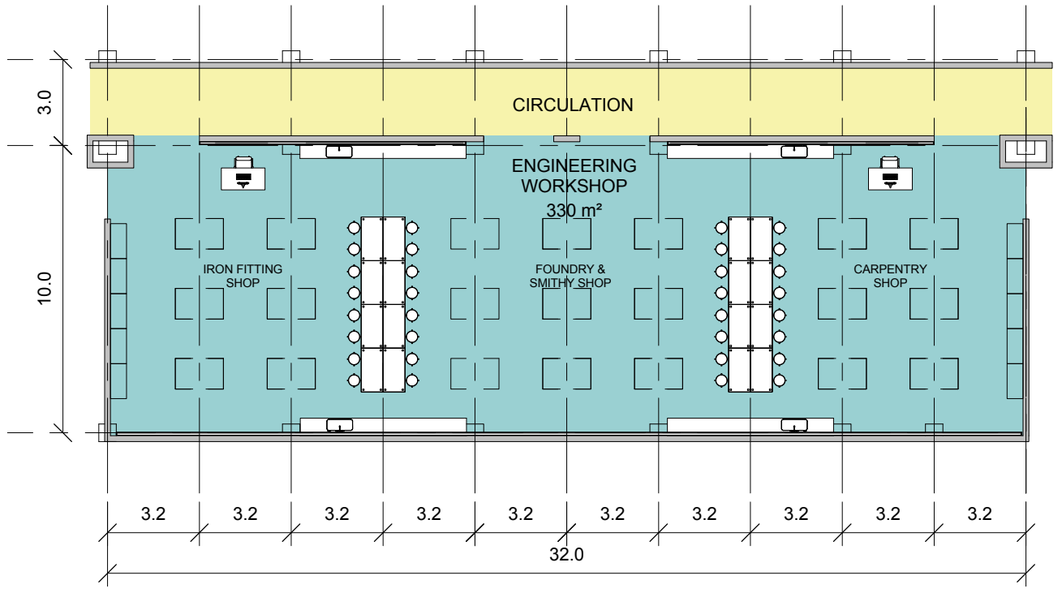
Control Station (AV)	
Video Projector (Clng. Mounted)	
Projector Screen	
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	
Bulletin Board	
Other	

REMARKS:

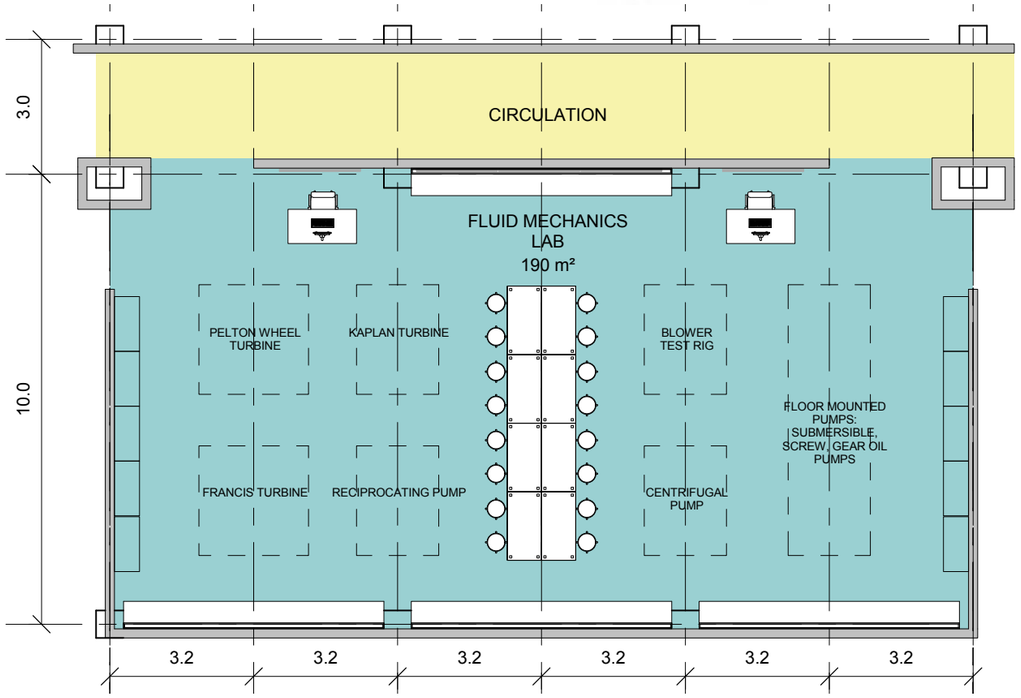
KEY PLAN:







TYPE 6 (Equipment Intensive Lab)



TYPE 6 (Equipment Intensive Lab)

SPACE NAME: FLUID MECHANICS LAB
SUBJECTS TAUGHT: FLUID MECHANICS (ME, CE)

OCCUPANCY: TEACHING WORKSHOP

UTILIZATION

Hours of Use (hours/day)	6
Hours of Use (hours/week)	30
Capacity (students/lab session)	30 (5 PER EXPERIMENT)

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	
Humidity	
50% ± 20% (Typical)	
Natural Ventilation	X
Artificial Ventilation (A/C)	

PLUMBING

Laboratory Vacuum (LV)	X
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	X
Laboratory Gas (LG)	
Carbon Dioxide (C02)	
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	
Hot Water (HW)	X
Cold Water (CW)	X
High Purity Water /(DI)	
Chilled Water (CHW S/R)	CHW
Floor Drain (FD)	FD (+TRENCH)
Eyewash (EW)	
Safety Shower (SS)	

LABORATORY EQUIPMENT

Vibration Sensitive	
Light Sensitive	
Vibration Producing	X
Heat Producing	X
Noise Producing	X

_FRANCIS TURBINE TEST RIG 1.8m x 0.7m x 1.8m
_CENTRIFUGAL PUMP 1.7m x 1.0m x 1.5
_RECIPROCAL PUMP 1.8m x 1.0m x 1.5
_HYDRAULIC RAM TEST RIG 6.5M X 0.9M X 3.9M
_PELTON WHEEL TURBINE TEST RIG 2.5m x 0.7m x 2.3m
_VENTURIMETERS, ORIFICE METERS, NOTCH PLATES
_SUBMERSIBLE PUMP
_SCREW PUMP
_GEAR OIL PUMP

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	
208V, 30A, 3 Phase	
Isolated Ground Outlet	X
Emergency Power	X
Phone	X
Data - Wired/ Wireless	X

LIGHTING

Lighting Level	
100 fc at bench/desk	
60 fc at bench/desk	X
Task Lighting	
"In Use" Light	
Zoned Lighting	
Dimmable	
Natural Daylight	X

HOODS

Chemical Fume Hood	
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	
Acids	
Solvents	
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	
Sealed Concrete	X
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling	
Height	6M OR MORE
Open	X
Acoustic Tile	
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	
Vision Panel	

ROLLING SHUTTERS OR GRILLES

CASEWORK / FURNITURE

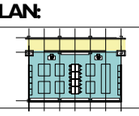
_ADJUSTABLE, MOVABLE LAB TABLES & CHAIRS
_TALL STORAGE CABINETS
_COUNTER (S.S.) WITH BASE STORAGE CABINETS & OVERHEAD SHELVING
_DESKS & CHAIRS FOR LAB ASSISTANTS

MISCELLANEOUS EQUIPMENT

Control Station (AV)	
Video Projector (Clng. Mounted)	
Projector Screen	
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	
Bulletin Board	
Other	

REMARKS:

KEY PLAN:



SPACE NAME: I.C. ENGINES LAB

SUBJECTS TAUGHT: INTERNAL COMBUSTION ENGINES (ME)

OCCUPANCY: TEACHING WORKSHOP

UTILIZATION

Hours of Use (hours/day)	6
Hours of Use (hours/week)	30
Capacity (students/lab session)	30 (4-5 PER EXPERIMENT)

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	
Humidity	
50% ± 20% (Typical)	
Natural Ventilation	X
Artificial Ventilation (A/C)	

PLUMBING

Laboratory Vacuum (LV)	X
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	X
Laboratory Gas (LG)	
Carbon Dioxide (C02)	
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	
Hot Water (HW)	X
Cold Water (CW)	X
High Purity Water /(DI)	
Chilled Water (CHWS/R)	CHW
Floor Drain (FD)	FD (+TRENCH)
Eyewash (EW)	
Safety Shower (SS)	

LABORATORY EQUIPMENT

Vibration Sensitive	
Light Sensitive	
Vibration Producing	X
Heat Producing	X
Noise Producing	X

_I.C. ENGINE TEST RIG 2M X 2.5M X 1.5M (HIGH)
_BOMB CALORIMETER
_SINGLE CYLINDER 4-STROKE MULTIFUEL VCR ENGINE
_WATER DYNAMOMETER
_WANKEL ENGINE MODEL
_BATTERY CHARGER
_EXHAUST GAS ANALYSER
_DIESEL ENGINE PERFORMANCE TEST RIG
_PETROL ENGINE PERFORMANCE TEST RIG

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	X
208V, 30A, 3 Phase	X
Isolated Ground Outlet	X
Emergency Power	X
Phone	X
Data - Wired/ Wireless	X

LIGHTING

Lighting Level	
100 fc at bench/desk	
60 fc at bench/desk	X
Task Lighting	
"In Use" Light	
Zoned Lighting	
Dimmable	
Natural Daylight	X

HOODS

Chemical Fume Hood	
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	
Acids	
Solvents	
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	
Sealed Concrete	X
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling	6.0M OR MORE
Height	
Open	X
Acoustic Tile	
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	
Vision Panel	

CASEWORK / FURNITURE

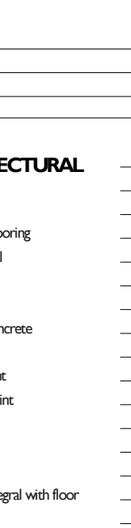
_ADJUSTABLE, MOVABLE LAB TABLES & CHAIRS
_TALL STORAGE CABINETS
_COUNTER (S.S.) WITH BASE STORAGE CABINETS & OVERHEAD SHELVING
_DESKS & CHAIRS FOR LAB ASSISTANTS

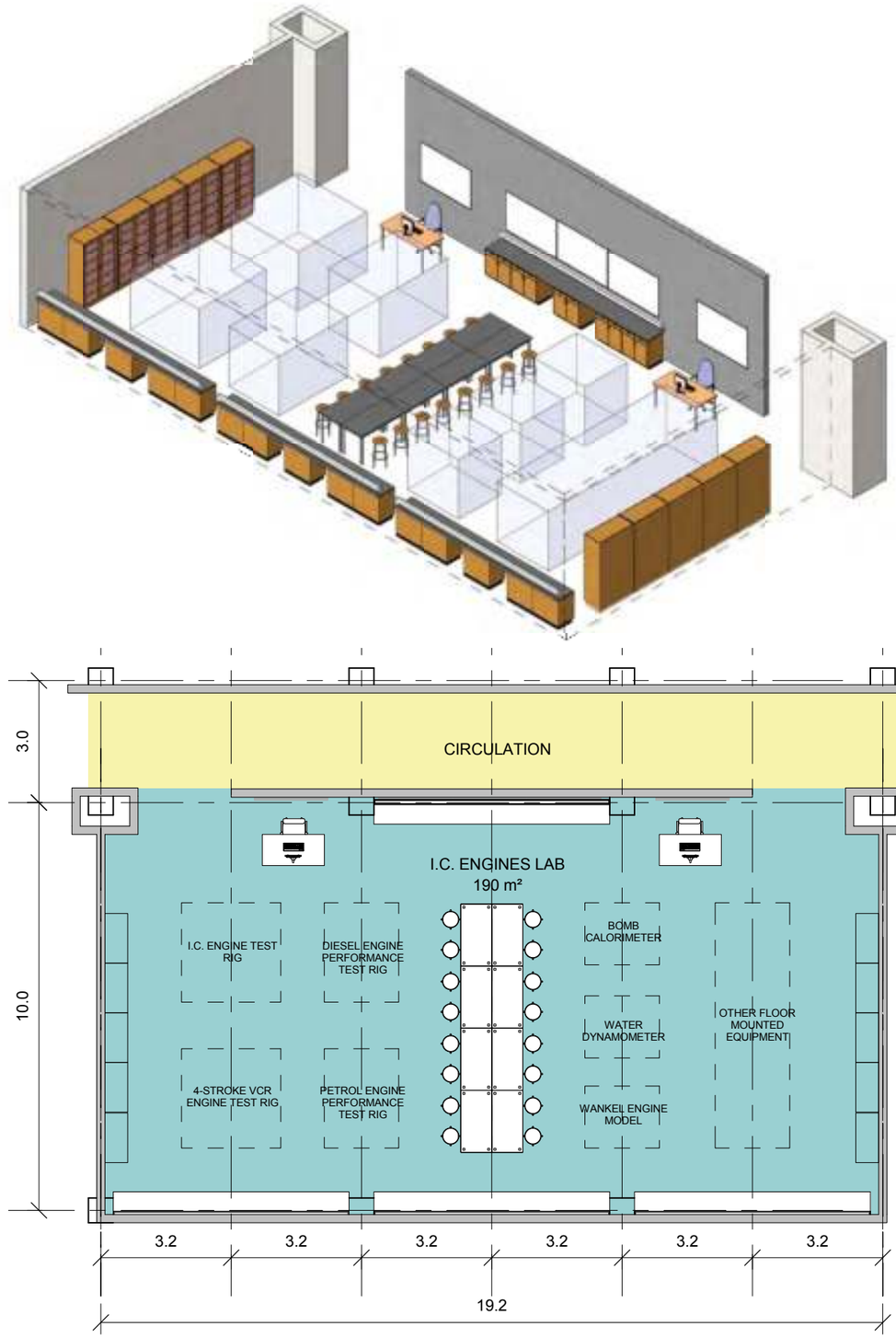
MISCELLANEOUS EQUIPMENT

Control Station (AV)	
Video Projector (Clng. Mounted)	
Projector Screen	
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	
Bulletin Board	
Other	

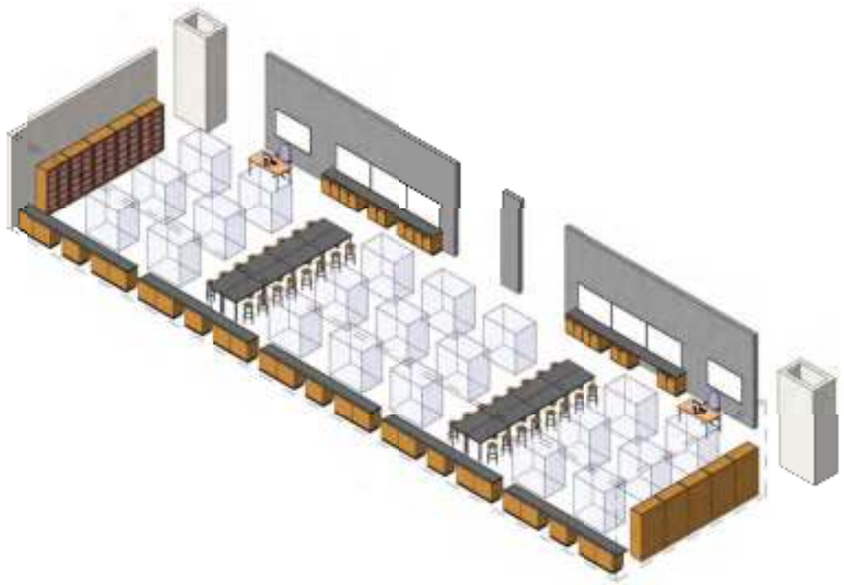
REMARKS:

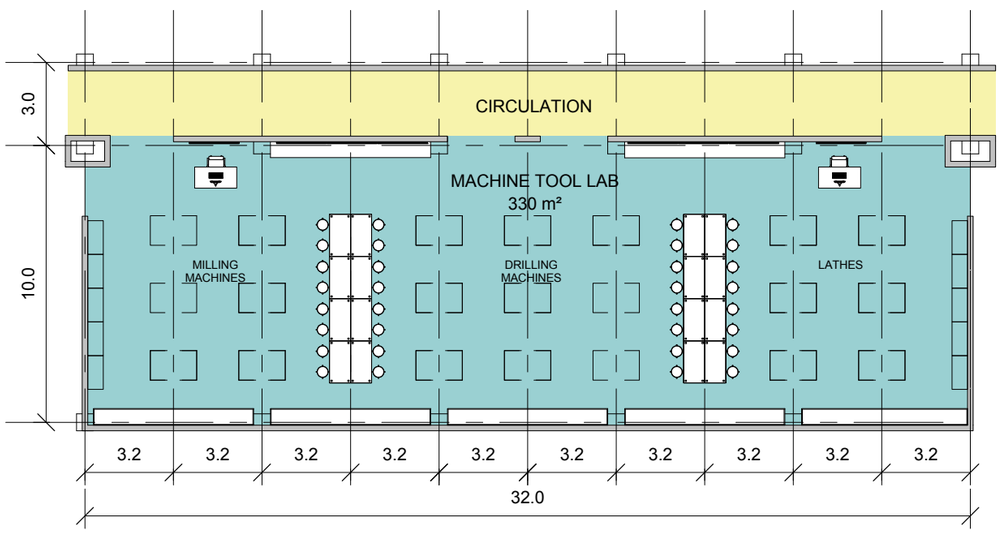
KEY PLAN:





TYPE 6 (Equipment Intensive Lab)





SPACE NAME: MACHINE TOOL LAB
SUBJECTS TAUGHT: Machine Tool Engineering

OCCUPANCY: TEACHING WORKSHOP

UTILIZATION

Hours of Use (hours/day)	6
Hours of Use (hours/week)	30
Capacity (students/lab session)	30 (5 PER EXPERIMENT)

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	
Humidity	
50% ± 20% (Typical)	
Natural Ventilation	X
Artificial Ventilation (A/C)	

PLUMBING

Laboratory Vacuum (LV)	
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	
Laboratory Gas (LG)	
Carbon Dioxide (C02)	
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	X
Hot Water (HW)	
Cold Water (CW)	X
High Purity Water /(DI)	
Chilled Water (CHWS/R)	
Floor Drain (FD)	
Eyewash (EW)	
Safety Shower (SS)	

LABORATORY EQUIPMENT

Vibration Sensitive	
Light Sensitive	
Vibration Producing	X
Heat Producing	X
Noise Producing	X

_LATHES
_CNC LATHES
_DRILLING MACHINES
_MILLING MACHINES

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	X
208V, 30A, 3 Phase	X
Isolated Ground Outlet	X
Emergency Power	X
Phone	X
Data - Wired/ Wireless	X

LIGHTING

Lighting Level	
100 fc at bench/desk	
60 fc at bench/desk	X
Task Lighting	
"In Use" Light	
Zoned Lighting	
Dimmable	
Natural Daylight	X

HOODS

Chemical Fume Hood	
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	
Acids	
Solvents	
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	
Sealed Concrete	X
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling	
Height	6.0M OR MORE
Open	X
Acoustic Tile	
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	
Vision Panel	

ROLLING SHUTTERS OR GRILLES

CASEWORK / FURNITURE

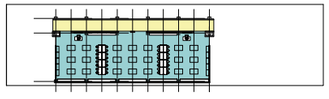
ADJUSTABLE, MOVABLE LAB TABLES AND CHAIRS
_TALL STORAGE CABINETS
_COUNTER (S.S.) WITH BASE STORAGE CABINETS &
_OVERHEAD SHELVING
_DESKS & CHAIRS FOR LAB ASSISTANTS

MISCELLANEOUS EQUIPMENT

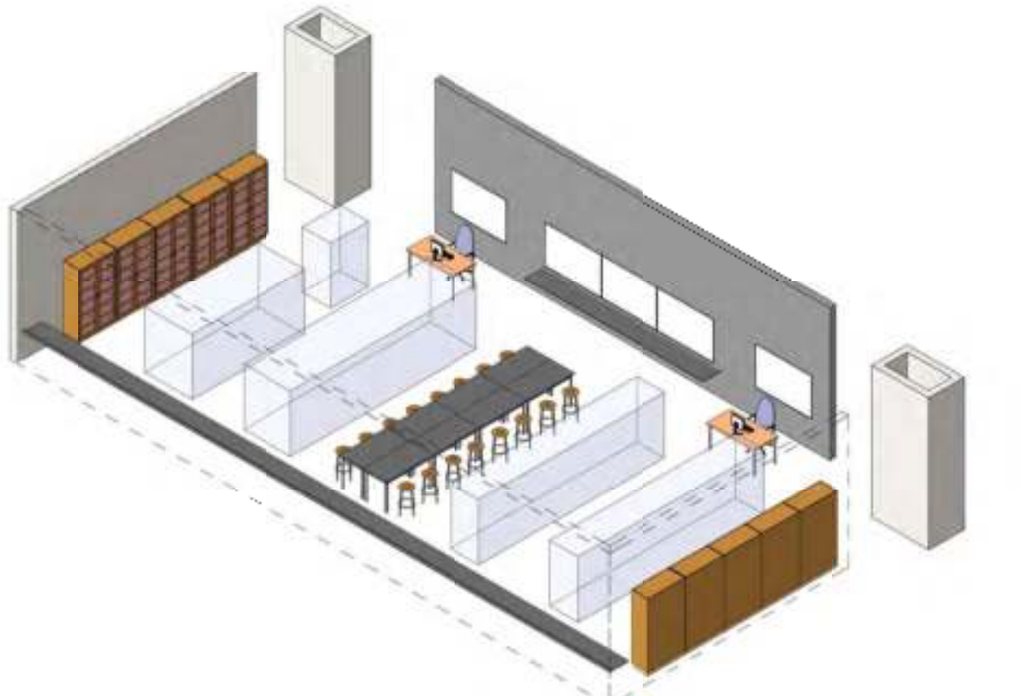
Control Station (AV)	
Video Projector (Clng. Mounted)	
Projector Screen	
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	
Bulletin Board	
Other	

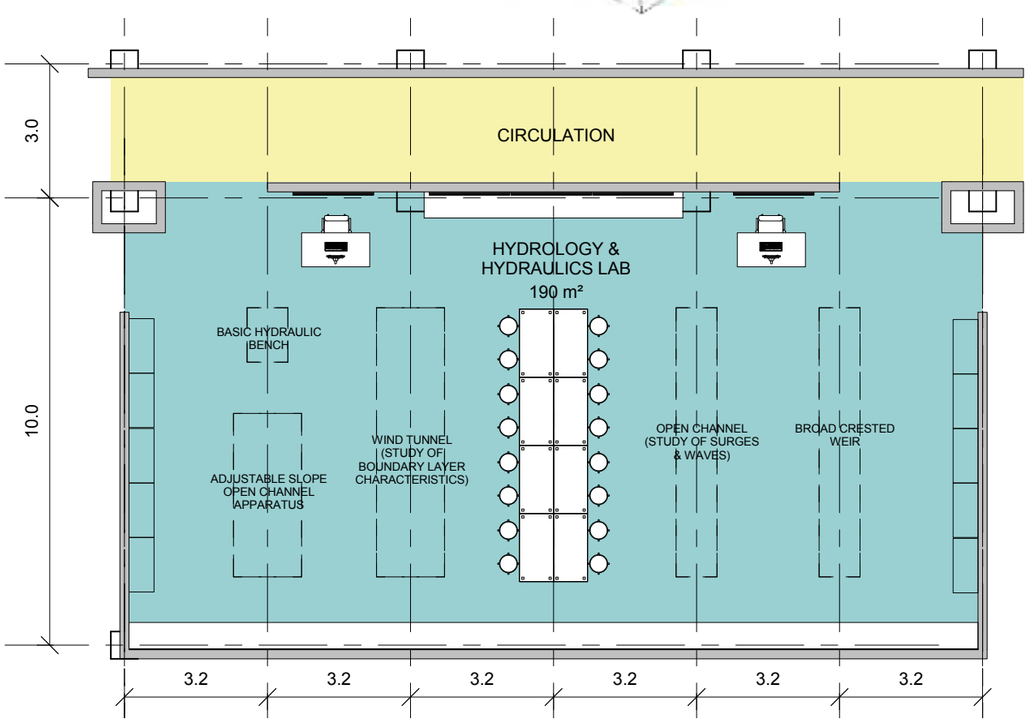
REMARKS:

KEY PLAN:



TYPE 6 (Equipment Intensive Lab)





SPACE NAME: HYDROLOGY & HYDRAULICS LAB

SUBJECTS TAUGHT: HYDROLOGY & HYDRAULICS (CE), WATER POWER ENGINEERING (CE)

OCCUPANCY: TEACHING WORKSHOP

UTILIZATION

Hours of Use (hours/day)	6
Hours of Use (hours/week)	30
Capacity (students/lab session)	30 (5 PER EXPERIMENT)

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	
Humidity	
50% ± 20% (Typical)	
Natural Ventilation	X
Artificial Ventilation (A/C)	

PLUMBING

Laboratory Vacuum (LV)	X
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	X
Laboratory Gas (LG)	
Carbon Dioxide (C02)	
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	X
Hot Water (HW)	X
Cold Water (CW)	X
High Purity Water /(DI)	
Chilled Water (CHW S/R)	X
Floor Drain (FD)	X (+ TRENCH)
Eyewash (EW)	
Safety Shower (SS)	

LABORATORY EQUIPMENT

Vibration Sensitive	
Light Sensitive	
Vibration Producing	X
Heat Producing	X
Noise Producing	X

_BROAD CRESTED WEIR

_WIND TUNNEL

_BASIC HYDRAULIC BENCH 1.2M X 0.7M (HIGH) X 1.2M

ADJUSTABLE SLOPE OPEN CHANNEL APPARATUS

_STUDIES OF WAVES & SURGES IN OPEN CHANNEL

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	X
208V, 30A, 3 Phase	X
Isolated Ground Outlet	X
Emergency Power	X
Phone	X
Data - Wired/ Wireless	X

LIGHTING

Lighting Level	
100 fc at bench/desk	
60 fc at bench/desk	X
Task Lighting	
"In Use" Light	
Zoned Lighting	
Dimmable	
Natural Daylight	X

HOODS

Chemical Fume Hood	
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	
Acids	
Solvents	
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	
Sealed Concrete	X
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling	
Height	6.0M OR MORE
Open	X
Acoustic Tile	
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	
Vision Panel	

ROLLING SHUTTERS OR GRILLES

CASEWORK / FURNITURE

ADJUSTABLE, MOVABLE LAB TABLES AND CHAIRS

_TALL STORAGE CABINETS

_COUNTER (S.S.) WITH BASE STORAGE CABINETS & OVERHEAD SHELVING

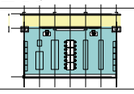
_DESKS & CHAIRS FOR LAB ASSISTANTS

MISCELLANEOUS EQUIPMENT

Control Station (AV)	
Video Projector (Clng. Mounted)	
Projector Screen	
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	
Bulletin Board	
Other	

REMARKS:

KEY PLAN:



TYPE 6 (Equipment Intensive Lab)

SPACE NAME: SOIL MECHANICS & FOUNDATION ENGINEERING LAB
SUBJECTS TAUGHT: FOUNDATION ENGINEERING (CE)

OCCUPANCY: TEACHING WORKSHOP

UTILIZATION

Hours of Use (hours/day)	6
Hours of Use (hours/week)	30
Capacity (students/lab session)	30 (4-5 PER EXPERIMENT)

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	
Humidity	
50% ± 20% (Typical)	
Natural Ventilation	X
Artificial Ventilation (A/C)	

PLUMBING

Laboratory Vacuum (LV)	X
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	X
Laboratory Gas (LG)	
Carbon Dioxide (C02)	
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	X
Hot Water (HW)	X
Cold Water (CW)	X
High Purity Water /(DI)	
Chilled Water (CHWS/R)	
Floor Drain (FD)	X (+TRENCH)
Eyewash (EW)	
Safety Shower (SS)	

LABORATORY EQUIPMENT

Vibration Sensitive	
Light Sensitive	
Vibration Producing	X
Heat Producing	X
Noise Producing	X

_SIEVES
_HYDROMETER
_LIQUID & PLASTIC LIMIT APPARATUS
_SHRINKAGE LIMIT APPARATUS
_PROCTOR COMPACTION APPARATUS
_UNIVERSAL TESTING MACHINE OF 20KN CAPACITY
_DIRECT SHEAR APPARATUS
_THERMOMETER
_FIELD DENSITY MEASURING DEVICE
_TRIAXIAL SHEAR APPARATUS

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	
208V, 30A, 3 Phase	
Isolated Ground Outlet	X
Emergency Power	X
Phone	X
Data - Wired/ Wireless	X

LIGHTING

Lighting Level	
100 fc at bench/desk	X
60 fc at bench/desk	
Task Lighting	
"In Use" Light	
Zoned Lighting	
Dimmable	
Natural Daylight	X

HOODS

Chemical Fume Hood	
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	
Acids	
Solvents	
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	
Sealed Concrete	X
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling	6.0M OR MORE
Height	
Open	X
Acoustic Tile	
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	
Vision Panel	

CASEWORK / FURNITURE

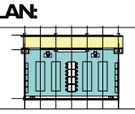
_ADJUSTABLE, MOVABLE LAB TABLES & CHAIRS
_TALL STORAGE CABINETS
_COUNTER (S.S.) WITH BASE STORAGE CABINETS & OVERHEAD SHELVING
_DESKS & CHAIRS FOR LAB ASSISTANTS

MISCELLANEOUS EQUIPMENT

Control Station (AV)	
Video Projector (Clng. Mounted)	
Projector Screen	
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	
Bulletin Board	
Other	

REMARKS:

KEY PLAN:



SPACE NAME: MATERIAL SCIENCES LAB
SUBJECTS TAUGHT: MATERIAL SCIENCES (CE), STRENGTH OF MATERIALS (CE), STRUCTURAL ENGINEERING (CE), ADVANCED STRUCTURAL ANALYSIS (CE)

OCCUPANCY: TEACHING WORKSHOP

UTILIZATION

Hours of Use (hours/day)	6
Hours of Use (hours/week)	30
Capacity (students/lab session)	30 (4-5 PER EXPERIMENT)

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	
Humidity	
50% ± 20% (Typical)	
Natural Ventilation	X
Artificial Ventilation (A/C)	

PLUMBING

Laboratory Vacuum (LV)	X
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	X
Laboratory Gas (LG)	
Carbon Dioxide (C02)	
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	X
Hot Water (HW)	X
Cold Water (CW)	X
High Purity Water /(DI)	
Chilled Water (CHWS/R)	
Floor Drain (FD)	X (+TRENCH)
Eyewash (EW)	
Safety Shower (SS)	

LABORATORY EQUIPMENT

Vibration Sensitive	
Light Sensitive	
Vibration Producing	X
Heat Producing	X
Noise Producing	X

_FIE - ELECTRONIC UNIVERSAL TESTING MACHINE
_COMPRESSION TESTING MACHINE
_TORSION TESTING MACHINE
_TENSILE TESTER
_HARDNESS TESTING MACHINE
_SPRING TESTING MACHINE
_FATIGUE TESTING MACHINE

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	
208V, 30A, 3 Phase	
Isolated Ground Outlet	X
Emergency Power	X
Phone	X
Data - Wired/ Wireless	X

LIGHTING

Lighting Level	
100 fc at bench/desk	
60 fc at bench/desk	X
Task Lighting	
"In Use" Light	
Zoned Lighting	
Dimmable	
Natural Daylight	X

HOODS

Chemical Fume Hood	
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	
Acids	
Solvents	
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	
Sealed Concrete	X
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling	6.0M OR MORE
Height	
Open	X
Acoustic Tile	
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	
Vision Panel	

ROLLING SHUTTERS OR GRILLES

CASEWORK / FURNITURE

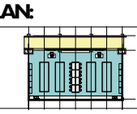
_ADJUSTABLE, MOVABLE LAB TABLES & CHAIRS
_TALL STORAGE CABINETS
_COUNTER (S.S.) WITH BASE STORAGE CABINETS & OVERHEAD SHELVING
_DESKS & CHAIRS FOR LAB ASSISTANTS

MISCELLANEOUS EQUIPMENT

Control Station (AV)	
Video Projector (Clng. Mounted)	
Projector Screen	
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	
Bulletin Board	
Other	

REMARKS:

KEY PLAN:



For views please see *Highway Engineering Lab* on page *D-27*

TYPE 6 (Equipment Intensive Lab)

SPACE NAME: HEAT TRANSFER & THERMODYNAMICS LAB

SUBJECTS TAUGHT: THERMODYNAMICS II (ME), HEAT & MASS TRANSFER (ME), REFRIGERATION & AIRCONDITIONING (ME)

OCCUPANCY: TEACHING WORKSHOP

UTILIZATION

Hours of Use (hours/day)	6
Hours of Use (hours/week)	30
Capacity (students/lab session)	30 (2 03 3 PER EXPERIMENT)

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	
Humidity	
50% ± 20% (Typical)	
Natural Ventilation	X
Artificial Ventilation (A/C)	

PLUMBING

Laboratory Vacuum (LV)	X
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	X
Laboratory Gas (LG)	
Carbon Dioxide (C02)	
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	X
Hot Water (HW)	X
Cold Water (CW)	X
High Purity Water /(DI)	
Chilled Water (CHW S/R)	X
Floor Drain (FD)	X (+ TRENCH)
Eyewash (EW)	
Safety Shower (SS)	

LABORATORY EQUIPMENT

Vibration Sensitive	
Light Sensitive	
Vibration Producing	X
Heat Producing	X
Noise Producing	X

_NATURAL CONVECTION APPARATUS
_FORCED CONVECTION APPARATUS
_CONDUCTION APPARATUS
_EMISSIVITY TESTING APPARATUS
_HEAT EXCHANGER
_PIN FIN APPARATUS
_COMPOSITE WALL APPARATUS
_STEFAN BOLTZMANN APPARATUS
_BENCH TOP COOLING TOWERS
VAPOR COMPRESSION SYSTEM, VAPOR ABSORPTION
SYSTEM, PULSE TUBE CRYOCOOLERS

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	X
208V, 30A, 3 Phase	X
Isolated Ground Outlet	X
Emergency Power	X
Phone	X
Data - Wired/ Wireless	X

LIGHTING

Lighting Level	
100 fc at bench/desk	
60 fc at bench/desk	X
Task Lighting	
"In Use" Light	
Zoned Lighting	
Dimmable	
Natural Daylight	X

HOODS

Chemical Fume Hood	
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	
Acids	
Solvents	
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	
Sealed Concrete	X
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling	
Height	6.0M OR MORE
Open	X
Acoustic Tile	
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	
Vision Panel	

CASEWORK / FURNITURE

ADJUSTABLE, MOVABLE LAB TABLES AND CHAIRS
_TALL STORAGE CABINETS
COUNTER (S.S.) WITH BASE STORAGE CABINETS &
OVERHEAD SHELVING
_DESKS & CHAIRS FOR LAB ASSISTANTS

MISCELLANEOUS EQUIPMENT

Control Station (AV)	
Video Projector (Clng. Mounted)	
Projector Screen	
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	
Bulletin Board	
Other	

REMARKS:

KEY PLAN:

TYPE 6 (Equipment Intensive Lab)

SPACE NAME: HIGHWAY ENGINEERING LAB
SUBJECTS TAUGHT: 4.4.143

OCCUPANCY: TEACHING WORKSHOP

UTILIZATION

Hours of Use (hours/day)	6
Hours of Use (hours/week)	30
Capacity (students/lab session)	30 (4-5 PER EXPERIMENT)

MECHANICAL

Temperature	
22°C ± 2°C (Typical)	
Humidity	
50% ± 20% (Typical)	
Natural Ventilation	X
Artificial Ventilation (A/C)	

PLUMBING

Laboratory Vacuum (LV)	X
Laboratory Air (LA)	
Compressed Air, 100 psi (A)	X
Laboratory Gas (LG)	
Carbon Dioxide (C02)	
Nitrogen Gas (N2)	
Helium	
Hydrogen	
Oxygen (O2)	
Sink	X
Hot Water (HW)	X
Cold Water (CW)	X
High Purity Water /(DI)	
Chilled Water (CHWS/R)	
Floor Drain (FD)	FD (+TRENCH)
Eyewash (EW)	
Safety Shower (SS)	

LABORATORY EQUIPMENT

Vibration Sensitive	
Light Sensitive	
Vibration Producing	X
Heat Producing	X
Noise Producing	X

_MINI CONCRETE MIXER
_MECHANICAL VIBRATOR
_SLUMP CONE
_FLOW TABLE
_PERMEABILITY TESTING APPARATUS
_SET OF SIEVES FOR COARSE & FINE AGGREGATES
_CBR APPARATUS
_HOT AIR OVEN
_HOT WATER BATH

ELECTRICAL

110V, 20A, 1 Phase	
220V	X
208V, 30A, 1 Phase	
208V, 30A, 3 Phase	
Isolated Ground Outlet	X
Emergency Power	X
Phone	X
Data - Wired/ Wireless	X

LIGHTING

Lighting Level	
100 fc at bench/desk	
60 fc at bench/desk	X
Task Lighting	
"In Use" Light	
Zoned Lighting	
Dimmable	
Natural Daylight	X

HOODS

Chemical Fume Hood	
Radioisotope Hood	
Laminar Flow Hood	
Biological Safety Cabinet	
Snorkel	
Canopy Hood	
Low Slotted Exhaust	
Other	

CHEMICALS

Bases	
Acids	
Solvents	
Radioisotopes	
Carcinogens/Regulated	
Chemical Waste Storage	
Biological Storage	
Radioisotope Storage	
Chemical Storage	

ARCHITECTURAL

Floor	
VCT	
Rubber Flooring	
Sheet Vinyl	
Epoxy	
Carpet	
Sealed Concrete	X
Wall Finish	
Epoxy Paint	
Regular Paint	X
Other	
Base	
Standard	X
Coved/Integral with floor	
Ceiling	
Height	6.0M OR MORE
Open	X
Acoustic Tile	
Gyp Board	
Doors	
900 x 2200	
1000 x 2200	
Uneven (1000x2200 & 500x2200)	
Vision Panel	

CASEWORK / FURNITURE

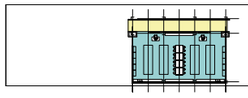
_ADJUSTABLE, MOVABLE LAB TABLES & CHAIRS
_TALL STORAGE CABINETS
_COUNTER (S.S.) WITH BASE STORAGE CABINETS & OVERHEAD SHELVING
_DESKS & CHAIRS FOR LAB ASSISTANTS

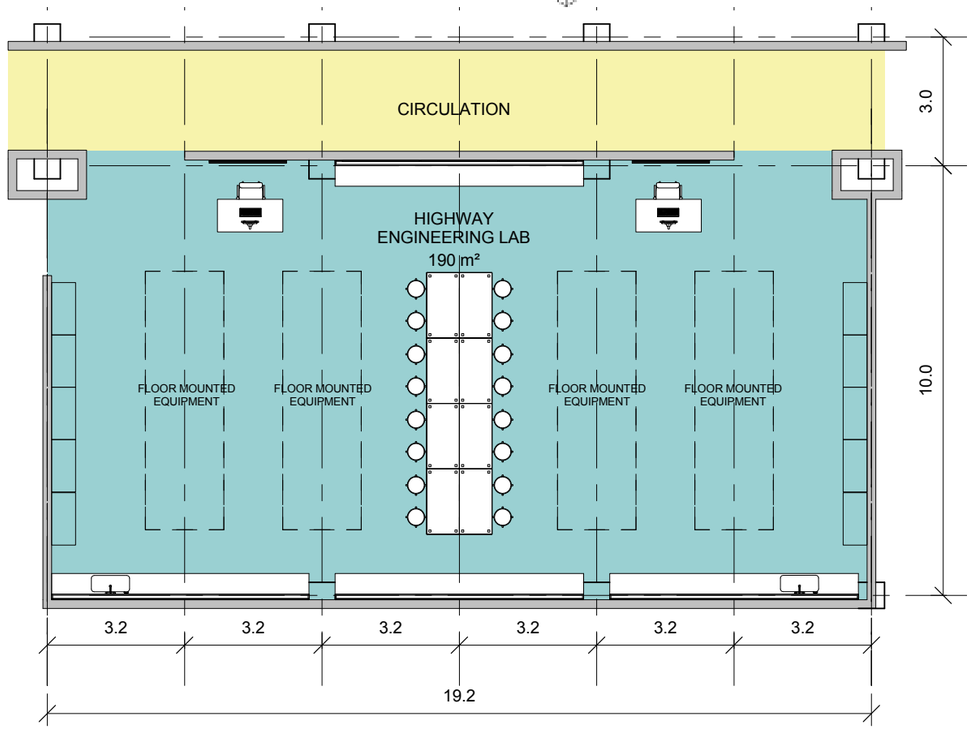
MISCELLANEOUS EQUIPMENT

Control Station (AV)	
Video Projector (Clng. Mounted)	
Projector Screen	
Marker Board	X
Chalk Board	X
Back-pack Storage	X
Black-out Shades	
Bulletin Board	
Other	

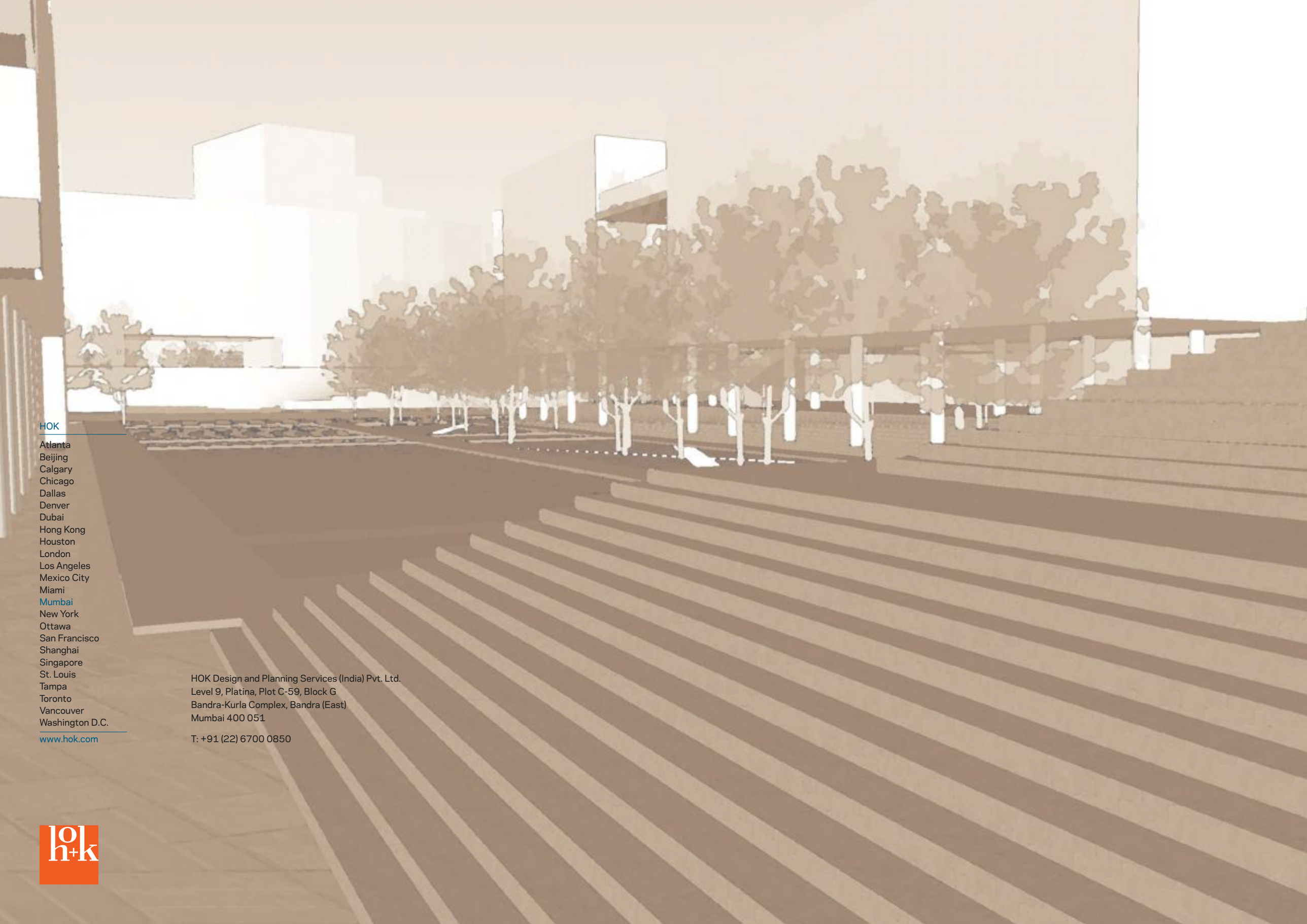
REMARKS:

KEY PLAN:





TYPE 6 (Equipment Intensive Lab)



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