Report of the Project Planning Committee for The Centre for Engineering Innovation and Entrepreneurship

November 22, 2013

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I. Executive Summary

Attracting and empowering the finest faculty, staff and students depends on the Faculty of Applied Science & Engineering's [FASE] ability to provide an environment that fosters creativity and inspires the very best in 21st Century learning and innovation.

FASE has undertaken extensive strategic planning as part of the $2 billion Boundless Campaign for the University of Toronto, the largest fundraising campaign in Canadian history. The following five strategic priorities were identified: developing top global engineering leaders; nurturing engineering innovation and entrepreneurship; advancing information & communications technology; revolutionizing biomedical engineering and human health; and reshaping the future of energy, environment and sustainability.

The Centre for Engineering Innovation and Entrepreneurship [CEIE] is integral to the pursuit of these priorities. A structure of approximately 15,000 gross square metres has been planned that will feature interactive and multi-functional teaching facilities; clusters of design studios which will serve to promote student teamwork; the administrative nerve centres of established and emerging multidisciplinary activities within the Faculty, including the Institute for Mulitdisciplinary Design & Innovation, the Centre for Global Engineering, and the Institute for Sustainable Energy. Additionally, much needed student club space is included in the program.

There is a vital need for new instructional and research space being driven by two revolutionary trends. The first is a wholesale shift in our understanding of the best ways to learn and to teach. State-of-the-art educators now emphasize instruction combined with hands-on, collaborative work as the key to enhanced understanding as opposed to passive note-taking which can result in poor information retention. The second trend is the expansion of engineering into many different disciplines such as health care, business systems, and information technology. This expansion requires engineers to be highly adept not only at working with other kinds of engineers but also with people from entirely different backgrounds. In fact, it is in these areas of overlap where innovation is most frequently found; with specialists bringing diverse skills to the table to work on common projects.

The Centre is a much-needed response to the sweeping changes taking place in engineering. Dynamic, flexible environments will break down artificial barriers between people, foster collaboration, encourage active learning and accelerate innovation. The building will encourage the final stage of the engineering continuum whereby new ideas and new products find their way into the public realm through entrepreneurial activity. Considering that close to 50% of all University of Toronto patents are already driven by the Faculty, the benefits of an increased focus on entrepreneurship is highly strategic and will be particularly effective.

As befits its ambitious mandate, the CEIE will be a showpiece. Located next to iconic Simcoe Hall and facing onto St. George Street— a main thoroughfare—the centre is destined to become a landmark for the University of Toronto. Many innovative areas are planned for learning, group work and research in the new building. Each of these components will help set a new standard for engineering education in Canada and position the Faculty of Applied Science & Engineering among the most elite in the world.

Using 2006 as a base year for enrolment, neither the faculty complement, nor the space in support of all activities has grown at anything approaching the rates of enrolment growth. This trend can lead to the risk of a poorer student and faculty experience. Illustration 1 demonstrates the relative growth patterns of faculty and students against revenues and space allocation between 2006 and 2012.

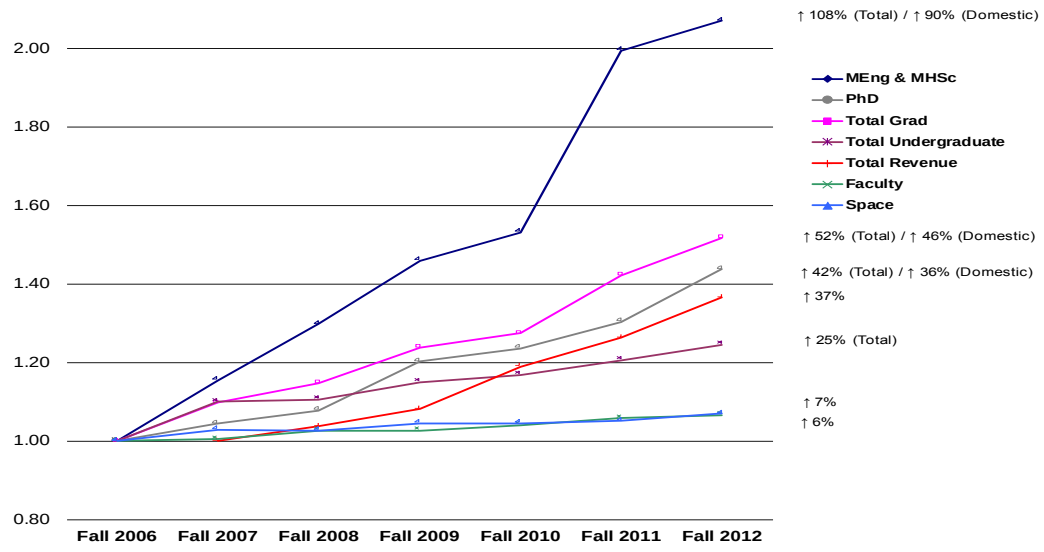


ILLUSTRATION 1. Growth Patterns within the Faculty of Applied Science and Engineering

A Divisional Space Review in 2008-09 indicated that the Faculty required additional space as well as the upgrade of over 60% of its existing space holdings. New space is expensive and in recent years two alternate sites, namely Sites 16 (200 College Street – Wallberg/Engineering Annex) and 17 (5 King's College Road – Haultain/Mechanical), have been extensively investigated to assess the potential for Engineering expansion. Both sites are brown sites with challenging construction access issues and interfaces with adjacent buildings that unfortunately elevated cost estimates to unaffordable levels. Other options explored were the purchase of properties such as 245 College Street and the Salvation Army site at 167 College Street at McCaul Street.

In March, 2012 the University of Toronto approved the allocation of Site 10 (47- 55 St. George Street – Simcoe Hall Parking Lot) to FASE for a five year period to enable the initiation of a capital project.

Assignment of the site was based on the following considerations:

- *the previous explorations and cost analyses associated with Sites 16 and 17 ($160-300 million),*
- *the need to build a sizeable structure to address space shortfalls within FASE, plus*
- *the serious challenge to raise external funds which potentially could be in excess of $95 million.*

It was decided that the proposed building would be programmed as a non wet-laboratory building to minimize costs, i.e. an office building accommodating flexible dry research endeavours, teaching spaces and student space. In preference, the space plan has targeted the innovative and interactive approaches to teaching, takes a major step forward to enhance the activities in support of ten multidisciplinary and emerging nerve centres, and makes a bold commitment to innovation, design and entrepreneurship. The space plan, as proposed, offers many flexible and exciting elements that include a 500-seat interactive classroom [also offers opportunities to others outside of FASE]; and a Hatchery to foster technical and social innovation and growth in emerging areas now being successfully promoted by the Centre for Global Engineering, ILead and IMDI. Additionally, the program requires that flexible space to directly support innovative student club activities be included.

Two other points of consideration, supportive of the approach undertaken, led to the proposed building program. The first is the recognition that funds for all capital projects are difficult to secure, but it appears that greater opportunities might exist for the support of innovation and the emerging thrusts consistent with the proposed space plan. The second point is the opportunity to target the renovation of those spaces vacated in other engineering precinct buildings once the CEIE building is complete to establish additional wet laboratories that will not be included within the proposed project. Typically these would be the laboratories required by the high demand areas of mechanical, civil, chemical and biomedical engineering researchers. The spaces to be vacated include approximately 1100nasm of facilities within the Engineering precinct accommodating program elements that are being relocated to Site 10 and an additional 500nasm of space that will be vacated from temporary space at 245 College Street. Some existing OSM teaching spaces may also be considered for reassignment. As OSM will schedule the new teaching spaces in Site 10, which are considerable, existing OSM spaces within other engineering precinct buildings may become available for repurposing and renovation. A maximum of 1500nasm of OSM space is under consideration. The details of space being vacated and being considered for repurposing are included in Appendix 4.

Procedural arrangements between OSM and FASE around the accommodation of academic activities are on-going and will determine the exact rooms which will be available for reallocation. A full assessment of the impact of the new CEIE building will not occur until post occupancy. At that point, rooms no longer required to meet the University's instructional needs will be released back to the centre for reallocation.

Site 10 was included in the 1997 Secondary Plan for the University of Toronto Area and includes as of right permission to build 10,490 gsm of space with a maximum height of 23m or approximately five floors. The 2011 St. George Campus Master Plan proposed an expanded envelope to accommodate 14,170gsm (approximately 7,085nasm) above grade with a maximum height of 45m (approximately 11 floors) stepping down to 21m (5 floors) and 13m (3 floors). Additional area is assumed possible below grade in both plans. Although the proposed envelope does not carry as-of-right permissions through a formal re-zoning process, the envelope has been reviewed both internally with University stakeholders and externally by area residence associations and municipal staff in Planning, Heritage and Urban Design.

The project, as conceived through schematic design and proposed here is 6,830nasm above grade and an additional 683nasm below grade for a total of 7,513nasm proposed on site. Additionally, one level of parking is planned for the site at a second level below grade.

During the schematic design phase, the envelope has been carefully considered to provide the best layout for the CEIE program while responding to the site and its various adjacencies and constraints. The resulting envelope takes elements from both the approved and proposed Secondary Plan envelopes. The envelope maintains a courtyard separation as articulated in the 1997 Plan envelope between the Physical Geography Building and a new 7-8 storey structure and includes a continuous 10m setback from the Simcoe Hall west façade. A lower structure is located at the south-east end of the site and allows for access off of Galbraith Road to below grade parking and service space. The building design will be required to acknowledge massing and articulation of the surrounding buildings and carefully consider the impact to views in particular those from Russell Street to the west, and from the Front Campus to the east. Additional permissions to build on the site to a height and capacity beyond existing approvals will be sought as part of the design and construction process.

One existing building, 49 St. George Street, is expected to be demolished in order to make a viable site for construction. This building is not listed on the inventory of heritage buildings in the City of Toronto, nor is it identified as a significant heritage resource in the in-force University of Toronto Area Secondary Plan that identifies a development envelope on this site and assumes the removal of the building. As the University values its heritage legacy, ERA Architects were engaged to assess the cultural heritage value of the building and confirm that removal of the building would not see a significant heritage resource lost. ERA were asked to assess the building based on criteria set out in Heritage Act (Reg. 9/06) which includes a description and evaluation of the following:

a) Design of the building, noting key features and physical exterior condition
b) Context within the St. George Campus
c) History, noting construction date, architect (if known), timeline of uses

ERA Architect's research concluded that the house has little historical or contextual value, and that there is little indicating it represents a historically significant work of architectural design. Research did not reveal an architect of record or publication of the design and found the house no longer sits within a residential context. Further, research indicates that the house has little associative historic value that would merit site interpretation or commemoration. Occupants of the house included three residential owners including R. Home Smith, a successful real estate financier responsible for developing parts of Etobicoke, and renowned geophysicist John Tuzo Wilson, who worked from 49 St. George Street in the early 1950's. However, research indicates that it was only after the geophysics program relocated to the Galbraith Building at the end of the 1950's that Wilson shifted his views about geophysics, renouncing established fixed earth theory and accepting plate tectonics, a theory for which he is now remembered as a leading champion.

ERA Architect's description and evaluation of 49 St. George Street has been shared with City of Toronto Heritage Preservation Services (HPS). HPS have expressed, verbally, their acceptance of the demolition of 49 St. George Street.

To make way for construction, the current occupants of 49 St. George Street, the Transitional Year Program (TYP), are being relocated to 123 St. George Street. Renovations are currently underway to accommodate this group. Offices, student lounge and computing space and new accessible entrance and washroom are within the scope of renovations being undertaken for TYP. TYP will have dedicated spaces on the basement, first and second floor. Woodsworth

College will also have dedicated spaces in the building and there are some facilities that will be shared by both building occupants. The anticipated total project cost for the renovation of 123 St. George Street is being funded centrally and being undertaken separately from the CEIE project.

The existing building at 45 St. George Street (referred to here as the 'Physical Geography' building) is a listed heritage building on the City of Toronto inventory. This building will remain occupied by the Faculty of Arts and Science, with the exception of a one-storey rear laboratory structure that is to be removed to make way for site access and new construction. The occupant of this laboratory space has recently been relocated on campus to the Earth Sciences building. The design of the CEIE building is planned to satisfactorily address the interfaces between CEIE and 45 St. George Street including maintaining window wells to lower level windows along the north face of 45 St. George. Earlier contemplated connections between 45 St. George and the CEIE building to improve accessible access within the Physical Geography building were considered in the schematic design, but are not possible with the preferred massing that steps away from the Physical Geography on all sides.

Garbage and recycling will be combined for the surrounding buildings including that of Simcoe Hall, the Nona MacDonald Visitor Centre and the Physicial Geography building as well as the new CEIE building and located in at-grade screened space accessed from Galbraith Road, with direct connections through to a service area within the CEIE building.

Parking on the campus is regulated by a City of Toronto Zoning By-Law that requires 1930-2130 spaces to be provided within delineated areas of the St. George campus. Site 10 currently accommodates 96 parking spaces at grade that, if lost through the development of the site, would place the University below the required threshold for parking space provision. Because of the tight site configuration, and poor soil conditions it has been determined that multiple levels of parking below grade will be prohibitively expensive. However, this site is critical to parking needs at the southern end of campus. The decision has been made, therefore, to include a single level of parking that is expected to yeild between 50-55 spaces.

The shortfall of approximately 40 parking spaces resulting from the proposed partial replacement strategy will be considered a variance to the University of Toronto Area Parking By-Law and will require City approvals. It is expected that the City's current autominimization policy will support the lowering of By-Law required spaces on campus. Further, to manage demand in the south-eastern quadrant of campus, Transportation Demand Management (TDM) strategies and policies will be considered to help reduce travel demand and redistribute demand in both space and time. In addition to existing programs that encourage faculty, staff and students to use alternate means of transportation through discounted TTC passes, ZipCar and Car2Go cars available on campus and access to a UTM shuttle bus, additional initiatives may be considered such as flex-pass options for occasional drivers and incentives for carpooling.

An interim Project Planning Report was accepted at a January 18th, 2013 Meeting of the CaPS Executive Committee which approved a $2miilion allocation allowing the project to proceed to schematic design. An RFP was issued to procure an architectural team to undertake the preliminary building design and site plans through the schematic stage. In April, 2013 Montgomery Sisam Associates in partnership with Feilden, Clegg & Bradley were appointed by the University of Toronto.

In September, 2103 the CaPS Executive Committee reviewed the progress to date and at the request of the Faculty of Applied Science and Engineering increased the allocation to a maximum of $3million to allow the project to proceed into and to complete the detailed design requirements of the project. This approval by the CaPS Executive Committee was on the level of funding and committed funding already accumulated for the building and the urgent need to maintain the momentum of the project which is at the core of the Faculty's Boundless Campaign initiatives.

Assuming municipal approvals are received in a timely manner allowing construction to begin in the fall of 2014, the project is now estimated to be fully operational by October 2017.

The total project cost estimate for the CEIE project includes two distinct parts including i) the Centre for Engineering Innovation & Entrepreneurship (CEIE) in a 7-8 storey structure plus one level of basement of 7513nasm (15,026gsm); and ii) one level of underground parking to be positioned on the second level below grade in 2900gsm (including ramping).

Operating costs are assumed to be in line with, or less than that of the existing Bahen Centre for Information Technology (BCIT) that under the 2011-12 budget model was $277/nasm. Sidney Smith Hall is also a reasonable comparator for a non-laboratory research building with 2011-12 budget model operating costs of $230/nasm. The planned building for Site 10, at 7513nasm, will incur approximately $1,728,000 to $2,080,000 per year in 2011-12 dollars escalated year over year. Operating costs will be apportioned to occupants including OSM and FASE and paid out of operating budgets.

Operating costs for the parking garage are based on those for the Graduate Residence that is currently operating at $44/gsm/annum. Operating costs include: equipment repair and maintenance, fire equipment repair and maintenance, supplies, general services (cleaning), hydro, steam, fabric maintenance (i.e. any F&S charges). For a garage and ramping of 2900gsm, the operating costs are expected to be $127,600/year escalated year over year.

Funding for the proposed CEIE project is being actively assembled from a variety of sources. Project funding has been identified from the Faculty of Applied Science and Engineering (FASE), the Provost Central funds including contributions to the 500 seat interactive auditorium and donor funds. It is expected that an internal loan assigned to the FASE will be required for a portion of the funding.

Funding for the proposed parking garage has been identified from the Faculty of Applied Science and Engineering and the Provost Central funds.

RECOMMENDATIONS:

That Planning and Budget Committee recommend to Academic Board

1. THAT the Report of the Project Planning Committee for The Centre for Engineering Innovation and Entrepreneurship, dated November 22, 2013, be approved in principle; and.

2. THAT the project scope totalling 7,513 nasm (15,026 gsm) for the CEIE space program, to be located on Site 10 (47- 55 St. George Street – Simcoe Hall Parking Lot) be

approved in principle, to be funded by the Capital Campaign, the Faculty of Applied Science and Engineering, Provost's Central Funds and borrowing; and

3. That the project scope of a single level of underground parking (2,900 gsm) to be located on Site 10 (47- 55 St. George Street – Simcoe Hall Parking Lot) be approved in principle, to be funded by Provost Central Funds and the Faculty of Applied Science and Engineering (FASE).

II Project Background

a) Membership

Ron Venter [Chair], Professor Emeritus, Department of Mechanical & Industrial Engineering, Faculty of Applied Science and Engineering
Jim Dawson, Executive Director of Advancement, Faculty of Applied Science and Engineering
Steve Miszuk, Director, Facilities and Infrastructure Planning, Faculty of Applied Science and Engineering
Stewart Aitchison, Vice-Dean-Research, Faculty of Applied Science and Engineering
Ted Sargent, new Vice-Dean-Research (from July, 2012)
Susan McCahan, Vice-Dean Undergraduate Studies, Faculty of Applied Science and Engineering
Kim Pressnail, Professor (former Chair- First Year Undergraduate Studies), Faculty of Applied Science and Engineering
Mark Kortschot, Chair, Division of Engineering Science, Faculty of Applied Science and Engineering
Greg Jamieson, Associate Professor, Department of Mechanical & Industrial Engineering Faculty of Applied Science and Engineering
Steve Bailey, Director, Office of Space Management
Julian Binks, Director, Planning and Estimating, Real Estate Operations (to July, 2012)
George Phelps, Director, Project Development (from July, 2012)
Ron Swail, Assistant Vice-President, Facilities and Services
Ray Cheung, Director, Facilities and Services (fromJuly, 2012)
Chirag Variawa, MIE Ph.D. Candidate, Graduate Student Representative, Faculty of Applied Science and Engineering
Nikola Radovanovic, Vice-President, Student Life, Engineering Society, Faculty of Applied Science and Engineering
Ishan Gupta, V-P Student Life (from May, 2012-2013)
Gabriel Stavos, V-P Student Life (from May, 2013)
Gail Milgrom, Director, Campus and Facilities Planning
Jennifer Adams Peffer, Senior Planner, Campus and Facilities Planning

b) Terms of Reference

1. Make recommendations for a detailed space program and functional layout for the Centre for Engineering Innovation and Entrepreneurship.

2. Identify the space program as it is related to the existing and approved academic plan for the Faculty of Applied Science and Engineering taking into account the impact of approved and proposed programs that are reflected in increasing faculty, student and staff complement. Plan to permit maximum flexibility of space to permit future allocation as program needs change.

3. Demonstrate that the proposed space program will be consistent with the Council of Ontario Universities and the University of Toronto space standards.

4. Identify all secondary effects, including space reallocations from the existing site i.e. Site 10, impact on the delivery of academic programs during construction, the possible required relocation as required to implement the plan of existing units and the loss of existing parking spaces on Site 10.

5. Address campus-wide planning directives as set out in the campus Master Plan, open space plan, urban design criteria and site conditions that respond to the broader University community.

6. Identify equipment and moveable furnishings necessary to the project and their estimated cost.

7. Identify all data, networking and communication requirements and their related costs.

8. Identify all security, occupational health and safety and accessibility requirements and their related costs.

9. Identify all costs associated with transition during construction and secondary effects resulting from the realization of this project.

10. Determine a total project cost estimate [TPC] for the capital cost including costs of implementation in phases if required, and also identifying all resource costs to the University.

11. Identify all sources of funding for capital and operating costs.

12. Complete report by September 1st, 2012*

**revised completion date January 2013 and November 2013*

c) Background Information

In 2009 the Faculty of Applied Science and Engineering [FASE] completed a divisional space audit which included an extensive review of the quantity and quality of its existing facilities. The study identified significant deficiencies in the quality of existing laboratories and support infrastructure, many of which are outdated and ill-configured to fully maximize their use without extensive renovation. The Bahen Centre of Information Technology [BCIT], opened in 2001/2, was the last significant capital project that provided for the expansion of FASE facilities; the

project was undertaken jointly with the Faculty of Arts and Science and also provided a boost to classroom facilities in support of both Faculties and the University in general.

Since this opening, now 10 plus years past, FASE has increased its undergraduate enrolment by a staggering 30% from 4,041 to 5,241 (headcount); the graduate enrolment has also increased tremendously in the last 5 years from 1,286 to 1,859 (FTE), which corresponds to a 45% increase, with an overall FTE Graduate Student-Faculty ratio in excess of 7.5. Space demands for graduate student growth can usually be accommodated with modest space increases, but when this growth is elevated to a 45% level, as is the case with FASE, the research laboratory space and office accommodations become seriously strained giving rise to an unsustainable situation.

The intent of the proposed building is to foster Engineering Innovation and Entrepreneurship. This is an area where there is considerable interest and support from Alumni, Friends of the Faculty, Industry, Governments, and Government agencies so that the funds required to launch this initiative have an excellent chance of being raised. Efforts to date to raise capital for buildings without a broad based theme such as exists for the CEIE have not met meaningful success. The new space will not only assist in all space deficiencies within FASE, but will also allow for space within the existing FASE buildings to become available and to be renovated to accommodate other pressing needs, such as research space and office space for graduate students in areas adjacent to these activities.

The need to plan for and acquire new permanent space has been in sharp focus for some four years within FASE. A Project Planning Committee was established to explore Site 16 (200 College Street – Wallberg/Engineering Annex) for the Centre for Enabling Technologies in January 2009, followed by an internally struck committee to explore Site17 (5 King's College Road – Haultain/Mechanical). Given the serious difficulties associated with constructing on these sites including access, demolition and staging/relocation of existing facilities, the focus has shifted to Site 10 (47- 55 St. George Street – Simcoe Hall Parking Lot). This site provides the best opportunity to address the pressing space needs of FASE; an additional advantage is that Site 10 is immediately adjacent to other FASE buildings.

The existing Secondary Plan for the University of Toronto Area includes approved development envelopes on sites across the campus. Site 10, has an approved envelope of 10,490 gross square metres with a maximum height of 23 metres. The recently completed 2011 St. George Campus Master Plan, which will become part of the University's submission for an amendment to the Secondary Plan, proposes additional capacity and height.

The Faculty requires additional good quality space, beyond that which exists, if it is to expand its faculty, solidify the recent sudden graduate student expansion, and ensure a further substantial increase in the overall graduate student enrolment numbers. Site 10 offers this unique opportunity and potential. The faculty plan is to target specific new areas of engineering innovation for growth that the entrepreneurial, academic and business communities have identified as critically important areas and in which leading engineering faculties need to invest to maintain their relevance at the forefront of engineering innovation and technology transfer. The new target areas planned for inclusion within the Centre for Engineering Innovation and Entrepreneurship [CEIE] that offer considerable potential for external fundraising within the Boundless Campaign are listed below and are described in more detail later in this report:

A. Educational Facilities: Interactive Auditorium; Design Meet; TEAL Rooms, Fabrication Facility

B. 10 Nerve Centres that link to multidisciplinary research intuitive in all Engineering Buildings:
   Cluster 1: Centre for Global Engineering
   Institute for Leadership Education in Engineering

   Cluster 2: Centre for Sustainable Energy
   Centre for Water Innovation
   Centre for Resilience & Critical Infrastructure
   Privacy & Security in the Mobile Internet

   Cluster 3: Design & Innovation
   Centre for Management and Technology Entrepreneurship

   Cluster 4: Institute for Multi-Disciplinary Design and Innovation
   Institute for Robotics and Mechatronics

C. Entrepreneurial Outreach: The Hatchery, Project Rooms, and

D. People Presence facilities that provide Study Space, Graduate Student Space, Meeting Space, Alumni Forum etc.

In addition to establishing and identifying the space requirements for these emerging initiatives, the Faculty will also relocate and expand selected research undertakings to Site 10 that are high demand areas that complement the emerging initiatives [Nerve Centres] or where the integration of existing research capabilities into new space satisfy this requirement. This approach will assist the fund- raising requirements of the project and simultaneously allow pockets of inferior space in existing FASE buildings to be vacated, updated and reassigned or effectively used as sequential swing space.

The 2009 Divisional Space Review also called for the investigation and resolution of the following issues within the planning for Site 10:

- Creation of new space, through the bringing together of multidisciplinary activities in CEIE that release up to 1,100 nasm in other FASE Buildings where space is needed to expand research initiatives, but first and foremost the space needs to be vacated to be renovated into quality space. This approach allows for the sequential re-assignment and systematic renovation of poor quality space in existing buildings. The same approach has allowed FASE to establish leading edge [and highly flexible] educational space in CEIE which means that existing and limited tutorial space in existing buildings can be redeveloped into quality research and other space as required. It should be noted that the reassignment of this space will take place over an extended period of time as funds, through CFI and other resources become available. An additional 500nasm of existing FASE space will be released from temporary space at 245 College Street.

- Educational facilities in the CEIE are to be controlled by OSM, with the exception of two Design Meet Rooms. The FASE has identified ten existing OSM classrooms which could be appropriate for future reassignment and conversion to other uses such as Faculty

research laboratory space. An agreement is being developed that could replace up to 1500nasm of these existing and often inadequate OSM facilities in FASE buildings with the multi-purpose educational facilities to be constructed in the new CEIE. However, a feasibility study must be undertaken to determine if the activities in these rooms, or others, will be sufficiently accommodated in the new building. The agreement is discussed in more detail in the body of the report..

- Creation of an innovative 500-seat interactive auditorium on the ground floor as a facility in support of the FASE requirements for interactive education plus a facility that can be used by other disciplines. The facility will be managed by OSM and a detailed agreement will be developed that ensures both flexible and effective use. FASE will use the room to accommodate groups of up to 320, but more often classes of 180-200, while the University will benefit from the additional 180 seats to accommodate up to 500 persons.

- Below grade parking to address, or partially address, the loss of 96 parking spaces that currently exist on Site 10 is being considered by the University Administration as are other locations for the parking needed to satisfy the City By-law addressing University parking. Preliminary schematic plans for Site 10 have addressed various parking alternatives. The current recommendation is to consider a single level of underground parking to accommodate 50-55 vehicles.

- Servicing of the building, and surrounding buildings currently serviced from the existing site, will be addressed on site within screened space located at grade. A waste compaction facility has been recommended.

- The potential to accommodate urgently needed undergraduate student club space and work space [as identified in the 2011 Student Club and Study Space Audit Report] in below grade space.

d) Statement of Academic Plan

The Faculty of Applied Science and Engineering consistently ranks among the top engineering schools worldwide. The 2011 Times Higher Education World University Ranking placed the Faculty 13th globally for engineering and information technology. The 2011 QS World University rankings, which measure universities by discipline, ranked the Faculty in the top 20 for electrical engineering, chemical engineering, civil and structural engineering, and computer science and information systems.

With average entry marks of 90.1%, FASE students stand with the best and brightest anywhere. Students come from every part of Canada and from around the world. More than 100 countries are represented in the student body and more than 40% of students claim cultural heritage outside North America. The cosmopolitan make up of the FASE student body brings a tremendous diversity of thought and experience to its classrooms, which in turn, greatly enriches the quality of academic enterprise.

The Faculty's professoriate is arguably the strongest in Canada and on par with the very best in the world. Over the last decade, the Faculty has attracted a new generation of enterprising

engineering minds, adding to what was already an exceptional foundation. FASE is first in Canada and 7th in the world for engineering publications and citations. And, although the faculty members represent just 5% of Canada's engineering faculty overall, they routinely win a third of Canada's share of major international and national awards.

Three critical observations, supported by the undergraduate and graduate enrolment trends and the extensive list of the Faculty's academic/educational achievements highlighted in the next pages, essentially define the significance of the proposed program in support of the academic mission of FASE. The space program articulated for this building, as defined in the following pages, provides for effective multi-functional and flexible educational and research space, advances multidisciplinary research initiatives within ten emerging nerve centres /institutes that reach across all FASE facilities and our industrial collaborators. It also merges these activities to establish The Hatchery where innovative ideas and concepts can be developed with the support of alumni, industry presence and participation, practicing engineers enrolled in professional masters programs, faculty and students. The broad theme of the project is in support of graduate and undergraduate student education, leadership, globalization and innovation also offers the best potential to secure broad base financial support to convert concept into working reality.

Observation 1: *The remarkable base of talent, proven excellence across the broad spectrum of engineering disciplines and location within the world's most multicultural city make our Faculty exceptionally equipped to educate globally minded engineers capable of advancing game-changing research and working with private and social enterprise for transformational impact.*

Observation 2: *A 2009 self-study audit identified two critical issues for the Faculty of Applied Science & Engineering: a significant lack of space and a deficiency of quality space. The situation has become a serious issue over the course of the past 10 years during which the quality of our program and faculty members has attracted record numbers of excellent applicants, nearly doubling enrolment (see Figure 1 and 2 below).*

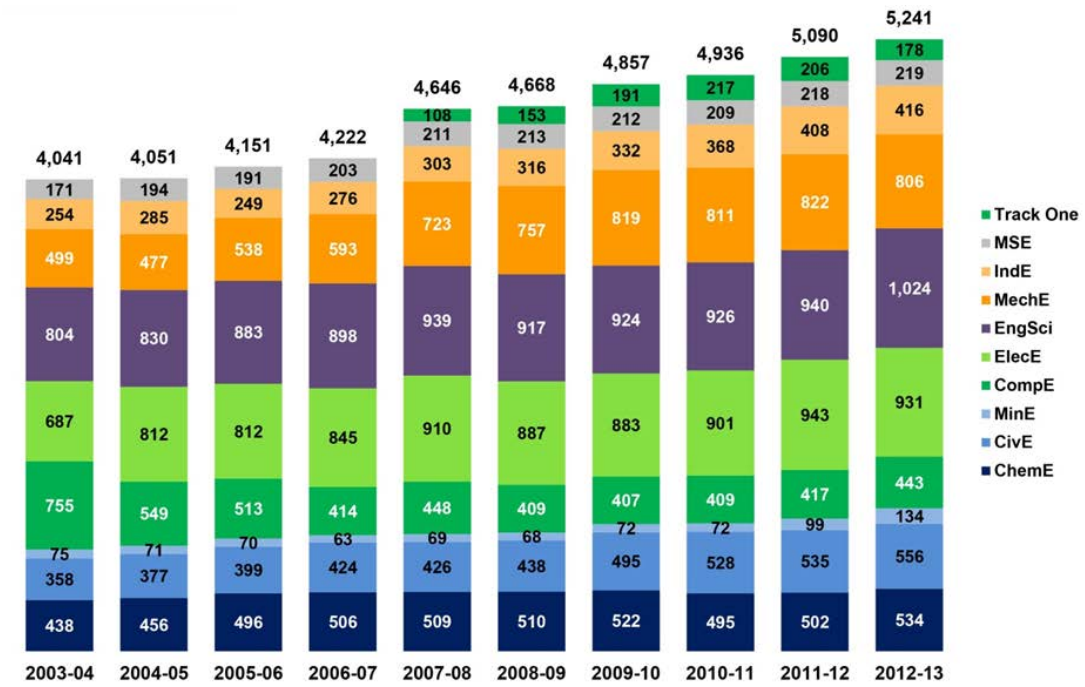


Figure 1: Undergraduate Enrolment 2003-2012 (Headcount)

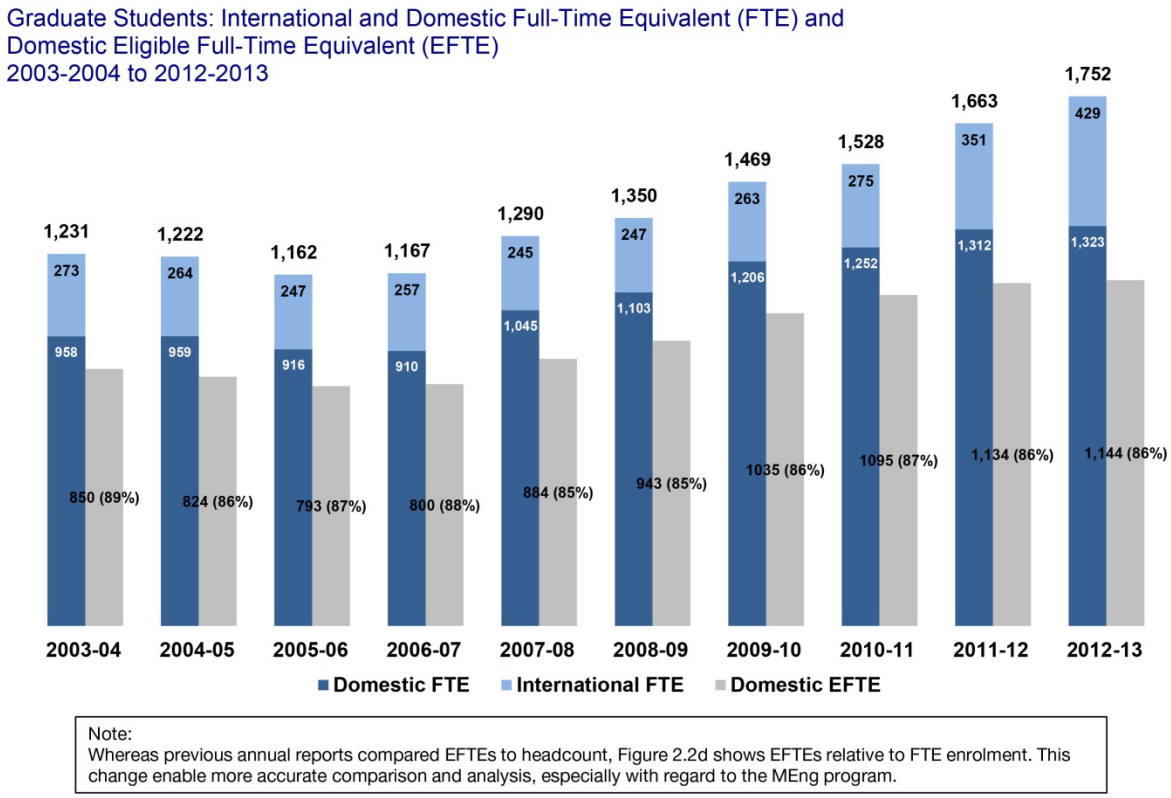


Figure 2: Graduate Enrolment 2003-2012 (FTE): International, Domestic and Eligible EFTE

Observation 3: *This past decade has also seen an evolution in the understanding of how best to teach FASE students. Research has demonstrated consistently that the conventional lecture format encourages limited active engagement and even less critical thinking and communication. The Faculty's students—and contemporary problems—compel us to revisit existing pedagogical approaches in favour of highly interactive, more personalized, and design-focused learning experiences with practical projects to address real challenges in the community.*

Within the FASE 2011-2016 Academic Plan, the chapters covering: "Student Experience and Educating Future Engineers," discuss FASE goals in areas of global engineering, leadership, entrepreneurship, and design. To illustrate:

- "The Dean's Task Force on Globalization and Engineering" in 2008 considered how the Faculty's education and research missions include globalization trends and challenges. To further our goals in preparing graduates for a global workplace and to address and influence global challenges through research, we established the Centre for Global Engineering in 2009. The Centre also serves as the focal point to invigorate our global activities and to engage alumni, faculty and students to continue advancing Canada's innovation agenda nationally and around the world.

- "The Dean's Task Force on Engineering Leadership Education" reviewed the advances made by the Engineering Leaders of Tomorrow program and developed strategic directions to prepare engineers to address increasingly complex global challenges. The Task Force identified the need for engineers who can balance the ambitions of their organizations with the limits of the planet, and who can mobilize others towards a common good. The final report recommended to Faculty Council the establishment of a Centre for Leadership Education in Engineering, approved in the spring of 2010.

- "Across the Faculty, we will enrich students' learning experiences by integrating design, communication, entrepreneurship, leadership, global engineering and professional engineering competencies into Engineering's forward-looking curricula."

- "Our goal is to develop our students into lifelong learners and future global engineering leaders in the fields of their choosing."

- Goal – "Further integrate professional competencies, such as global engineering, entrepreneurship, leadership and communication into undergraduate and graduate curricula.

- Goal – "The Office of the Vice-Dean, Graduate Studies, will coordinate efforts to increase the number of graduate courses and aim to offer a minimum of one graduate half-course per tenure stream faculty member per year. This includes expansion of courses for graduate Engineering Certificates such as the Entrepreneurship, Leadership, Innovation, and Technology in Engineering (ELITE), Engineering and Public Policy (EPP), and Engineering and Globalization certificates, and our Prospective Professors in Training program.

- Goal – "The Office of the Vice-Dean, Graduate Studies and the Associate Chairs and Directors of Graduate Studies will continue to support Faculty-wide groups who conduct a wide variety of activities involving leadership education for graduate students. Individual departments and institutes will provide strong support for their graduate student societies. The Office of the Vice-Dean, Graduate Studies, working with departments, institutes and graduate student societies, will increase the number of graduate student social events that transcend discipline boundaries.

- "Our Faculty continues to focus on the significant need to improve our physical infrastructure. To this end, we will enhance research facilities; create teaching, design, student club and flexible lab spaces; and develop reliable and effective computing and study spaces for undergraduate and graduate students.

- Goal – "Enhance our instructional space to facilitate innovative teaching methods and create efficiencies on how we share space. This includes flexible interactive teaching space for substantial numbers of students, design and group project space and lecture/lab combination space.

- Goal – "Enhance our undergraduate and graduate students' non-traditional educational opportunities, including international academic exchanges and internships, courses

offered abroad, field courses, and credit for work in extra-curricular activities such as design teams.

- Goal – “Enhance teaching and design facilities, upgrade undergraduate laboratory space, and make flexible space available for extra-curricular activities

- Goal – “Through the Office of the Vice-Dean, Undergraduate, the Faculty will establish an Engineering Design Education Group to promote and advance engineering design education within the Faculty. The group will, among other things, provide input into the labs/classrooms for design across the Faculty and the Graduate Attribute on Design.

- “U of T Engineering faculty members are global research leaders whose pursuits advance the forefront in their fields. A significant number of our endeavours touch upon at least one of our four broad, cross-Faculty Research Foci that we have established in the Academic Plan: Bioengineering, Sustainability, Information and Communication Technology, and Enabling Technologies. In addition, departments and institutes are also setting research priorities that contribute towards and support Engineering’s research excellence. We will leverage our strengths to develop multi-disciplinary research programs, enable our researchers to make significant impacts, advance engineering knowledge and innovation, and promote the Faculty’s profile.

- Under Bioengineering – “Bioprocess and Bioproduct Engineering: This includes use of engineered microbiological (bacterial and algal) systems for treating waste air and water streams, for regeneration of polluted land and groundwater, and for generating bio-fuels, bio-electricity and new high-value bio-products. In addition researchers are exploring the use of Canadian forestry products in non-traditional applications, including industrial foams, flame-retardant materials, and paper surface science.

- Under Sustainability – “Urban and Industrial Environments: Our interdisciplinary approach to research provides an excellent position to address the increasingly complex issues associated with the urban and global environments: new transportation systems, energy efficient and healthy buildings, sustainable materials processing, industrial processes and manufacturing activities, drinking water, impact of air quality on human health and sustainable urban environments.”

- Goal – “Establishing appropriate EDUs that further our multidisciplinary, research and engineering education outreach, collaboration and influence initiatives;”

- ESP (Engineering Strategies & Practice) was launched in 2007. It is a foundational course offered in first year that uses the engineering design process as a context for developing skills in Professional Communication, Problem Solving, Independent Thinking, Systems Thinking, and Team Dynamics. Praxis, for Engineering Science students, was launched in 2008 and teaches similar concepts with increased emphasis on theory. Points listed above from the Academic Plan also apply here.

Below are brief descriptions of many of the innovative areas planned for learning, group work and research to be within the CEIE that will help set a new standard for engineering education

in Canada and position the Faculty of Applied Science and Engineering among the topmost elite in North America.

Interactive Auditorium
One of the greatest concerns for top lecturers teaching large classes is the one-way flow of information that inculcates passivity in students and has been proven to result in poor retention of information. A planned 500-seat interactive auditorium will be a marquee facility, with a design focused from the ground up on audience engagement. Features that will promote engaged learning include wireless communications systems that allow students to engage in a dialogue with the professor and with one another; a large stadium-style projection wall that will allow a clear view of even the smallest objects or experiments; theatre-quality lighting; curved tables with seating for either four or six persons rather than individual seats that allow for group work; and many other innovations that encourage engaged learning and nimble transitions between lecturing and discussion.

Learning Areas
These proposed areas go well beyond the traditional lecture hall or classroom to allow for dynamic group work in addition to formal teacher-student presentation. Learning areas will feature movable chairs and group tables serviced by multiple screens that allow for a variety of configurations and easy movement. These spaces, as well as the working areas and light fabrication facility, will be critical to supporting the mandatory design work in the first-year Engineering Strategies and Practice course, the Engineering Science PRAXIS courses, and fourth-year design-focused Capstone courses offered by Departments and Divisions across the Faculty. In addition, many of these spaces will be open 24 hours a day to ensure that a group's momentum is never lost to logistical considerations.

Working Areas and Light Fabrication Facility
These are the spaces where ideas take physical shape. Plans currently call for 36 working tables for project planning and discussion separated into six areas of 6. These tables for planning and execution of group projects surround a light fabrication facility that allows students to move easily from light machinery back to their work tables. Examples of such work by first-year engineering students include everything from transit maps for the blind to more space-efficient bike racks for busy streets to inventory systems for Second Harvest, a charity that distributes excess food.

The Engineering Hatchery
This is an incubator space specifically for undergraduates and possibly graduates (as required) working on co-curricular design projects with commercialization potential. The entrepreneurial Hatchery is planned to feature 12 flexible, partitioned pods where students can work in private groups to push forward their ideas. These pods surround shared meeting tables available to any of the student groups working in the Hatchery. This dedicated entrepreneurial space also supplies an excellent venue for mentorship opportunities with business owners, venture capitalists and other relevant professionals who can help students navigate the process of taking their great ideas from concept and out into the marketplace.

Project Design Innovation and Industry Presence Units
Partnerships and exposure to private industry is extremely important to help ensure that novel ideas become products and processes that benefit people. Within the CEIE various project, design innovation and industry rooms will be available as flexible work space to accommodate

unique project opportunities and or personnel. The Units will each be either 24 or 36nasm in size.

Interdisciplinary Research Clusters
The Centre for Engineering Innovation and Entrepreneurship will house ten of the Faculty's most innovative research centres and institutes. These multidisciplinary research clusters will help promote a research culture of discovery and entrepreneurship throughout the building and provide exceptional opportunities for student placements and teaching.

e) Space Requirements

Existing space

The Faculty of Applied Science and Engineering currently occupies approximately 66,000 nasm of space in 16 buildings:

Building	Nasm	% of Total	Year Constructed/ Renovated
Galbraith Building	10,740	16.3	1960
Wallberg Building	9,910	15.0	1949,1974
Bahen Centre	8,884	13.8	2002
Sanford Fleming Building[1]	8,227	12.5	1907
Mechanical Engineering Building	5,466	8.3	1909,1948
Mining Building	5,300	8.0	1904,1991,2011
Aerospace Building[2]	5,383	8.2	1961,2012
Rosebrugh Building	2,925	4.4	1921
Pratt Building	2,833	4.3	1965,1990
Haultain Building	1,667	2.5	1904,1996
CCBR	1,563	2.4	2004
Engineering Annex	1,271	1.9	1920
245 College Street	513	.8	
254-56 McCaul Street	509	.8	1912
Fields Institute	340	.5	1995
Electrometallurgy Lab	149	.2	1947
Total Nasm	**65,680**		

1 *includes UTL-Engineering Library (1,561 nasm)*
2 *off-campus*

Occupant Profile for existing and approved growth (FTE)

The total number of FTE faculty, staff and students for 2011/12 and projected for 2016/17 were used as input measures in the Council of Ontario Universities Building Block space formula to generate a theoretical requirement for facilities at the divisional level as described in the next section, Space Analysis. COU input measures, defined within the Building Blocks, are used by all Ontario postsecondary institutions for this purpose. They may differ somewhat from other commonly used definitions used by the Faculty.

	2006/07	2011/12	Projected Growth 2016/17	Total 2016/17	5- & 10-yr Changes 06-11	11-16	06-16
FTE Faculty	216	230	15	**245**	7%	7%	13%
FTE Post Doctoral Fellows[1]	96	170	10	**180**	77%	6%	88%
FTE Research Associates	59	93	5	**98**	56%	5%	64%
FTE Staff	233	288	40	**328**	24%	14%	41%
FTE Undergraduate Students	4,378	4,755	-35	**4,720**	8%	0%	8%
FTE Graduate (PhD)	562	733	245	**978**	30%	33%	74%
FTE Grad. (Master-Doctoral)	459	580	99	**679**	26%	17%	48%
FTE Grad. (Master-Professional)	146	356	59[2]	**415**	144%	17%	184%
FTE Graduate Total	1,167	1,669	403	**2,072**	43%	24%	77%
FTE Students Total	5,545	6,424	368	**6,793**	16%	6%	23%
Weekly Student Contact Hours							
Group W - Aero, IBBME, Mech, Civil, Mat Sc, Chem		8,938	8,938				
Group X - APSE, ECE, Eng Sci		6,204	6,204				

[1] PdF count as of July 2012
[2] Estimated with carry-forward of existing Master student ratio
*Input measure for class labs calculated as the product of enrolment and scheduled, supervised hours; grouped by type of instruction). WSCH for 2016/17 (projected) carried forward from 2011 (actual) for the analysis.

Since 2006/07 faculty FTE has grown by 7% with a further 7% projected to the year 16/17. Undergraduate FTE are expected to remain steady at an 8% increase over 2006/07 but the growth in FTE graduate students, which has already increased by 43% is expected to have a further increase of 24% by 2016/17. As the number of undergraduate students is not expected to change, the number of weekly undergraduate student laboratory contact hours has been kept constant in the space analysis.

Space Analysis

In 2008-09, FASE carried out a Divisional Space Review and identified deficiencies in space, both with respect to quality and quantity. At the time, using 2008 data, the Division occupied 62,500 nasm and demonstrated a 5,000 nasm shortfall using COU as a benchmark, and an 11,500 nasm shortfall using FASE's criteria based on the needs of a leading edge research intensive University and calibrated to space requirements expected by the Faculty and 2008/09 enrolments and including additional space required to accommodate further growth and new

strategic initiatives. Since that time, more than 3,000 nasm has been added to the Faculty's inventory through renovation and addition projects such as the Centre for Microsatellite Science and Technology at Aerospace, the Wallberg Biozone Research Facility, and the Civil Engineering Interdisciplinary Design Studios in the attic of the Lassonde Mining Building.

An additional outcome of the study was an assessment of the quality of the Faculty's space. Only 27% of all space occupied was assessed as satisfactory for its current purpose, with 4% being of poor quality and the significant balance [69%] needing attention. Space quality metrics included a wide range from inappropriate use of space to deficiencies related to accessibility, asbestos abatement and HVAC systems for example. A number of improvements have been made to existing space (and are ongoing) since the report was issued in addition to the projects listed above.

The existing FASE space, and the Faculty's space inventory post construction of the CEIE are identified in the table on the following page and are compared to the space generated using the Council of Ontario Universities (COU) standards determined using both the division's existing complement of faculty, staff and students and the projected complements for 2016/17 (as shown under Occupant Profile).

The space types fall in two groupings – that generated for teaching, research and office space that would be wholly under the jurisdiction of the faculty, and that generated for facilities that are considered "campus" wide resources (i.e. classrooms, library space, food services, etc.) some of which fall under the jurisdiction of the Faculty but also include spaces used by members of the University community at large or, alternately, are in locations other than the FASE buildings but are available to FASE students, faculty, etc.

What is interesting is that the shortfall for 2011/12 and for 2016/17 (assuming the construction of the CEIE), remains around 5,000 nasm similar to the shortfall identified in the 2008-09 study. Although the space occupied by the Faculty continues to grow so too does its population and activities.

	Generated Space 2011/12 Nasm	Existing Inventory FASE & OSM Nasm	%I/G	Generated Space 2016/17 Nasm	Proposed CEIE Nasm	Total Nasm Existing FASE & OSM + Proposed CEIE	%I/G
TEACHING/RESEARCH/ACADEMIC SUPPORT							
CLASS LABS	10,873	10,531	97%	10,873	1,429	11,960	110%
RESEARCH LABS	28,751	25,383	88%	34,276	1,390	26,773	78%
OFFICE - ACADEMIC & NON-ACADEMIC							
Faculty, PDF, Res Assoc Offices	6,853	7,360	107%	7,271	408	7,768	107%
Grad Student Offices	6,676	7,919	119%	8,288	409	8,328	100%
Non-Academic Staff Offices	3,750	3,756	100%	4,270	574	4,330	101%
Office Service	4,314	4,811	112%	4,957	288	5,099	103%
Total Office	21,592	23,846	110%	24,785	1,679	25,525	103%
TOTAL ACADEMIC FACILITIES	**61,216**	**59,760**	**98%**	**69,934**	**4,498**	**64,258**	**92%**
CAMPUS FACILITIES							
CLASSROOMS							
FASE Classrooms	7,902	917		8,355	856	1,773	
OSM Classrooms/FASE Bldgs.*		7,815			978	8,793	
Total Classrooms	7,902	8,732		8,355	1,834	10,566	
LIBRARY FACILITIES & CAMPUS STUDY SPACE	6,662	2,404		6,938	137	2,541	
STUDENT CLUB AND LOUNGE SPACE	2,409	1,994		2,547	799	2,793	
OTHER							
Food Services					100	100	
Bike Storage					25	25	
Inactive Assignable		604					
Non-University - Industry					120	120	
TOTAL CAMPUS FACILITIES		**13,734**			**3,015**	**16,145**	
Total CEIE (Program Area)					**7,513**		
Total FASE Space		**65,680**			**6,535**	**72,215**	
Total OSM Space		**7,815**			**978**	**8,793**	

* Depending on building, classrooms are used by other Faculties 25% to 52% of the time.

Academic Facilities
While, overall, FASE appears to have 98% of the academic facilities it required in 2011/12, even with the construction of the CEIE this percentage will slip, in the academic space grouping, to 92% by 2016/17. Although this may seem like an adequate amount of space, what this does not capture is the real need for improvements to the quality of the Faculty's space nor the vital need for new instructional and research facilities to meet two revolutionary trends in the field of engineering:

- The first is a wholesale shift in understanding of the best ways to learn and to teach. State-of-the-art educators now emphasize instruction combined with hands-on, collaborative work as the key to enhanced understanding, as opposed to passive note-taking which can result in poor information retention.

- The second trend is the expansion of engineering into many different disciplines such as health care, business systems, and information technology. This expansion requires engineers to be highly adept not only at working with other kinds of engineers but also with people from entirely different backgrounds. It is in these areas of overlap where innovation is most frequently found, with specialists bringing diverse skills to the table to work on common projects.

Many of the proposed spaces have been planned in response to these new and future collaborative and interdisciplinary methods of teaching and research. Built-in flexibility will allow for a range of programming on a day-to-day basis and adaptation as pedagogy and industry evolve.

The 2008-9 review emphasized the need for research space. Outside the scope of this project, a need for wet lab space continues (one department is only at 38% of COU). The potential for additional space to become vacated (possibly repurposed OSM classroom space) in existing Engineering Buildings may continue to address this deficit.

Campus Facilities
The demand generated by the FASE students for campus facilities, such as classrooms, library and study space, student lounges and clubs is, of course, partially met within the FASE buildings themselves, but also within other campus spaces and so must be looked at in full context. For example, the 2011 Report of the Working Group on FASE Student Club and Study Space recognized that with over 32,000 nasm of student study space on the St. George campus, the broader issue was not the quantity of space so much as its availability to FASE students, both in terms of proximity to their classes and laboratories and with operating hours appropriate to their coursework.

Classrooms
The previous table identified dedicated FASE classroom space (917 nasm) and classrooms in FASE buildings centrally booked through the OSM (7,815 nasm). The OSM rooms in the 7 Engineering buildings and in the Bahen, which is shared with Arts & Sciences, are listed below. 95% of all FASE classroom hours are accommodated within these buildings.

OSM Classroom bookings in FASE buildings

Building	FASE (hours)	Total (hours)	FASE % of Total	% Used by Other
Rosebrugh Building	2,656	3,482	76%	24%
Mechanical Engineering Building	2,555	3,455	74%	26%
Wallberg Building	5,170	7,180	72%	28%
Galbraith Building	10,975	15,883	69%	31%
Mining Building	720	1,187	61%	39%
Sanford Fleming Building	4,469	7,710	58%	42%
Haultain Building	1,985	3,495	57%	43%
Bahen Centre	23,199	48,526	48%	52%
Total	**51,727**	**90,916**	**57%**	**43%**

It should be noted that within these buildings there is significant use of classrooms by other Faculties (from 24% in the Rosebrugh Building to 52% in the Bahen Centre).

The CEIE Building will add 856 nasm of FASE classroom space and 978 nasm of OSM classroom space. As discussed elsewhere in this report FASE has identified some existing OSM classrooms which may be appropriate for future reassignment and conversion to other uses such as Faculty research laboratory space. However, a feasibility study must be undertaken to determine if the activities in these rooms, or others, will be sufficiently accommodated in the new building.

Student Club and Lounge Space

The 2011 Working Group Report noted that while the need to improve the student experience through improving the Faculty's physical resources was a continuing priority, there was a particularly imperative issue to be addressed in that 25% of the available club facilities were located at 245 College Street which unfortunately is a temporary allocation as the University is considering redevelopment of the site. As well, with the increasing enrolments and competition from peer institutions for recruiting top students, the need for quality club and study space continues to grow. This need to provide a longer-term solution for student club and lounge space has been extensively addressed in the Site 10 space program. The biggest challenge in addressing the array of student club space needs is the accommodation of workshop-based activities, as such, unique facilities in support of student club activities are to be established in the basement; flexibility has been again introduced into the design of these facilities so that they are used during the day for academic programs and revert to club usage in the evenings and weekends. In addition, benches in corridors and flexible teaching spaces add to the inventory of study space.

The CEIE building project will add approximately 799 nasm of student club and lounge space that will serve to promote the learning experience within the planned innovative CEIE environment.

Library and Study Space

While the Engineering Library may be appropriately housed there remains the need for FASE students to continue to access additional study space across campus. However, the new facility

does begin to satisfy the desire for convenient accessible study space within FASE buildings, and there is potential in future to renovate some space vacated as a result of the project.

The CEIE building will add 137 nasm of student study space to the Faculty's space inventory.

III. Project Description

a) Vision Statement

The Faculty of Applied Science & Engineering at the University of Toronto is launching a landmark initiative that will raise the bar for engineering education to a new level both in Canada and abroad.

A state-of-the-art Centre for Engineering Innovation and Entrepreneurship will build upon the latest research and best practices to create one of the finest teaching and research environments available at any engineering school anywhere in the world.
In the Centre, traditional barriers that impede excellence will be removed, replaced by versatile environments that enable and accelerate all facets of engineering innovation—from theoretical learning, conceptual thinking and group planning to project management, prototyping and light fabrication to advanced research led by some of the finest engineering minds—all enveloped in a vibrant culture of entrepreneurship.

The significance of this Centre is profound on both a national and international scale. Study after study has cited an innovation gap in Canada that is tied to poor productivity and reduced quality of life. With engineering graduates accounting for a significant percentage of new patents issued in the country, it is difficult to conceive of a more strategic initiative to reverse this trend than one that will elevate the capabilities of engineers emerging from Canada's top engineering school. The impact will be felt globally, as well, with our strategic focus on global engineering and support for students and faculty who are confronting many of the fundamental challenges plaguing the world's populations.

The role of engineers is expanding rapidly in ways that could scarcely have been imagined just a generation or two ago. Not only does engineering now permeate almost every conceivable field of endeavor, but increasingly, the powerful combination of inquisitiveness, analytical thinking, entrepreneurship and technical know-how that defines an engineer also makes him an exceptional leader. More than 25% of Canadian CEOs are engineers.

The borders of engineering have also expanded to encompass global challenges such as those stemming from rapid urban development, man-made crises, natural disasters and economic disparity. Much of the credit for this push into global engineering goes to students themselves who are informed and engaged in international issues and wish to apply their engineering expertise to broader challenges.

Amidst these forces of change, engineers now inhabit a demanding but very exciting world with few perceivable barriers. Clearly, we must adapt in the way we educate our engineers, maintaining a focus on technical expertise while responding to the growing need for well-rounded, global leaders. Fundamentals now include ethics, communication skills, business

acumen and a multidisciplinary versatility. In the new world of engineering, our graduates will need to be able to work effectively with anyone from government officials, business system specialists and healthcare experts to epidemiologists, childcare advocates or villagers in a developing country.

Building from Strength

The University of Toronto is uniquely positioned to produce this new caliber of engineer. Recently recognized by the Shanghai Jao Tong Academic Ranking of World Universities as the top engineering program in Canada and 13th in the world, we are well positioned to raise engineering education and research at U of T to a level among the absolute best in the world. Such a reputational leap also creates a virtuous circle whereby the school is continuously strengthened as it attracts ever-greater numbers of top academics and research funding. The presence of such an elite engineering institution in the heart of our largest city will be even more of a key driver of Canadian enterprise in the years to come.

The catalyst that will allow this transformation to take place is the Centre for Engineering Innovation and Entrepreneurship. With average entry marks of more than 91%; a ranking of 7th in the world for engineering publications and citations; and students who flock to U of T from over 100 countries around the world, the Faculty has been tremendously successful within current constraints. To move forward, however, we need a transformational space that will elevate our entire learning, teaching and research landscape.

The CEIE will change the Faculty of Applied Science and Engineering in two broad ways. First, it will be a major factor in eliminating unnecessary schisms between disciplines by bringing students and faculty from across the engineering landscape together into shared environments. Secondly, it will support the fluid—even messy—nature of creativity and discovery by providing spaces where collaboration and group work is the dominant work style.

As in most universities, the Faculty at U of T tends to reflect norms from previous generations that sought physical separation based on discipline. In the new Centre, students and researchers will work alongside colleagues from different engineering streams in lecture halls, practical work areas and in common areas and witness first-hand the common principles that underlie all branches of engineering. Increasingly, this exposure is expanding to areas outside of engineering such as the sciences, architecture, and forestry.

In terms of interactivity and collaboration, the key is providing the proper environment that facilitates—rather than inhibits—creative group efforts in both theoretical and practical work spaces. Lecture rooms, and the auditorium in particular, will heighten active, engaged learning with features such as wireless communications that allow three-way dialogue from speaker to audience, from the audience back to the speaker, and between audience members. Similarly, practical areas will consist of “design-meeting” spaces that can be reconfigured easily with fluid access between conceptual and “light fabrication” work areas.

Collaboration extends to the crucial stage of engineering innovation which involves creating businesses and launching products. Dedicated space will be made available for the incubation of start-up companies with oversight from faculty members and mentorship from alumni and representatives from private industry around issues such as how to access seed funding and venture capital.

b) Space Program and Functional Plan

The Four Macro-Elements of Space Program

The planned space program and activities for the CEIE are most conveniently grouped into four macro integrated elements as illustrated below, and which will be described in more detail later in this section. The Macro-Elements include the following:

Element A: Educational Facilities
Element B: Multidisciplinary
Element C: The Entrepreneur, Outreach, Spinoffs
Element D: People Presence

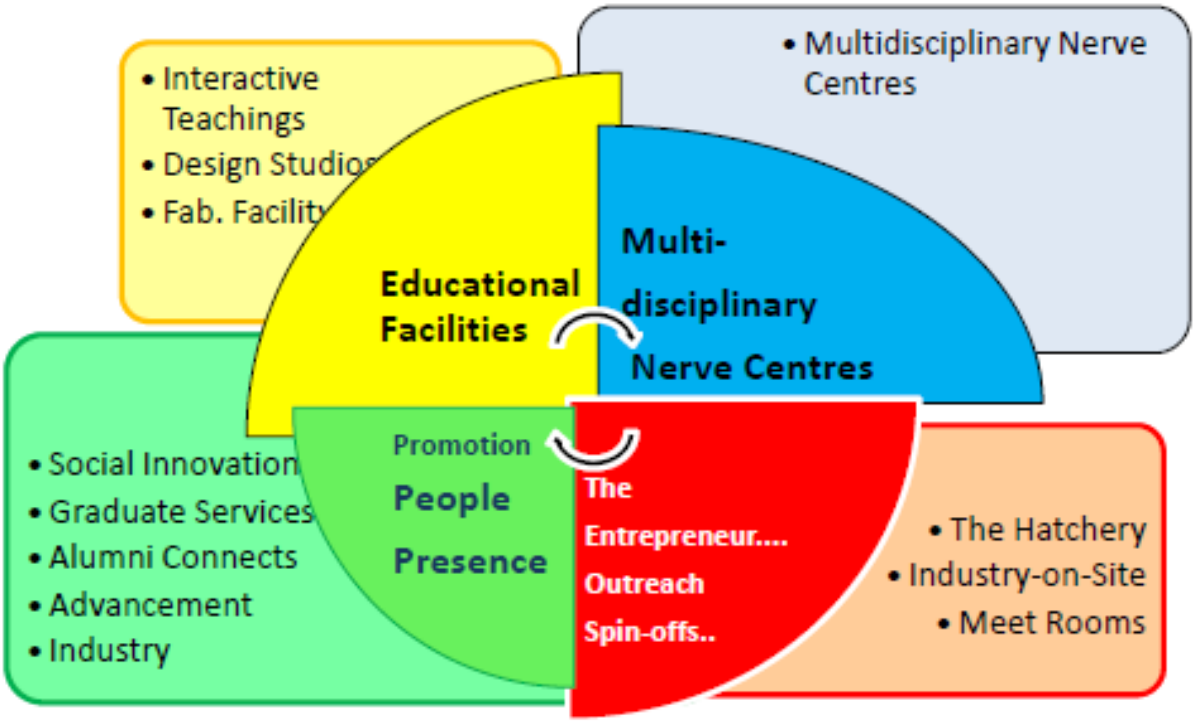


ILLUSTRATION 2. The Four Macro-Elements of what is to comprise the CEIE

In terms of interactivity and collaboration, the key is providing the proper environment that facilitates and inspires—rather than inhibits—creative group efforts in both theoretical and practical work spaces.

In addition, there are space program elements that do not fall within the four Macro-Elements pictured above; these are described separately in a later section.

Space Program Summary

The Summary below identifies 6,830 nasm proposed above grade, with an additional 683 nasm below grade, for a total of 7,513 nasm (approximately 15,000 gsm). In addition to this space program a further 2,900 gsm will be constructed to accommodate a single level of underground parking for vehicles.

A. Instructional Facilities		**3,392**	
B. Nerve Centres		**1,774**	
CLUSTER 1		402	
	Centre: Global Engineering	180	
	Leadership Education in Engineering	222	
CLUSTER 2		534	
	Centre: Sustainable Energy	126	
	Centre: Water Innovation	120	
	Centre: Resilience + Crit. Infrast.	150	
	Privacy + Security Mobile Internet	138	
CLUSTER 3		240	
	Centre: Management + Tech Ent	168	
	Design + Innovation	72	
CLUSTER 4		598	
	Multi-Disciplinary Design and Innovation	150	
	Institute of Robotics + Mechatronics	448	
C. The Entrepeneur		**924**	
D. People Presence		**1,338**	
	Advancement + Alumni	214	
	Alumni Attractor	92	
	Prof. Masters' Business Services	85	
	Food Services	115	
	Study Space	36	
	Student Innovation Clubs (The ARENA)	796	**598 below grade**
Other Assignable Space	Basement Storage	**85**	**below grade**
Total		**7,513**	**nasm**

For planning purposed the gross up factor for this building is estimated to be approximately 2.0 gross square meters for every 1.0 nasm. The estimated gross of the building is 15,026 square meters plus an additional 2,900 gsm for a single level of underground with ramped access from Galbarith Road.

Room Data Sheets, providing detailed requirements (see reference SP-# below), have been prepared for each room identified in the space program and are available upon request.

Element A: Educational Facilities

The focus is the creation of a unique interactive classroom and multi-functional design studios to function as meeting rooms and or classrooms and positioned in close proximity to a light fabrication facility. All facilities will be used in support of graduate and undergraduate activities in design, teaching and industrial interactions and suitably integrated into the mandates of ELEMENTS B, C and D. Clusters of design studios and fabrication space will be located within the building and will serve to promote student teamwork.

	Total Rooms Proposed	NASM Per unit Proposed	Total NASM Proposed	Data sheet I.D.
A. Educational Facilities				
Tiered Auditorium (500-Seat)*	1	1,000	1,000*	SP-7—SP7.1
Computer Classroom (60-Seat)	1	216	216	SP-10
Computer Visualization Room	1	50	50	SP-10.1
Design Meet Room	8	108	864	SP-9—SP9.2
TEAL Room	8	108	864	SP-11—SP 11.2
Fabrication Facility	1	398	398	SP-8—SP8.4
Subtotal - Instructional Facilities:	**20**		**3,392**	

*Includes an allowance for classroom support (AV and storage)

Element B: Multidisciplinary, Nerve Centres

Ten administrative nerve centres are identified within four cluster[1], s, representing established and emerging multidisciplinary activities within the Faculty. Multidisciplinary nerve centres are comprised predominantly of office and support space and should be located in close proximity to each other to enable shared services such as reception, kitchenette, and storage. The allocation of space provided in the tables below for each specific functional activity within a cluster is identified with a nasm count estimate; selected offices will be modified into 'open-concept' space as the floor plate for each entity is designed. All Units will require access to selected Educational Facilities listed in ELEMENT A.

In addition to establishing and identifying the space requirements for these emerging initiatives, Faculty will also relocate and expand selected research undertakings to Site 10 that are high demand areas that complement the emerging initiatives.

[1] The number of clusters could expand to five and will be a function of the building layout/ floor plan.

	Total Rooms Proposed	NASM Per unit Proposed	Total NASM Proposed	Data sheet I.D.
B. Nerve Centres				
CLUSTER 1				
Centre: Global Engineering				CGEN
Offices:				
Director Office	1	18	18	SP-2
Faculty Office (Visitor)	5	12	60	SP-1
Admin. Office	3	12	36	SP-1
Graduate Student Office (12)	4	12	48	SP-1
Office Support:				
Reception/Kitchenette	.5	24	12	SP-4 shared
Storage	.5	12	6	SP-5 shared
Subtotal – Global Engineering:	**14**		**180**	
Institute: Leadership Education in Engineering				ILEAD
Offices:				
Director and/or Assoc. Office	4	18	72	SP-2
Admin. Office	7	12	84	SP-1
Graduate Student Office (9)	3	12	36	SP-1
Office Support:				
Meeting Room (6-seat)	1	12	12	SP-3
Reception/Kitchenette	.5	24	12	SP-4 shared
Storage	.5	12	6	SP-5 shared
Subtotal – Leadership Educ.:	**16**		**222**	
CLUSTER 1 Total	**30**		**402**	

	Total Rooms Proposed	NASM Per unit Proposed	Total NASM Proposed	Data sheet I.D.
CLUSTER 2				
Centre: Sustainable Energy				SCE
Offices:				
Director and/or Assoc. Office	2	18	36	SP-2
Admin. Office	1	12	12	SP-1
Graduate Student Office (6)	2	12	24	SP-1
Office Support:				
Reception/Kitchenette	.25	48	12	SP-4.1 shared
Storage	1	12	12	SP-5
Media + Display Room	1	30	30	SP-22
Subtotal – Sustainable Energy:	**7.25**		**126**	
Centre: Water Innovation				WI
Offices:				
Director Office	1	18	18	SP-2
Admin. Office	1	12	12	SP-1
Graduate Student Office (9)	3	12	36	SP-1
Office Support:				
Reception/Kitchenette	.25	48	12	SP-4.1 shared
Storage	1	12	12	SP-5
Media + Display Room	1	30	30	SP-22
Subtotal – Water Innovation:	**7.25**		**120**	
Centre: Resilience + Crit. Infrast.				CRCI
Offices:				
Director Office	1	18	18	SP-2
Faculty Office (Visitor)	1	12	12	SP-1
Admin. Office	5	12	60	SP-1
Graduate Student Office (9)	3	12	36	SP-1
Office Support:				
Meeting Room (6-seat)	1	12	12	SP-3
Reception/Kitchenette	.25	48	12	SP-4.1 shared
Subtotal – Resilience + Crit. Infr:	**11.25**		**150**	
Privacy + Security Mobile Internet Technologies				PSMI
Offices:				
Director Office	1	18	18	SP-2
Admin. Office	5	12	60	SP-1
Graduate Student Office (12)	4	12	48	SP-1
Office Support:				
Reception/Kitchenette	.25	48	12	SP-4.1 shared
Subtotal – Privacy + Security:	**10.25**		**138**	
CLUSTER 2 Total	**36**		**534**	

	Total Rooms Proposed	NASM Per unit Proposed	Total NASM Proposed	Data sheet I.D.
CLUSTER 3				
Centre: Management + Tech Ent				CMTE
Offices:				
Director Office	1	18	18	SP-2
Admin. Office	3	12	36	SP-1
Graduate Student Office (24)	8	12	96	SP-1
Office Support:				
Reception/Kitchenette	.5	24	12	SP-4 shared
Storage	.5	12	6	SP-5 shared
Subtotal – Management + Tech:	**13**		**168**	
Design + Innovation				D&I
Offices:				
Director Office	1	18	18	SP-2
Admin. Office	2	12	24	SP-1
Office Support:				
Meeting Room (6-seat)	1	12	12	SP-3
Reception/Kitchenette	.5	24	12	SP-4 shared
Storage	.5	12	6	SP-5 shared
Subtotal – Design + Innovation:	**5**		**72**	
See C. for Hatchery and Meeting				
CLUSTER 3 Total	**18**		**240**	

CLUSTER 4				
Institute for Multi-Disciplinary Design and Innovation				IMDI
Offices:				
Director Office	1	18	18	SP-2
Admin. Office	5	12	60	SP-1 Incl. 2 Eng.in Res.
Office Support:				
Reception/Kitchenette	.5	24	12	SP-4 shared
Storage	1	6	6	SP-5.3
Teaching:				
PACE (Computer Teaching Lab)	1	54	54	SP-23
Subtotal – Mult-Disc. Design + In:	**7.5**		**150**	
Institute of Robotics + Mechatronics				IRM
Offices:				
Director Office	1	18	18	SP-2
Research Office	2	12	24	SP-1
Admin. Office	2	12	24	SP-1
Office Support:				
Reception/Kitchenette	.5	24	12	SP-4 shared
Storage	1	40	40	SP-5.1
Teaching:				
Interdisciplinary Lab	1	80	80	SP-25
Research:				
Interdisciplinary Lab	1	250	250	SP-24
Subtotal – Robotics + Mech:	**8.5**		**448**	
CLUSTER 4 Total	**16**		**598**	

Element C: The Entrepreneur, Outreach, Spinoffs

The CEIE is a much-needed response to the sweeping changes taking place in engineering. Dynamic, flexible environments will break down artificial barriers between people, foster collaboration, encourage active learning and accelerate innovation. The building will encourage the final stage of the engineering continuum whereby new ideas and new products find their way into the public realm through entrepreneurial activity. Dedicated space will made available for the incubation of start-up companies with oversight from faculty members and mentorship from alumni and representatives from private industry. In the new Centre, students and researchers will work alongside colleagues from different engineering streams in lecture halls, practical work areas and in common areas.

This space specifically configured to assist and promote the incubation and development of ideas. It offers the potential for effective participation with industry.

	Total Rooms Proposed	**NASM Per unit Proposed**	**Total NASM Proposed**	**Data sheet I.D.**
C. The Entrepeneur				
Collaborative Space:				
The Hatchery	1	120	120	SP-26
Hatchery Pods*	12	12	144	SP-3
Hatchery Meeting Room	6	12	72	SP-3
Industry Room (small)	4	24	96	SP-15
Industry Room (large)	4	36	144	SP-16
Innovation Launch Room	6	24	144	SP-15
Student Project Room	6	24	144	SP-15
Meeting Room (6-seat)	5	12	60	SP-3
Subtotal – The Entrepeneur:	**44**		**924**	

- The Hatchery Pods will be suitably partitioned with the central Hatchery space.

Element D: People Presence

These areas provide required social space that serves to support all types of interaction with alumni, friends of the Faculty, professional graduate students. Other people presence related spaces include student clubs and study space and other administrative outreach spaces.

D. People Presence				
Advancement + Alumni				ADV
Offices:				
Director Office	2	18	36	SP-2
Admin. Office	5	12	60	SP-1
Workstations	7	10	70	SP-32
Office Support:				
				SP Separate entry below
Copy Room	1	12	12	SP-1

Reception/Kitchenette	1	12	12	SP-4
Storage	1	12	12	SP-1
Storage (Secure File/Safe)	1	12	12	SP-1
Subtotal – Advancement + Alum.:	**18**		**214**	

	Total Rooms Proposed	**NASM Per unit Proposed**	**Total NASM Proposed**	**Data sheet I.D.**
Alumni Attractor				AA
				All one room with different areas in the room
Alumni Meeting Room	1	36	36	SP-33
Forum/Study Space/Carrels (4)	1	40	40	SP-33
Carrels (4)	4	4	16	SP-33
Subtotal – Alumni Attractor	**1**		**92**	
Professional Masters' Business Services				HOTL
				All one room with different areas in the room
Workstation (hotelling)	5	3	15	SP-31
Data Benches	4	5	20	SP-31
Lounge for Graduate Students	5	10	50	SP-31
Subtotal – Masters' Bus. Service:	**1**		**85**	
Food Services				F1, F2
'Grab + Go' coffee outlet	1	50	55	SP-34 Incl. storage
Open seating/study	1	30	30	SP-36
Vending	1	30	30	SP-35
Subtotal – Food Services:	**3**		**115**	
Study Space				S
Study Space	1	36	36	SP-30
Subtotal – Study Space:	**1**		**36**	

Student Innovation Clubs (The ARENA)				SIC
Offices	4	12	48*	SP-1.1
Meeting Room	2	12	24	SP-45
The Arena work area	1	255	255	SP-47
Mulit-media/Music Room	1	55	55	SP-48
Storage (Media)	1	25	25	SP-49
Storage (Project Teams)	1	150	150*	SP-5.2
Storage (Fabrication)	12	15	180	SP-41
Storage (Lockers)	1	9	9	SP-44
Storage (Furniture)	2	15	30	SP-42
Data Access Room	1	15	15	SP-43
Student Janitor Service	1	5	5	SP-46
Subtotal – Student Clubs:	**27**		**796**	

* above grade; remaining 598 nasm Student Club space is proposed below grade.

Other Space Program Elements/ Below Grade Space:

The storage spaces proposed below grade are identified below.

Storage				
General Storage	4	15	60	SP-50
Bicycle Parking* (50) *some will be external to the building	1	25	25	SP-52
Subtotal – Other:	**5**		**85**	
Total Building			**7,513nasm**	**15,026 gsm**

[Anticipated below grade 683 nasm]

The Arena, planned for inclusion in the basement, is discussed in greater depth below:

The ARENA

The *FASE Report of the Working Group for FASE Student Club and Study Space* was tabled in November 2011. The assignable space already documented in Elements A, C and D certainly addresses many of the identified space deficiencies. However, the planned ARENA[2] is particular significant in that is gives prime focus to establishing flexible facilities that *directly* serve the requirements of FASE student clubs that currently exceed 80 and involve some 1700 students. New student club space, with the essential and convenient storage requirements, is detailed in Appendix 2; the layout is such that the space provides facilities that, when suitably managed with reservation schedules, can support a range of important activities such as study space and *orphan* activities that need flexible open floor space with good lighting. Furthermore the space is centrally located within the CEIE and serves to support those students that already reach out within their innovative club structures.

At present student clubs use the *temporary* facility at 245 College Street until such time as that space is demolished. It is the worst space within FASE and will certainly have to be replaced when the development of the site commences, anticipated in 1-2 years. The opportunity to significantly upgrade the club experience is a significant element of the planned space program. The new space will accommodate the requirements of all 80 clubs [providing dedicated storage and bookable working space] with special sound-proof facilities for the clubs promoting a musical bent. The club activities that are to be excluded are the Solar Vehicle [currently accommodated in the Annex Building] and the SAE Formula Vehicle [currently accommodated in the Haultain Building], the concrete canoe manufacture and theatre set building for Skule Nite.

Non-assignable Space

The non-assignable spaces include, but are not limited to, areas such as corridors, stairs, mechanical service rooms etc. These aspects in the building program will be accommodated

[2] ARENA. Arbitrary name to collectively define the Club Activity;

within the gross to nasm factor of 2.0. Some specific requirements that have to be met in non-assignable spaces are the following:

- Custodial closets should be located one per occupied floor level and should be large enough to accommodate a floor slop sink, ladder, cleaning supplies, vacuum, mops/brooms & cart. Closets should be stacked above each other and close to washrooms. The upper floors with smaller footprints might require less.

- A larger custodial room should be located next to the receiving area and be large enough to accommodate the floor scrubber (with appropriate charging station and dump area – floor drain with curb) and storage of bulk items; such as, toilet paper, cleaning supplies & lamps.

- A room for custodial staff– an area the size of a private office will likely be sufficient to accommodate a small table with several chairs, small bar fridge, bulletin board and telephone. Male and Female change rooms with lockers are also required.

- At least one telecommunication closet is required on each floor and stacked above each other with one serving as the "Building Entry Point" (likely in the basement close to the Galbraith Building); these closets should be separate from electrical closets. The telecommunications rooms or *data closets* are required to be 7 feet x 9 feet minimum and suitable for housing two free standing racks need to be available on all full floors and presumably on every second floor for smaller and possibly medium sized floors. As noted, *data closets* to be located directly above each other on each floor and linked by risers of a size conforming to U of T standards. The maximum distance between a closet and point served is 90m.

- Cable trays are to be accommodated in passageways that feed into the data closets.

- Wireless communication is to be provided throughout the building. To accommodate the high density anticipated within the ground floor interactive classroom additional dedicated wireless closets should be anticipated.

- Recycling depots are required on each floor, where blue totes can be accessed and stored by custodial staff; totes will be taken down to the delivery area by staff on a regular pick-up schedule by recycling vehicle. These depots should be located next to custodial closets.

- Washrooms are required on every floor; there should be a larger number of fixtures on the levels where the large lecture theatre, tutorial rooms and ARENA [basement] are to be located. It is proposed to have both men's and women's washrooms as is the norm, but to include a separate unisex accessible washroom that is preferably located between the men's and women's facilities or nearby. The accessibility washroom should also address *parent needs* and accommodate a two person *ablution facility* on the floor [similar to a tiled shower base] provided with both hot and cold water taps plus small fold down seat or permanent tiled seating pods to facilitate the rinsing of feet. The intent is to make the accessible unit sufficiently flexibile to address all individual needs, including gender-neutral facilities. On the smaller footprint upper floors some adjustments might be possible or recommended.

- Hydration water filling stations/drinking fountains at the correct height for drinking or bottle filling stations, with a non-tempered water supply, are required on every floor preferably located near the washrooms.

- Corridors should be wide, but not excessive and provide for pockets where student can sit on robust solid wooden features [chairs, long benches]; see the unique bench in the BCIT atrium. Suggest variations on size and length in appropriate areas of the corridors. A second, consistent feature in the building must be the distribution of *data benches*[3] where students can access power outlets and access the wireless network. These benches can overlook windows and should be provided with stools. Other innovative additions could be considered to add functional uniqueness and creativity.

- At least two passenger elevators are required, both being capable of accommodating freight [one may be larger] and servicing basement requirements; elevator standard must meet U of T approval.

- The mechanical and electrical rooms will be located in the basement and/or within penthouse space.

- Delivery Areas, Loading Dock. The building will require a loading dock to be located at grade in an enclosed area for delivery of items into the CEIE only. Small truck delivery is anticipated where goods can be picked up and placed on a trolley. The loading dock need be no larger than 4m x 3m wide with an adjacent caged storage area of equivalent size to store items in transition into or out of the building.

- Waste management and a loading dock are to be accommodated at grade in an enclosed area or in the basement; waste management by compaction is recommended but does require a 25 foot height and pick up by a 35 foot truck. Garbage compaction and recycling for CEIE and surrounding buildings should be managed together in this location including for the physical geography building and Simcoe Hall.

Functional Space Plan

Several factors begin to shape the building's layout and massing including the following:

- efficiency of stacking and massing
- critical adjacencies to, and separation from, other program areas
- desire for natural light
- appropriately scaled ceiling heights and volumes
- direct access to the exterior, at grade levels
- clustering of space according to hours of operation
- need for security

[3] Data Bench. A standard 18 inch wide bench, 2 metres long hardwired with standard power outlets where students can relax and access the wireless network.

The table below identifies the four macro elements [colour coded] as well as many of the sub-elements within each and attempts to illustrate preferred locations within the building for program above grade. The student clubs area (the Arena) is planned to be located below grade.

In broad terms it is essential to locate the large auditorium on the ground floor adjacent to a spacious lobby and coffee-shop. Similarly, all Design Meet Rooms, the Fabrication Facility and Technology Enhanced Active Learning (TEAL) rooms etc. are best located on the lower floors with the largest floor-plates. These rooms will be heavily accessed by students so that a stair-case linking these lower level floors should be included and designed to encourage the use of stairs for high traffic areas.

INITIAL ESTIMATE OF FLOOR LOCATION and ADJACENCY

		ELEMENT A						ELEMENT B												ELEMENT C								ELEMENT D							
								1		2				3		4																			
	ID	Auditorium	Computer Teaching Facility	Computer Visualization Facility	Design Meet Rooms	TEAL Rooms	Fabrication Facility	Centre Global Engineering	Institute: Leadership Educ. in Engng.	Centre/ Institute: Sustainable Energy	Centre: Water Innvation	Centre: Resilience & Critical Infra.	Privacy & Security/ Mobile Internet	Centre: Mgmt. & Tech. Entrepreneur	Design & Innovation	Integrated Manf. & Design Institute	IMDI: PACE	Institute: Robtics & Mechatronics	IRM RESEARCH Laboratory	IRM U/G Laboratory	INDUSTRY ROOMS - large	INDUSTRY ROOMS - small	DESIGN INNOVATION ROOMS	PROJECT ROOMS	MEETING ROOMS	Design & Innovation Meeting Rooms	Design & Innovation HATCHERY	Study Space	Prof. Masters Business Services	Advancement Offices	Alumni Attractors	Student Innovative Clubs, ARENA	Storage for Project Teams	Food Coffee Outlet	Food Vending Machines
Floor	Floor plate within Atrium	AU	CTF	CVF	DM	TEAL	FAB	CGEN	ILEAD	CSE	WI	CRIC	PSM	CMTE	D&I	IMDI		IRM	IRM	IRM	INDS	INDL	IDR	SPR	MR		D&I	SS	HOTL	ADV	AA	SIC	S	F1	F2
lower	no		x	x																												x	x		x
ground	no	x																																x	
2nd	no	x																																x	
3rd	no					x																													
4th	no				x		x																												
5th	yes															x	x	x	x	x					x	x									
6th	yes													x	x										x	x	x								
7th	yes							x	x																x	x									
8th	yes									x	x														x	x									

Some flexibility can be provided by completing floor plans on the lower floors with the addition of the small Meeting Rooms and or Study Spaces as these are best distributed within the building. Note that an X designation, with no other option shown, requires that that room(s) be on the floor indicated if at all possible.

Each of four clusters within Element B should each be preferably be one floor since the nerve centres within each cluster are required to share a receptionist, kitchenette and waiting area. For example, cluster 1 which comprises the CGEN and ILEAD could easily be accommodated on an upper floor; both would also benefit from being adjacent to a TEAL ROOM or DESIGN MEET ROOM. Similarly, for cluster 4, the IMDI and IRM administrative suites need to be on the same floor, but the labs associated with each could adjacent or one floor up or below.

Finally, floors with the green roof sites should be used to accommodate people activities, such as the Alumni Attractor rooms and the Professional Masters' Business Suite.

c) Building Considerations

Description

The building must feel comfortable, airy, light and student friendly. Equally important, the building must be functional and robust with durable materials that can be easily maintained. Peer buildings include the CCBR (atrium), the BCIT and the UTM Library (vertical partition used to divide open spaces).

The building should include the following characteristics:

- High Quality
- Functional and Durable[4]
- Attractive, spacious feel
- Welcoming
- Innovative
- Green/Sustainable: LEED® NC Silver (design to this standard), minimum Tier 1 Toronto Green Building Standard, striving to meet Tier 2 where possible.
- Finishes:
  - i. local materials where possible within budget and where meeting criterion for durability for interior and exterior
  - ii. durable, attractive hard surface materials (i.e. terrazzo in high traffic public spaces; polished concrete floors in lab and work spaces)

The designers are required to give careful consideration to the costs of operating the building upon completion and to demonstrate the innovation that has been effectively incorporated into the design of the building.

Building Characteristics and Massing

Total CEIE Nasm	7,513 nasm
Gross up Factor	overall gross area to nasm 2:1
Total CEIE Gross Floor Area	15,026 gsm
Total Gross Floor Area Parking	2900 gsm
# Floors Above Grade	7-8
# Floors Below Grade (CEIE)	1
# Floors Below Grade (Parking)	1

[4]Since the University will own and operate this new building for 50 years or more, it is important to construct a building that will endure. One way to achieve this durability is to reference the following: "CSA S478-95 (R2007) The Guideline on Durability in Buildings." Consideration to the inclusion of a specialist on the design team who practices in the area of durable buildings should be given.

The building's main entry is anticipated off of a landscaped forecourt accessed from St. George Street and located on axis with Russell Street. An atrium space at the CEIE's main entry will function as crush space/lobby for the auditorium, as well as providing breakout space from the auditorium for various academic purposes such as poster sessions. The ground and mezzanine level are expected to accommodate a small cafe and study/seating area and will accommodate events as well.

The ground floor should include the auditorium and a feature stairway linking the below grade floors to the main floor and the lower above grade floor(s) of the building. The inclusion of such a feature staircase is proposed to invite students to use the stairs rather than the elevators and provide seamless connection between the main public levels of the building.

The new building is anticipated to be 7-8 storeys in height, plus a mechanical penthouse (as required) and an elevator machine room. One below grade floor will also be included for programmable space and an additional level below grade is expected to accommodate parking.

Although the proposed envelope, as provided in the 2011 St. George Campus Master Plan, included an 11-storey envelope situated on axis with Russell Street with portions stepping down to 5-storeys mid-block and again to 3 storeys along the north and west, an alternate envelope has been developed through schematic design that lowers the overall mass to 7-8 storeys, provides a generous landscaped courtyard on axis with Russell Street and includes a lower building along the eastern edge of the site that incorporates the parking access ramp and service bay accessible off of Galbraith Road.

Much discussion has occurred around the in-force 1997 Secondary Plan that included consideration to maintain views from the west campus to Simcoe Hall and the Convocation Hall dome. To the extent possible, the CEIE design endeavors to maintain this view while considering the impact on program and other important views and vistas. In particular, the impact of views from the Front Campus looking west beyond Simcoe Hall will need careful consderation. As the new building will be experienced from all sides, attention must be paid to create attractive facades that are mindful to adjacent heritage buildings and respond equally from all vantage points.

Consideration should be paid to ground level connections through the building off of St. George Street, the Knox College walkway immediately north of the site and a new proposed pedestrian walkway immediately east of the site running north-south adjacent to Simcoe Hall. Open space amenity tied to this building at the ground level, both facing St. George Street and within the 10m set-back between Simcoe Hall and the building site will be key to the buildings success within the campus environs.

Personal Safety and Security

Site 10 will conform to University of Toronto standards on building security. This building will be extensively used by student and other populations and will be used 24/7. Access needs to be coded so that students can enter at all times to particular controlled areas. Upper floors and access to these floors by elevator needs to be time controlled.

Security within particular zones is anticipated but can only be defined once the initial layout of activities have been undertaken within a yet to be defined building envelope.

Telecommunications Data

Wireless
The building is required to be extensively equipped for pervasive wireless at the time of construction.

Hard-wired network connectivity
It is recommended that fibre optics and some UTP copper cables to be pulled to the new building on Site 10 from a nearby location, presumably from the Sandford Fleming Building. These cables are to terminate in a building entrance facility [BEF] as defined by University standards. A structured cabling system should be provisioned for the building, specifically trays in corridors, equipped with risers and tele-communications rooms that by necessity conform to standards. See http://doghaus.cns.utoronto.ca/standards

Cabling required, in accordance with current standards, would be category 6, but need to understand whether or not it is preferable to advance to category 6a to accommodate 10 Gbps UTP connections downstream; recommend consultation with Tom Currie of I & TS; preference to proceed with category 6a. Similarly, it is to be noted that the fibre optic cable could evolve from the current standards that are OM3 to OM4 which will serve to increase the reach of 10Gbps. It is also required that the Computer Visualization Room [SP-10.1] have a hard wired connection to the SciNet node within the McClennan Building for allow for the very high speed transmission of data.

The tele-communications rooms or *data closet* are required to be 7 feet x 9 feet minimum and suitable for housing two free standing racks need to be available on all full floors and on every second floor for smaller and possibly medium sized floors. *Data closets* to be located directly above each other on each floor and linked by risers of a size conforming to U of T standards.

Signage and Donor Recognition

Signage within the building is to be systematic and uniform throughout. Appropriate donor wall recognition is expected to be established within the Atrium.

Accessibility

Planning principles related to Accessibility are identified in the 2011 St. George campus master plan:

> *"The University's buildings, landscape and grounds must accommodate a diverse population in an open and inclusive campus. The campus environment should adhere to the principles of universal design with all new construction on campus."*

The University of Toronto is committed to ensure that its buildings and services are accessible to persons with disabilities. Compliance with the University's Barrier Free Accessibility Design Standards is required for all new construction and renovation projects at the St. George campus. Design teams are required to submit the checklist to the University at 75% completion of the Design Development. Neither the ODA, nor the University, requires full adherence to the

standard. For renovation projects, particularly of older buildings, there may be some recommendations that are very difficult or impossible to implement. However, design teams must provide written explanation in the event of non-compliance. In the case of a heritage building where it is either prohibitive from a heritage maintenance perspective, or is cost prohibitive, the University has a policy of accommodation elsewhere on campus.

A final version of the Proposed Accessible Built Environment Standard (Ontario Building Code elements) will be released for public review early 2013. Once legislated, it will apply to new projects, major retrofits, common space and circulation areas, and change in use.

A Universal Design consultant is required for all Capital Projects on all three campuses. The outside consultant ensures that accessibility is incorporated from the outset of a project and that accessible, barrier-free expertise will inform decisions throughout the design process.

Sustainability Design and Energy Conservation

The building will be designed and constructed to meet a LEED® NC Silver rating or better and will fully comply with the City of Toronto's Green Standard Tier 1, striving to meet Tier 2 where possible. The TPC does not, at the current time, include funds to pursue LEED Silver certification.. The decision to proceed with LEED certification is under discussion and will be made prior to this project going to Governing Council for final approvals.

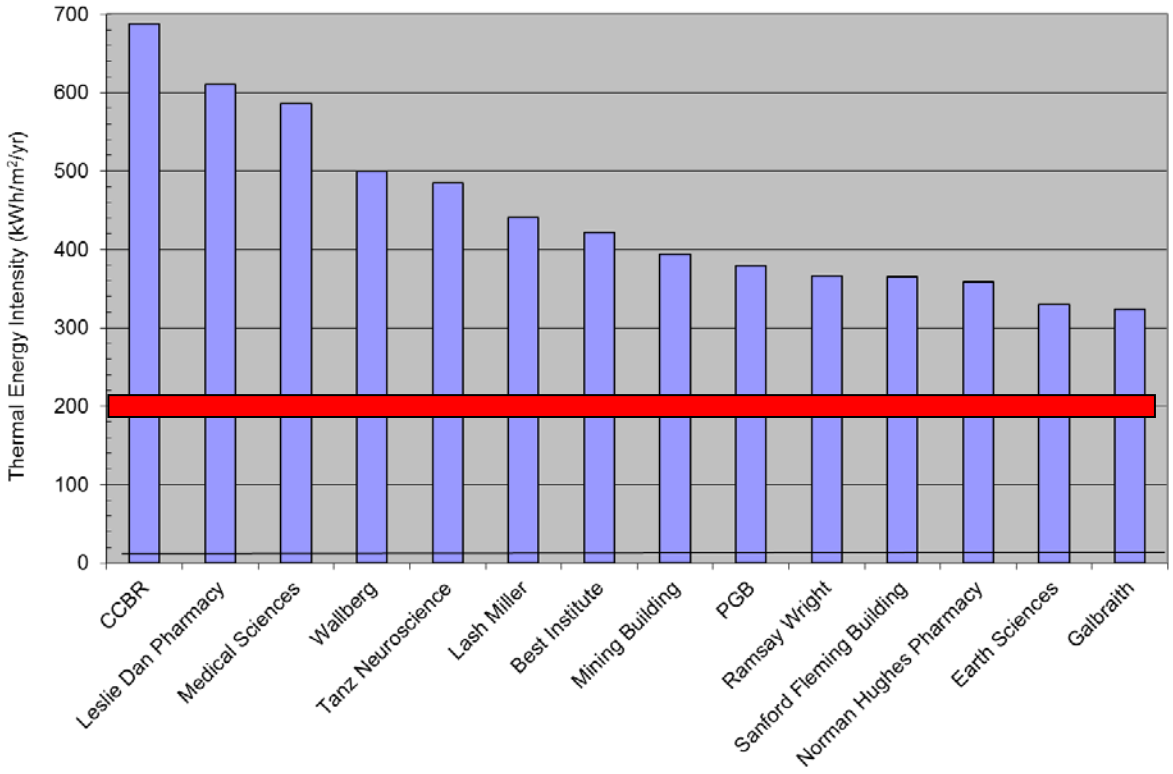
Some of the sustainable design strategies to be considered are:

- Green roof as per City Bylaw and/or water cistern installation;
- Grey water systems for flushing toilets and urinals, and for landscape watering systems;
- Low maintenance native plantings;
- Water-efficient fixtures and combined water fountains/bottle-filling stations;
- Durable, local materials with renewable and/or recycled content;
- Flexibility within rooms to accommodate a variety of functions;
- Energy efficient equipment and fixtures;
- Energy efficient lighting and controls, coordinated with natural light where appropriate;
- Heat recovery from equipment such servers;
- Zoned HVAC control wherever beneficial and desirable;
- Optimal energy efficiency for reduced operating cost and emissions;
- Provision of recycling depots for source-separation of waste throughout the building to meet the needs of the University's recycling and waste reduction programs;
- Roof areas suited to the incorporation of solar thermal water collectors and photovoltaic collectors if funding for such installations becomes available;
- Generally, the project design should seek to incorporate and showcase technologies related to research and teaching.

Below is a plot of thermal energy use intensity for various University of Toronto buildings in the academic year 2011-12. Some of the higher energy use intensities (EUIs) can be explained because of the existence of wet labs and the corresponding higher fresh air demands of exhaust hoods. It is worth noting, however, that the Galbraith Building, which was built in 1960, has a comparatively low EUI (about 300 kWh/m^2). Given Toronto's relatively mild climate and

therefore rather modest demand for heating energy compared to other cities in Canada, the Galbraith Building is well above the national average (200 kWh/m^2 for office buildings).

The average age of St George Campus buildings is approximately 60 years. Given the potential life span of the Center for Engineering Innovation and Entrepreneurship, life cycle costing is essential in its planning and design.



* note: red line indicates the national average at 200 kWh/m2

One approach is to set an achievable and economically justifiable EUI for the new building. This approach is already incorporated into Tier 2 requirements of the Toronto Green Standard. Achieving this latter standard may be favoured over LEED as certification costs would be avoided. However, as LEED and Tier 2 are not mutually exclusive; both could be met simultaneously and each should be explored in early design work.

Achieving Tier 2, a voluntary standard that exceeds the required Tier 1 standard, would reduce life cycle operating costs, minimize the environmental impact of the new building, as well as demonstrate leadership to U of T students and to the community. Achieving the Tier 2 standard will also demonstrate leadership within the City and help strengthen our relations with the local municipal government.

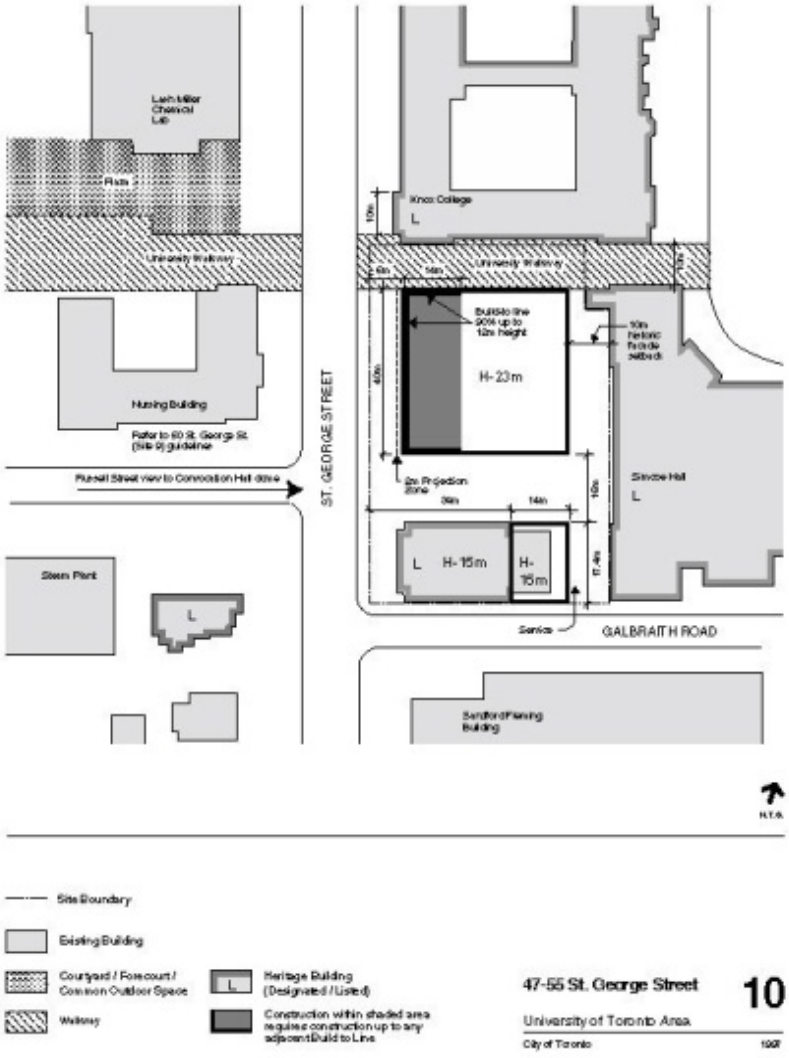
The Tier 2 standard requires the building to achieve 35% better than Model National Energy Code (MNECB), 10% better than the current Ontario Building Code. Tier 2 also includes best practice commissioning, aggressive storm water management, recycling infrastructure, and heat island reduction. Achieving this standard is a modest step forward for this University and is recommended assuming it can be achieved within the budgetary constraints of the project.

d) Site Considerations

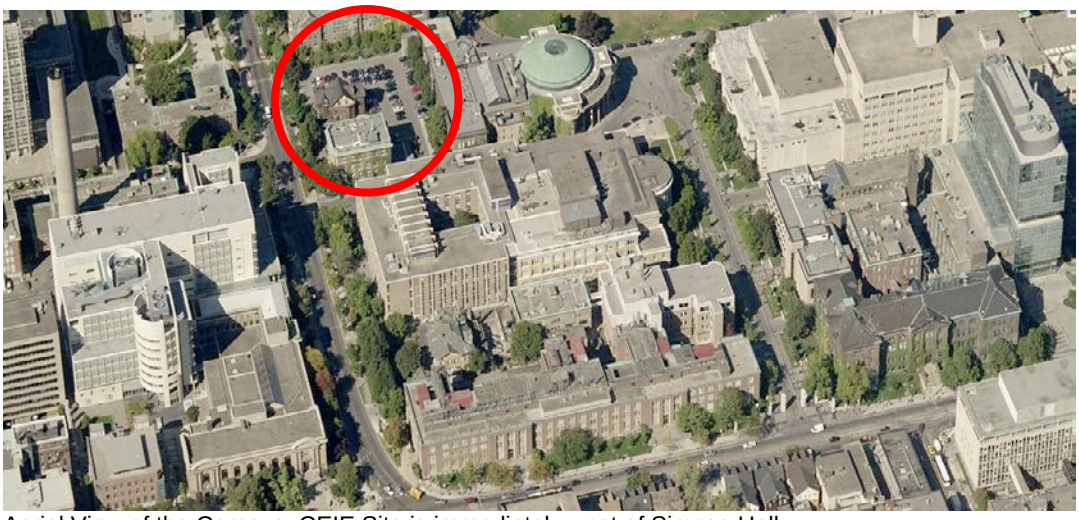
Campus Planning

The CEIE building is proposed to be located on the east side of St. George Street in the area bounded by Simcoe Hall to the east, Knox College to the north and 45 St. George Street (Physical Geography building) to the south. The site currently accommodates 96 surface parking spaces and two buildings at 45 and 49 St. George Street. The project will require demolition of 49 St. George Street, as well as demolition of a small one-storey addition at the rear of 45 St. George Street to proceed as envisioned.

This site, included as Site 10 in the 1997 Secondary Plan for the University of Toronto Area, includes as of right permission to build 10,490gsm of space with a maximum height of 23m or approximately 5 floors.



Context map: Site 10, Approved Envelope



Aerial View of the Campus; CEIE Site is immediately west of Simcoe Hall.

The recently completed 2011 St. George Master Plan maintains this location as Site 10 and proposes an augmented building envelope of 14,170gsm above grade, at a maximum height of 45 metres (11 floors) and stepping down to 21m (5 floors) and 13m (3 floors). Additional program is expected to be accommodated below grade. Although the proposed envelope does not carry as-of-right permissions through a formal re-zoning process, the envelope has been reviewed both internally with University stakeholders and externally by area residence associations and municipal staff in Planning, Heritage and Urban Design.

During the schematic design phase, the envelope was carefully considered to provide the best layout for the CEIE program while responding to the site and its various adjacencies and constraints. The resulting envelope takes elements from both the approved and proposed Secondary Plan envelopes. The project proposed, here, accommodates 6830nasm in 7-8 storeys above grade and an additional 683nasm one level below grade for a total of 7513nasm proposed on site. The envelope maintains a courtyard separation as articulated in the 1997 Plan envelope between the Physical Geography building and a new 7-8 storey structure and includes a lower structure located at the south-east end of the site and allowing for access off Galbraith Road to below grade parking and service space. Permissions to build on the site to this height and capacity beyond existing approvals will need to be sought as part of the design and construction process.

Site 10 is located on St. George Street at the termination of Russell Street, which offers the potential to create a significant view terminus. The garden/forecourt should be located on axis with the street, as illustrated in the both the 1997 Secondary Plan and the 2011 Master Plan. The building design should also acknowledge massing and articulation of surrounding buildings, and carefully consider the impact to views in particular from Russell Street to the west, including the views to Simcoe Hall and the Convocation Hall dome, and from the Front Campus to the east. The impact of shadows cast within open spaces should be minimized.

Development on this site offers the opportunity to connect and add to the public realm, through the careful placement and design of indoor and outdoor connections. Pedestrian connections are important through the site, for University of Toronto students travelling across campus, and specifically for students, staff and faculty connecting to other Engineering buildings such as the Galbraith Building to the south, and the Bahen Centre across St. George Street. A significant east-west pedestrian walkway constructed following the recommendations of the University Open Space Master Plan titled "Investing in the Landscape" is located between Knox College and the site's northern edge. This walkway connects the Front Campus to St. George Street and across the street to the Davenport Lash Miller Garden. A new lane, running between the proposed building and Simcoe Hall within a 10m setback, and perpendicular to the Knox laneway, is proposed to be designed as a pedestrian space, part of U of T's larger pedestrian network.

The proposed garden entrance/forecourt off St. George Street and pedestrian lane between the new building and Simcoe Hall should be designed as open space amenities. Landscaping elements (lighting, pavers, bollards, plantings etc.) should be in keeping with the St. George streetscape and/or Knox College walkway.

Further, the ground floor level should include program elements that contribute to the public realm. A glazed atrium space is proposed, which could house study and lounge seating areas as well as a café kiosk and lobby and informal academic gathering elements outside the large auditorium. This atrium could serve as an internal through-connection between the forecourt and pedestrian laneway described above.

An existing exit stair protrudes from Simcoe Hall into the space of the proposed pedestrian laneway, and should be considered for redesign/realignment to maximize the experience in this location. Architects have been requested to design with an understanding of this issue, and the TPC includes funds to better accommodate this exiting function on the site. Consideration will be made for the provision of an overhead link in lieu of the existing stair that would allow the safe egress of persons from Simcoe Hall Council Chambers into the stairwell of the planned CEIE building.

The Physical Geography Building located at 45 St. George Street, on the south-west corner of the site is to remain with the exception of a 1-storey laboratory addition that will be demolished as part of this project. This building is listed in the inventory of heritage properties by the City of Toronto. The Faculty of Arts & Science [FAS] currently occupies the building and intends to continue to occupy the building into the foreseeable future. Renovation to 45 St. George Street is anticipated in the future, outside the scope of this project. It is to be noted that the building has no elevator and is therefore inaccessible even into the first floor level. The interim PPR for the CEIE building suggested that the design not preclude future connections to allow for the Physical Geography building to become more fully accessible. However, the schematic design of the CEIE building steps away from the Physical Geography building.

Existing large-caliper trees on the site will be protected wherever possible. Trees along the Simcoe Hall west face and along St. George Street, in particular, will require special tree protection during construction activities. Birch trees located along the Nona MacDonald walkway at the north end of the site will likely be damaged during construction and will need to be reinstated or other plantings introduced as part of the landscaping plan for the new building.

Demolition of Existing Structures

49 St. George Street
One existing building located at 49 St. George Street is expected to be demolished in order to make a viable site for construction. This building is not listed on the inventory of heritage buildings in the City of Toronto, nor is it identified as a significant heritage resource in the in-force University of Toronto Area Secondary Plan that identifies a development envelope on this site and assumes the removal of the building. As the University values its heritage legacy, ERA Architects were engaged to assess the cultural heritage value of the building and confirm that removal of the building would not see a significant heritage resource lost. ERA were asked to assess the building based on criteria set out in Heritage Act (Reg. 9/06) which includes a description and evaluation of the following:

a) Design of the building, noting key features and physical exterior condition
b) Context within the St. George Campus
c) History, noting construction date, architect (if known), timeline of uses

ERA Architect's research concluded that the house has little historical or contextual value, and that there is little indicating it represents a historically significant work of architectural design. Research did not reveal an architect of record or publication of the design and found the house no longer sits within a residential context. Further, research indicates that the house has little associative historic value that would merit site interpretation or commemoration. Occupants of the house included three residential owners including R. Home Smith, a successful real estate financier responsible for developing parts of Etobicoke, and renowned geophysicist John Tuzo Wilson, who worked from 49 St. George Street in the early 1950's. However, research indicates that it was only after the geophysics program relocated to the Galbraith Building at the end of the 1950's that Wilson shifted his views about geophysics, renouncing established fixed earth theory and accepting plate tectonics, a theory for which he is now remembered as a leading champion. Professor Wilson was the second principal of Erindale College (UTM) who was recently commemorated with a sculpture installed at the main entrance to the UTM campus.

ERA Architect's description and evaluation of 49 St. George Street has been shared with City of Toronto Heritage Preservation Services (HPS). HPS have expressed, verbally, their acceptance of the demolition of 49 St. George Street.

To make way for construction, the current occupants of 49 St. George Street, the Transitional Year Program (TYP), is being relocated to 123 St. George Street. Renovations are currently underway to accommodate this group along with expansion space for Woodsworth College

45 St. George Street One-storey Rear Laboratory
The development envelope for the site also anticipates the demolition of the one-storey rear (east) laboratory structure located at 45 St. George Street (Physical Geography Building), a listed heritage building. The laboratory is located at basement level but projects above grade and is not part of the original building. Approval for demolition of this addition was included in the 1997 University of Toronto Secondary Plan. The intent is for the activities accommodated in this laboratory, presently used by a faculty member in the Department of Geography, within the Faculty of Arts and Science, to be relocated to another location on campus. The majority of the

relocation of this laboratory use has been relocated to the Earth Sciences building. Final relocations will occur within the coming months in advance of required demolition.

Demolition of both structures will require approvals by the City of Toronto and will proceed as the first works of construction.

e) Campus Infrastructure Considerations

The University of Toronto Utilities and Building Operations group has reviewed the requirements for this building and offers the following recommendations and estimates:

Heating Supply

A preliminary estimate (based on peer buildings) of the steam requirements for the new building is 5,354 lbs/hour. Combined with the existing flow required for the existing Physical Geography building (810 lbs/hour), the total required for the site is 6,164 lbs/hour. The existing steam (two 1-1/4" lines combining to 2-1/2" in Physical Geography) and condensate (1" diameter) lines from the mains in the tunnel on Galbraith Road are too small in diameter to provide this service. It is recommended that the steam lines be replaced by two 3" take-offs in the tunnel combining to 4" in the basement of Physical Geography. The new building can be fed from there. The existing undersized steam lines can be re-purposed as condensate return lines.

Tie-ins to the existing steam mains must be scheduled so as to coincide with the annual system maintenance shutdown which usually takes places in late August.

Costs associated with using the district heating system would include all of the piping changes required to connect as well as an energy transfer station located in the new building consisting of heat exchangers (one to run, one as 100% standby) and the required controls and duplexed hot water pumps. Heating costs are distributed to the building on a metered basis.

Cooling Supply

Chilled water is available from the central plant in the Medical Sciences Building. The closest connection points of sufficient flow are the 16 inch supply and return lines in front of the Sandford Fleming Building. The existing 8 inch lines that currently serve Simcoe/Convocation Hall would have to be excavated and replaced with 12 inch lines. Once in the Convocation Hall basement they can be reduced to 10 inches for the run to Site #10. An energy transfer station must be located in the new building consisting of heat exchangers (one to run, one as 100% standby) and the required controls and duplexed chilled water pumps. Project cost estimates must include these items.

A conservative estimate of the cooling required for the new building is 215 tons. We have this amount available from the Medical Sciences chilled water plant however, this would reduce the amount of spare capacity we have available to cover the gradual creep of cooling loads within the research buildings. Therefore, if district cooling is desired for the building, we would require a transfer of funds from the project equivalent to the cost for providing a chiller and cooling tower of 215 ton capacity.

The benefits from connecting to the district chilled water system would include a reduction of building space that would have to be devoted to mechanical systems as well as n + 1 redundancy in the plant that could only be replicated by local equipment if two complete chillers and two complete cooling towers were installed with one set in run mode and the other in standby mode. The TPC includes connection to the central system. However, if the activities within the building are not sufficiently critical to warrant n+1 redundancy, then a single chiller and cooling tower could be considered at reduced cost (i.e. no piping connections required).

Electricity Supply

The estimated loading of the new building is 1,206 kW (or 1,500 kVA at 0.8 power factor). This is based upon 5 W/sf for electrical loads and 3W/sf for HVAC loads. When the source of cooling is decided upon, this can be further refined.

In 2003 Toronto Hydro installed an electrical duct bank up St. George Street to serve new buildings that were on the University's capital plan including Site 10. The cost for this major infrastructure was paid by the University in advance, with the understanding that as each project is implemented, it will reimburse the University for a proportional share of the cost. Based on estimated loads for this building, the amount of reimbursement would be $783,000 from this project. This amount must be included in the Total Project Cost estimate for the project. In addition, Toronto Hydro will also charge a fee to connect the service.

Site Issues

A number of items pertaining to site issues are listed below.

General

- There are high voltage cables on the perimeter of the site. Refer to Appendix 8 for underground plans. Accurate location of these services on site must be performed before proceeding with design and certainly before any construction takes place.
- Adjacent Building & Structures (underpinning, shoring, removals): Required for Geography (45 St. George Street), and possibly for Simcoe Hall.
- Noise or Vibration Restrictions (isolation, working hrs): Construction to be coordinated with schedule for meetings held in the Governing Council Chambers, located in Simcoe Hall as well as with occupants of the Physical Geography building.

Known Hazmat: Hazardous Materials
Single Storey Addition to Physical Geography: This section of the building has asbestos floor tiles and asbestos insulation on the piping system. Removal of these items can be made for about $12,000 prior to demolition. No information is available regarding lead in paint finishes but this can be surveyed prior to the project. Since the painted surfaces will be removed during the demolition, the contractor will be advised to follow lead procedures if the paint is identified as lead-containing. The contractor will determine appropriate disposal methods based on a leachate test.

Roadway Access
The site is accessible from St. George Street via Galbraith Road. Site 10 will be known as 55 St. George Street.

Servicing
Long term, site servicing is anticipated to be located in below grade space and/or adjacent space at the southern end of the site and accessed from Galbraith Road. This area will serve as the refuse and recycling collection point for the building. The new development will need to incorporate the servicing needs for CEIE and garbage and recycling for CEIE and adjacent buildings as well as a below-grade parking entrance.

Soil Conditions
Report on Soil Conditions (Rock, Fill, Contaminants, Water) has shown poor soil conditions. These have been considered in the schematic design and cost estimate.

An environmental assessment phase 1 may also be required for the site.

Trees
Existing large caliper trees will be maintained where possible and will require adequate protection to ensure their survival during construction.

f) Secondary Effects

A number of secondary effects are identified below:

Demolition
As discussed in detail under Site Considerations/Campus Planning Issues, the research laboratory at the rear of the 45 St. George Street (Physical Geography Building), and the building at 45 St. George Street will need to be demolished to make way for the new CEIE Building.

Demolition will require approvals by the City of Toronto and will proceed as the first works of construction.

Research currently taking place on the rooftop of the Physical Geography building may require relocation or to be halted during construction.

Assuming a bridge connection replaces the existing exit stair leading from the Simcoe Hall Council Chambers, timing of connections will need to occur during summer months when the interruption to regular meetings of the University Boards and Committees can be minimized.

Transitional Year Program
To make way for construction, the current occupants of 49 St. George Street, the Transitional Year Program (TYP), is being relocated to 123 St. George Street. Renovations are currently underway to accommodate this group. Offices, student lounge and computing space and new accessible entrance and washroom are within the scope of renovations being undertaken for TYP. TYP will have dedicated spaces on the basement, first and second floor. Woodsworth College will also have dedicated spaces in the building and there are some facilities that will be

shared by both building occupants. The anticipated total project cost for the renovation of 123 St. George Street is being funded centrally and being undertaken separately from the CEIE project.

Parking

Parking on the campus is regulated by a City of Toronto Zoning By-Law that requires 1930-2130 spaces to be provided within delineated areas of the St. George campus. Site 10 currently accommodates 96 parking spaces at grade that, if lost through the development of the site, would place the University below the required threshold for parking space provision. Because of the tight site configuration, and poor soil conditions it has been determined that multiple levels of parking below grade will be prohibitively expensive. However, this site is critical to parking needs at the southern end of campus.

The decision has made, therefore, to include a single level of parking that is expected to yield between 50-55 spaces.

The shortfall of approximately 40 parking spaces resulting from the proposed partial replacement strategy will be considered a variance to the University of Toronto Area Parking by-law and will require City approvals. It is expected that the City's current autominimization policy will support the lowering of by-law required spaces on campus. Further, to manage demand in the south-eastern quadrant of campus, Transportation Demand Management (TDM) strategies and policies will be considered to help reduce travel demand and redistribute demand in both space and time. In addition to existing programs that encourage faculty, staff and students to use alternate means of transportation through discounted TTC passes, ZipCar and Car2Go cars available on campus and access to a UTM shuttle bus, additional initiatives may be considered such as flex-pass options for occasional drivers and incentives for carpooling.

Vacated Space

Space vacated by FASE (up to 1,100 nasm within FASE precinct buildings) upon the completion of the new building will be renovated to provide additional needed research and student spaces. The cost associated with renovating vacated space in existing Engineering buildings is not included in this project. An additional 500nasm of space currently allocated to Engineering at 245 College will be released for future development of the site.

Some existing OSM teaching spaces may also be considered for reassignment. As OSM schedules the new teaching spaces in Site 10, which are considerable, existing OSM spaces within other engineering precinct buildings may become available for repurposing and renovation into wet laboratory spaces. A maximum of 1500nasm of OSM space is under consideration. The details of space being vacated and being considered for repurposing are included in Appendix 4.

Procedural arrangements between OSM and FASE around the accommodation of academic activities are on-going and will determine the exact rooms which will be available for reallocation. A full assessment of the impact of the new CEIE building will not occur until post occupancy. At that point, rooms no longer required to meet the University's instructional needs will be released backto the centre for reallocation.

g) Schedule

Final approval of the CEIE project will allow for the final set of documents to be prepared. Assuming appropriate municipal approvals are acquired in a timely manner, the project is scheduled to be tendered in the spring of 2014 with the potential to commence construction in the early fall of 2014.

The anticipated project milestones include those summarized below:

Governance Approval in Cycle 3	February 2014
Consultant Selection	April 2013
Schematic Design Completion	October 2013
Relocation of Occupants from site	May 2014
City Approvals (rezoning or CofA, SPA, building permits)	March 2014-March 2015*
Design Development and Contract Drawings Completion	July 2014
Tender and Award of Construction Contract	August-September 2014
Mobilization and Construction	Sept. 2014 to Aug. 2017
Commissioning and Moving	August/September 2017
Full Operational Occupancy	October 2017

*Level of approvals not yet determined. Schedule could be impacted by delays in permitting and City approvals. The above schedule assumes 1 year for SPA approval with CofA or Re-zoning occurring in tandem. Demolition and excavation permit would be required in advance of full approvals in order to meet schedule.

Staging or Phasing Requirements

No staging of occupants either within the Physical Geography Building at 45 St. George Street or Simcoe Hall is anticipated throughout the construction period. Periods of noisy construction will need to take into account neighbouring uses including, but not limited to, residential occupancy at Knox College to the north and University governance meetings being held in the Simcoe Hall Council Chamber. Scheduling of noisy construction will be required to mitigate disruption.

University members who currently park their cars in the Simcoe Hall lot will be advised of the lot closure in advance of construction and alternate locations on campus will be made available for their use. To minimize the loss of revenues, it is recommended that the parking lot not be closed until demolition and excavation are each ready to begin, estimated in the fall of 2014. If excavation does not immediately follow the demolition on site, it is suggested that some part of the lot be re-opened for use by casual pay-per-use customers during the hiatus.

Garbage and recycling activities that are currently accommodated within bins on site will need to be relocated during construction. These activities will be accommodated within the new structure, forming a district solution on site.

h) Funding, Allocation and Use of Classroom Space

CEIE Building Interactive Auditorium for 500 Occupants

A 500-seat auditorium is included within the space plan that represents an important addition to the University's inventory of teaching facilities. Since FASE only requires, at best, a 320 seat capacity, the intent is for the University to contribute 36% of the cost of this unique facility which is the pro-rata cost to increase the size from 320 seats, as required by FASE, to the 500-seat auditorium. Until such time as the detailed design and costs are known the anticipated cost sharing will be fixed at the 64/36 percentage split between FASE and the University. Details of the financial contribution are detailed in Section VI.

The auditorium agreement is to allow the seat count in the space to be theoretically adjusted down to 275 seats for FASE only when FASE classes are to be scheduled in the facility. This will permit class sizes of 180 students to be scheduled in the facility while meeting the utilization standard of filling 65% of the seats. FASE has many classes that exceed the 180 count but it is necessary to get to this value to ensure a minimum use of some 26 hours per week within the 9:00 – 5:00 time period. With this agreement FASE would be able to use the classroom and the University acquires a larger facility. Other users would be required to respect the 500-seat capacity of the room and ensure that 65% of the seats would be filled.

TEAL and Design Meet Classrooms
It is a requirement and in the interests of both parties that a detailed agreement between FASE and OSM be developed prior to the commencement of construction. The agreement is to address the usage of the auditorium, the Design Meet Rooms and TEAL Rooms that are used in support of tutorials and student project activity. There is already agreement in principle that it is preferable for the auditorium, the 8 TEAL Rooms and 6 Design Meet Rooms, all of which are to be located with the CEIE, to be operated by OSM. Two additional Design Meet Rooms will remain in the FASE inventory for exclusive use. FASE plans to use these rooms in support of its undergraduate programs but as a good citizen of the University understand the importance for all such facilities to be gainfully used across the University, consistent with the OSM guidelines.

The agreement is expected to have two distinct components; the first, which deals specifically with the auditorium, has the support of both FASE and OSM. The second, which deals with the Design Meet Rooms and TEAL Rooms has yet to be fully developed once the design of the building is completed but there is certainly agreement to move in this direction to ensure effective utilization of all space.

As noted previously there are a total of 14 unit TEAL and or Design Meet Rooms to be included in the agreement. Each unit room is 108 nasm so that the 14 rooms total an impressive 1,512 nasm. The intent of FASE is to make effective use these rooms in support of course offerings, particularly for the very large ESP, PRAXIS and Capstone Design courses, and when they are not in use that they be used by others within the University as part of the OSM operation booking schedule.

Classroom Facilities in other FASE Buildings
It is clear that this new inventory of classrooms in the CEIE Building is significant and as a result, FASE and others will be using considerably less of the OSM tutorial space currently available within various buildings that comprise the engineering precinct, i.e. the Galbraith, Haultain, Wallberg, Sandford Fleming, Bahen buildings etc.

Since FASE continues to be deficient in research space with wet lab requirements, the agreement, as OSM schedules these new facilities in the CEIE, would be for OSM to relinquish

and transfer existing OSM holdings in the engineering precinct buildings to FASE. FASE in turn would be able to renovate these spaces into wet laboratory research facilities that allow for the expansion of activities where required. This is essentially a space trade between OSM and FASE; the transition will take time and needs to be documented with room transfers identified.

For FASE this is important as the CEIC was deliberately planned as a non-wet laboratory facility; a conscious decision to keep construction costs at a minimum, but also with the realization that most of the funding would need to be secured from alumni and donors who have indicated a preference to support innovation, entrepreneurial, leadership and global initiatives involving students undertaking both graduate and undergraduate studies.

Procedural arrangements between OSM and FASE around the accommodation of academic activities are on-going and will determine the exact rooms which will be available for reallocation. The agreement will need to explore all uses of existing rooms and the projected use of the new rooms including the auditorium to address tutorial usage, examination scheduling etc. A full assessment of the impact of the new CEIE building will not occur until post occupancy. At that point, rooms no longer required to meet the University's instructional needs will be released back to the centre for reallocation.

IV Resource Implications

Total Project Cost Estimate
The total project cost estimate for the CEIE project includes two distinct parts including i) the Centre for Engineering Innovation & Entrepreneurship (CEIE) in a 7-8 storey structure plus one level of basement of 7517nasm (15,026gsm); and ii) one level of underground parking to be positioned on the second level below grade in 2900gsm (including ramping).

The Total Project Cost estimates include allowances for the following:

- Construction costs based on a stipulated sum form of tender
- Construction cost to include building to LEED equivalent silver standard
- Construction contingency of 10% of the estimated construction cost
- HST where applicable
- Permits and Insurance
- Professional fees
- Data and Telephone terminations
- Furniture and AV equipment
- Miscellaneous costs such as signage and donor recognition
- Total financial costs are included and determined based on available funding wihtin a detailed cash flow analysis

Operating Costs
Operating costs are assumed to be in line with, or less than that of the existing Bahen Centre for Information Technology (BCIT) that under the 2011-12 budget model was $277/nasm. Sidney Smith Hall is also a reasonable comparator for a non-laboratory research building with 2011-12 budget model operating costs of $230/nasm. The planned building for Site 10, at 7513nasm, will incur approximately $1,728,000 to $2,080,000 per year in 2011-12 dollars escalated year over

year. Operating costs will be apportioned to occupants including OSM and FASE and paid out of operating budgets.

Operating costs for the parking garage are based on those for the Graduate Residence that is currently operating at $44/gsm/annum. Operating costs include: equipment repair and maintenance, fire equipment repair and maintenance, supplies, general services (cleaning), hydro, steam, fabric maintenance (i.e. any F&S charges).

For a garage and ramping of 2900gsm, the operating costs are expected to be $127,600/year escalated year over year.

Funding

Funding for the proposed CEIE project has been identified from the Faculty of Applied Science and Engineering (FASE), Provost Central funds including contributions to the 500 seat interactive auditorium and donor funds. Additionally, the Engineering Society within the Faculty of Applied Science and Engineering operates a capital fund which was designed to enhance the infrastructure for undergraduate student spaces. They are very supportive of the extensive undergraduate facilities that are planned to be incorporated into the Centre for Engineering Innovation and Entrepreneurship [CEIE] and have now specifically committed $1M to name the student club space in the lower level of the CEIE. It is expected that an internal loan assigned to the FASE will be required for a portion of the funding.

Funding for the proposed parking garage is being actively assembled from a variety of sources including those identified from the Faculty of Applied Science and Engineering (FASE) and Central funds.

V Recommendations

That Planning and Budget Committee recommend to Academic Board

1. THAT the Report of the Project Planning Committee for The Centre for Engineering Innovation and Entrepreneurship (CEIE), dated November 22, 2013, be approved in principle;

2. THAT the project scope totalling 7,513 nasm (15,026 gsm) for the CEIE space program, to be located on Site 10 (47- 55 St. George Street – Simcoe Hall Parking Lot) be approved in principle, to be funded by the Capital Campaign, the Faculty of Applied Science and Engineering, Provost's Central Funds and borrowing; and

3. That the project scope of a single level of underground parking (2,900 gsm) to be located on Site 10 (47- 55 St. George Street – Simcoe Hall Parking Lot) be approved in principle, to be funded by Central Funds and the Faculty of Applied Science and Engineering (FASE).