Application for Ministerial Consent
Ontario Colleges of Applied Arts and Technology

Bachelor of Building Science

Submitted To: **Postsecondary Education Quality Assessment Board**

Submitted By: **Algonquin College of Applied Arts and Technology**

Date of Submission: April 2011

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Section 1: Introduction

Section 1.1: College and Program Information

Full Legal Name of Organization: **Algonquin College of Applied Arts and Technology**
Operating Name of Organization: **Algonquin College of Applied Arts and Technology**
Common Acronym of Organization (if applicable): **NA**
URL for Organization Homepage: **www.algonquincollege.com**
Proposed Degree Nomenclature: **Bachelor of Building Science**
Location (specific address) where program is to be delivered (each location requires a location-specific consent from the Minister): **Algonquin College, 1385 Woodroffe Avenue, Ottawa, Ontario K2G 1V8**
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Anticipated Start Date: **Fall 2012**
Anticipated Enrolment for the first 4 years of the program: Year 1: 40 Year 2: 72 Year 3: 101 Year 4: 127
Initial Tuition Fee per semester: $2,657

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Section 1.2: Executive Summary

Proposed Credential Nomenclature:
Bachelor of Building Science

Anticipated Program Start Date:
September 2012 – Year 1

Program Overview
The building industry is evolving to meet the growing need for greater sustainability in building design and performance. In addition, it is experiencing a technological transformation a well as a growing demand for building design and energy modelling.

The proposed Bachelor of Building Science program prepares graduates through a comprehensive pedagogical approach that seeks to find a balance between a solid knowledge of the building envelope and sustainability in design, construction and building operations. Learners develop a solid understanding of construction principles, management and design coupled with a foundation in energy in buildings (utilization, efficient management, conservation and green generation). Students develop skills in analysis and problem solving to optimize the performance of buildings by promoting a healthy and comfortable living environment, structural durability, energy efficiency and low environmental impact.

This proposed co-operative education program provides for learning in an environment that is rich in research and scientific inquiry for the attainment of program learning outcomes and the development of student projects. Applied in-lab projects in addition to work experience will help students develop the practical skills and the leadership skills that this industry demands.

Finally, this comprehensive program prepares graduates to pursue further academic study in Building Science and construction related fields.

Program Learning Outcomes
1. Integrate sustainable building practices and alternative energy solutions and present options that balance client specifications, site conditions, and human factors.
2. Use sound, acceptable engineering principles for the solution and documentation of situations encountered during the construction or rehabilitation of buildings.
3. Communicate effectively with all project stakeholders.
4. Read, interpret, and, with direction, modify documents related to building plans, including working drawings that involve structural, electrical, and mechanical features.
5. Formulate strategies for the efficient and effective commissioning and operation of buildings and building systems.
6. Evaluate the practical applications of primary and secondary theoretical research related to existing and emerging construction methods and materials.
7. Analyze, test, and comment on the functionality of alternative structural, mechanical, and electrical solutions proposed for integration in both new projects and renovations.
8. Contribute to the on-going economic viability of construction and engineering projects through the application of principles of estimating, accounting, and cost controls.
9. Facilitate partnerships and productive interactions within project teams that involve knowledge-workers and skilled trade workers.
10. Ensure work, activities, and practice are in compliance with established ethical and professional standards, as well as local, provincial, and national legislation.
11. Adapt to changes in employment requirements through the development, implementation, and updating of professional and personal development plans.

Curriculum Design

The curriculum has been designed to meet the honour's degree-level standard and provides the appropriate depth and breadth of knowledge, along with applied specialized preparation in the areas of critical thinking and scholarly research, problem solving and analysis, communications, leadership and professional capacity and autonomy, as they relate to Building Science. The two co-op placements provide further experiential learning opportunities.

The program of study is summarized below:

Year	Semester	Course Title
YEAR 1	Semester 1	Computer Applications for Design and Reporting I
		Space and Place: Site Development and Built Environments
		Introduction to Building Science
		Engineering Principles
		Calculus I
	Semester 2	Computer Applications for Design and Reporting II
		Materials Science
		Electricity and Power Generation Fundamentals
		Building Design Processes
		Calculus II
YEAR 2	Semester 3	Geotechnical Engineering
		Building Frame and Structural Studies
		Technical Communication
		Linear Algebra
	Semester 4	Sustainable Design
		Building Systems
		Business Development for the Construction Industry
		Differential Equations
		Co-op Preparation Seminar
	Co-op Work Term I	
YEAR 3	Semester 5	Renewable Energy
		Advanced Engineering Principles
		Statistics
		Introduction to Construction Project Management
	Semester 6	Alternative Energy
		Seminar in Constructability
		Building Information Modeling
		Energy Conservation and Auditing
	Co-op Work Term II	

Year	Semester	Course Title
YEAR 4	Semester 7	Advanced Modeling and Simulation
		Applied Energy Management
		Professional Portfolio Development
		Building Science Research Project I
	Semester 8	Seminar in Sustainable Solutions
		Scenarios in Team Leadership
		Construction Methods for Renovation and Rehabilitation
		Building Science Research Project II

Algonquin College's Strengths and Capacity to Deliver the Program

Algonquin College of Applied Arts and Technology was established in 1967 and was named after the First Nations people who lived in the area. Algonquin was formed from the merger of the Eastern Ontario Institute of Technology, established in 1957, and the Ontario Vocational Centre, established in 1965.

The College has undergone significant growth since its establishment and continues to grow today. All three Algonquin College Campuses are currently undergoing major expansion projects. The Perth and Pembroke Campuses are building all-new campus facilities and the Woodroffe Campus is completing the construction of the new Algonquin Centre for Construction Excellence.

Dedication to student success is one of Algonquin College's primary guiding principles and is demonstrated in the quality of its programs, its staff, the continual expansion of its facilities, and by forging of strategic partnerships. Furthermore, the College strives to ensure students have access to the education and skills training demanded by the marketplace to launch rewarding careers in their chosen fields.

With thousands of successful alumni, an annual full time enrolment of 17,000 students, 40,000 part-time registrations and thousands of full time and part time employees, Algonquin makes a significant economic and social impact locally, regionally, nationally and internationally.[1]

Algonquin is committed to being one of the most comprehensive colleges in Ontario, offering a broad variety of programs, subject matter, delivery modes and program durations. Algonquin is also the only publicly-funded English-language college in Ottawa, Perth and Pembroke and services the needs of these areas and their surrounding communities. As a result, Algonquin will continue to expand its program offerings which include a full range of products including academic upgrading, apprenticeship, certificate, graduate certificate, diploma, advanced diploma and degree programs as well as corporate learning solutions and international education and projects. As the province's labour needs evolve, so will the program mix of the College. [2]

1 Algonquin College 2008-2013 Strategic plan p.p.5, 8 http://www.algonquincollege.com/reports/pdf/Strategic_Plan_web.pdf

2 Algonquin College 2008-2013 Strategic plan p.p.5, 8 http://www.algonquincollege.com/reports/pdf/Strategic_Plan_web.pdf

Algonquin's application for Ministerial Consent to offer a Bachelor of Building Science is in response to the evolving labour needs of the Building Construction Industry. This application further aligns with the College's present direction detailed within its current Strategic Plan 2008-2013, which articulates the intent to expand program mix including degree program offerings.

Algonquin has offered educational programming in the fields of architecture, civil engineering, construction and building trades for over 40 years. The College has established a good reputation in the delivery of high quality Building Construction related programming and currently offers a broad array of certificate, diploma, advanced diploma, and graduate certificate programs, and bridging programs for internationally-educated professionals.

The School of Advanced Technology at the Woodroffe Campus houses the College's selection of Architecture/Civil/Construction and trades labs and equipment, as well as in-class student projects and industry-sponsored applied research projects. The College's capacity to provide the human and physical resources required to offer an excellent educational experience for students is unsurpassed in the region. In addition, the College's ability to deliver bachelor-level education is evidenced by the success of four comparable programs.

This application details existing and new facilities, learning resources, and technological infrastructure. Our teaching faculty currently includes professors who have terminal credentials in their respective fields.

Opportunities for Graduates and Overview of Support and Recognition of the Program from the Professions, Other Postsecondary Institutions.

During the course of developing the Bachelor of Building Science program proposal, an in-depth labour market analysis research study was commissioned by the College to determine the need for the proposed program. The study concluded that there is a definitive need for this degree program and that the credential will provide graduates with opportunities for advancement in the Building Construction Industry.

Labour Market Analysis (Hanover Research Council)

In March 2010, the College contracted Hanover Research Council (HRC) to examine the potential need for a Bachelor's degree in the field of Building Science. The following highlights some of the findings:

- The demand for building science in Canada is most closely tied to the construction industry. Currently, in response to the global and national recession, the construction industry has struggled across Canada. However, the industry appears to remain strong within the province of Ontario.
- As compared with previous projections, employment growth rate projections for occupations related to building science for the 2006-2015…show that the employment growth rates for the majority of occupations in building science outpace the rates for all occupations.
- Of the four occupational classifications covered in this report, three have retirement age gaps which are at or below the national average. A lower age gap indicates that there are likely to be more openings due to retirement each year.
- In 2009, the job prospects for technical occupations in architecture, drafting, etc. were rated as "limited" for Canada. However, within Ontario, the market for architectural technologists

and technicians was rated as "good" for the near term future. In Quebec, the occupation of architectural technologists and technicians received a "fair" rating.

- The current occupational outlook for other technical inspectors and regulatory officers in Canada is rated as "good." In Quebec, the occupation of construction inspector is also rated as "good" and is projected to maintain this positive outlook. Information for this occupation is not available for Ontario.
- There appears to be a dearth of bachelor degree programs in building science in Canada. While building sciences is a common component of engineering and architecture programs, an entire curriculum dedicated to the study of building science appears to be rare in the country. This may provide an opportunity for Algonquin to fill an educational gap in a field which is projected to be in demand in the coming years.

Employer Demand Interest

The same Hanover study further states the following:

> "According to the Human Resources and Skills Development Canada the Future Average Annual Growth 2006-2015 for related professions are the following: Managers in construction and transportation 1.6%; civil, mechanical and industrial engineering technicians 2.6 % ; Technical occupations in architecture, drafting, etc 0.6%; Other technical inspectors and regulatory officers 1.7%.Because of the advances in building materials, the development of new "smart" and "green" buildings, and the changes in building standards, the occupation is becoming more complex. Ontario Job Futures cites that because of increasing complexity, those with a degree in construction science will have an advantage in the job market going forward."

Applicant Demand Interest

As the Labour Market Analysis indicates, this Bachelor of Building Science program does not have many comparable programs in the province of Ontario that can be used to gauge applicant demand.

The analysis of the applicant demand indicates that there is significant interest in the program among potential applicants (approximately 70% of the respondents expressed some level of interest in taking the Bachelor of Building Science program), and that the interest is likely to translate into registrations that would allow the program to meet enrolment targets.

The proposed program's advisory committee as well as numerous other industry representatives have endorsed this proposed offering. This application for ministerial consent includes recent letters of support from prominent associations and industry affiliates including The Ottawa Construction Association, the Engineering Institute of Canada, the Canadian Construction Association, the Building Envelope Council of Ottawa, the Greater Ottawa Home Builders Association, the Society of Energy Professionals and the NRC. Note that throughout the course of program development the title evolved from Bachelor of Applied Technology (Building Science) to Bachelor of Building Science. Letters of support may reflect either title. The title change was endorsed by the Advisory Committee.

In addition, further evidence of support indicates paid co-op placement opportunities and permanent jobs to graduates from organizations such as Ellis Don, PCL, Aecon Buildings Ottawa, GRG Buildings, Revay and Associates, Morley Group, MTBA, JL Richard, Taplen, Uniform Developments, Boucher Design, Arborus Consulting and Trinity Development Group. Endorsements by the aforementioned industry affiliates provide testament to Algonquin's capacity to deliver quality programming in the field of Building Science. This proposed program

will give students the opportunity to develop their skills within state-of-the-art facilities using the latest tools and technologies. The College's location in the Nation's Capital, where major Canadian governmental building science research labs are located will provide additional advantages to graduates in terms of networking and future job prospects.

The addition of the Bachelor of Building Science to the College's programming mix will expand students' educational opportunities for further studies and lifelong learning. Graduates of the Bachelor of Building Science program will receive consideration for eligibility for graduate studies. Ryerson University has indicated that graduates will be considered for acceptance into the graduate program in Building Science and University Canada West recognizes Algonquin's degree programs for a graduate study pathway into their Master's of Business Administration program. The Dean of the Faculty o f Technology and Trades is further engaged in discussions with a number of Canadian and international universities to forge other similar opportunities.

In summary, marketing studies affirm the need for Algonquin College to offer a Bachelor of Building Science program and industry trends and market analyses are indicative of employment opportunities for graduates. There is resounding support of our industry affiliates for the proposed curriculum as well as a commitment to provide co-op placements and employment opportunities. It is expected that graduates of the Bachelor of Building Science program will become future global leaders within the Building Construction Industry and will be sought out by employers locally, nationally and internationally.

Section 1.3: Program Abstract

Using an approach that values historical developments as the basis for today's building construction achievements in sustainability and alternative energy use, graduates emerge from this Bachelor of Building Science program prepared for positions in private industry as well as government agencies. Graduates are able to work as researchers, junior analysts, building specialists, technical staff, construction project team leaders, and consultants. Theoretical and applied studies, grounded in sound engineering principles, enable students to develop a knowledge base in construction methods and materials, building operations, and the overall integration of building components. Course work and co-op work terms combine to add breadth and depth to the students' exploration and research within the Building Science discipline. In addition, access to advanced learning environments provides the opportunity for students to experience current and emerging technologies that support both the construction and operation of buildings. Finally, this knowledge base joins with relevant personal and interpersonal skills and allows students to participate and lead effectively in a variety of contexts, such as new building projects, renovations, or rehabilitations. Technology is an important learning tool throughout the program.

Section 2: Degree Level Summary

This section provides a summary of the program features and resources that ensure that the proposed Bachelor of Building Science program meets the Board's standard for a Baccalaureate/Bachelor Honours degree. Although the six categories are treated independently for the purposes of discussion, the proposed degree-level program integrates the elements of the standard in a holistic fashion, and creates opportunities for students to demonstrate more than one of the six categories in any given performance. This alignment between the Board's standard and the proposed degree-level learning outcomes, and between the proposed degree-level learning outcomes and the courses that make up the proposed Bachelor of Building Science program was monitored throughout the development of the program (See Section 4.3: Learning Outcomes).

For this summary, then, some key points will be highlighted for each of the six categories of knowledge and skills that form the Board's standard for a Baccalaureate/Bachelor Honours degree.

Depth and Breadth of Knowledge

The proposed Bachelor of Building Science program has been developed to provide students with the necessary knowledge and skills using a scaffolding approach to learning. Each semester and year strengthens and stabilizes central concepts, methodologies, and theoretical approaches before moving students further into the specialized disciplinary content related to building science. The first year of study provides an introduction to the discipline as a whole, along with the related mathematical and engineering principles that will continue to be developed throughout the program. Students also begin to experience major fields in the discipline through courses like Materials Science, Electricity and Power Generation Fundamentals, and Building Design Processes. These disciplinary strands continue into the third year of the program when students begin to specialize in the area of energy and energy management.

The applied nature of the program maintains a focus on the gathering, review, evaluation, and interpretation of information through the use of hands-on laboratory environments and drafting studios and the constant interaction with the living lab facilities provided by the new Algonquin Centre for Construction Excellence (ACCE) building. With its targeted Leadership in Energy and Environmental Design (LEED) Platinum certification, the building will allow students to generate and compare a wide range of hypotheses related to building operations and energy management, and connect some of those hypotheses to choices made during the design and construction of the building. This ever-present resource, combined with other advanced courses and the two work experiences, enables students to develop the essential research knowledge that supports the capstone research project in the final year of the program. These projects will allow students to showcase their critical thinking and analytical skills within the context of the knowledge acquired throughout the program.

In addition to the core courses, students devote more than twenty percent (20%) of their studies to content outside of the discipline, through a combination of mandated and free elective courses. This interaction with other fields of study provides students with a breadth of learning through which they continue to exercise critical thinking and analytical skills. Moreover, they develop an appreciation and aptitude for a diversity of research methodologies that enables them to examine a greater array of hypotheses and assumptions beyond the specific discipline of building science.

Conceptual and Methodological Awareness/Research and Scholarship

In the first semester, students begin their engagement with both the methods of enquiry and current research in the discipline. The first semester course, Space and Place: Site Development and Built Environments, provides the necessary conceptual framework for many of the courses that follow through a critical examination of the connection that exists between buildings and users of buildings. With this essential relationship in mind, students begin to explore the ways in which research questions are formed, problems are solved and theoretical research makes its transition into practical applications in building science.

Moreover, the evolving nature of practices and procedures in construction and construction-related industries ensures that questions and problems raised in courses like Sustainable Design, Renewable Energy, Alternative Energy, Seminar in Constructability, and Seminar in Sustainable Solutions will require both established ideas and techniques and current research for the development of effective solutions that can be implemented in real-life situations.

The learning environment in which the students collaborate with faculty will encourage not only logical and sustained arguments, but also the appropriate use of research. As they progress through the program, students develop a greater level of autonomy, and it is the combination of astute commentary on, and use of, scholarship in the discipline and demonstrated academic integrity in the documentation of their research that provides evidence of their intellectual growth during their studies.

Communication Skills

Within the context of the construction and construction-related industries, communication skills are an essential foundation for success. The importance of effective communication with all stakeholders has been captured in one of the degree-level learning outcomes (See Section 4.3: Learning Outcomes). In order to prepare students not only for the work experiences that are part of the program, but also for employment upon graduation, the development of written and oral communication skills is threaded through the program with progressive levels of difficulty and exposure to discipline-specific techniques.

Beginning with non-core courses offered during the first year of study, students begin an examination of fundamental communication and critical thinking skills that apply across a wide range of disciplines and ensure the ability to make meaningful connections with non-specialist audiences on topics of increasing complexity. Core courses in Technical Communication and Business Development for the Construction Industry help students to appreciate the role of stakeholders, to develop further techniques for communicating with specialists, and to provide some familiarity with the issues that could arise during their first work experience. Advanced core courses in Professional Portfolio Development and Scenarios in Team Leadership focus on the communication skills that are an integral part of obtaining and maintaining employment. These courses provide students with additional techniques and concepts that prepare them for the expectations they will encounter upon graduation.

Beyond specific courses that address communication skills, the need for effective communication of structured and coherent arguments is built into many of the courses through the assignments. Whether in the form of presentations, lab reports, technical reports, or seminars, students are expected to present and document their research findings in a manner that is consistent with the professional requirements of the discipline.

Application of Knowledge

The proposed Bachelor of Building Science program integrates theoretical knowledge with practical applications throughout the program. Courses have been designed to keep established techniques in close contact with the related theories and concepts. The ACCE building is a tremendous resource in this area because the integrated data gathering tools provide primary source data for both quantitative and qualitative evaluation. Access to this information contributes to the development of analytical skills that can be combined with related scholarly work and modeling and simulation techniques to solve problems and propose solutions.

Technology plays an important role in the program as a tool for the collection and presentation of data. Students begin with common tools that are used across a number of disciplines and continue to develop expertise with those software applications in a variety of contexts. In subsequent years, students work with more discipline-specific tools and software as they evaluate more complex situations that can involve the components of a building or the building as a whole. Courses like Building Information Modeling, Advanced Modeling and Simulation, and Applied Energy Management are key examples of points in the program where students demonstrate their application of knowledge from the recognition and use of underlying principles through the framing of questions to the proposing of solutions. These courses and others like them ensure that students are able to meet or exceed the expectations of the final year Building Science Research Project, the capstone project for this proposed degree-level program.

Moreover, the program is structured to prepare students for progressive levels of responsibility in their work experiences. The first work experience, then, allows students to bring together the knowledge and skills developed over the first two years of the program. Through the lens of real-world experience, the application of concepts and principles from within and outside the discipline is understood as a necessary component of success in the workplace. Over the third year of the program, work experience merges with more advanced theories and concepts to prepare students for increased responsibility, as determined by their more developed ability to make sound judgments, propose solutions, and solve problems.

Professional Capacity/Autonomy

As a discipline driven by professional reputation and relying heavily on the autonomy and integrity of its practitioners, this category of the Board's standard has been built into the program through the following degree-level learning outcomes:

- facilitate partnerships and productive interactions within project teams that involve knowledge-workers and skilled trade workers.
- ensure work, activities, and practice are in compliance with established ethical and professional standards, as well as local, provincial, and national legislation.
- adapt to changes in employment requirements through the development, implementation, and updating of professional and personal development plans.

While it is true that certain courses within the program play a much stronger role in the demonstration of these outcomes, they are threaded throughout the program and integral to the two work experiences and the capstone Building Science Research Project in the final year. As such, group work is an important part of the program from the very beginning and problem-based learning emerges as an instructional methodology in the final two years of the program. Both of these approaches support the qualities and transferable skills that position graduates for fulfilling contributions in and beyond their employment.

Finally, non-core courses for the program have been developed to support and encourage a broader intellectual engagement with not only their local community, but also the global community as it continues to grow and evolve. Students, then, develop a sense of personal responsibility and accountability within an inclusive civic discourse that is the hallmark of a degree-level education.

Awareness of Limits of Knowledge

From the beginning of the program, students engage with the uncertainty, ambiguity, and limits to knowledge. The far-reaching results of errors in construction applications place a greater focus on the assessment and mitigation of risk. In order to deal with risk effectively and professionally, students develop a firm awareness of their role within an integrated project team.

Courses, especially in first year, are structured to introduce students to a number of scientific and engineering principles. Though widely used, there are varying degrees of certainty surrounding the use and application of these principles. Uncertainty is then connected to experimental design as a means of updating and adapting approaches to solving problems.

Using a stronger, adapted model for simulation exercises, students move into more complex topics and systems as they progress through the program. With supervision, students are able to gauge the effect of experimental variables and design constraints on the results that they receive. This, in turn, requires them to consider the stability of their interpretations and their approach to analysis. In both a repetitive and increasingly complex fashion, the program presents the students with learning opportunities that re-enforce the necessary realization for appreciating the limits of knowledge: that each problem must be faced as a unique or novel challenge because errors emerge from the differences between problems, not the similarities.

Section 3: Admission, Promotion, and Graduation

The requirements for admission are appropriate to the learning outcomes of the program and the degree level standard. The minimum admission requirements stipulated for a bachelor's program are met. An Ontario Secondary School Diploma or equivalent and six university or university/college courses are required at the Grade 12 level, with a minimum average of 65% as per the benchmark, along with a minimum grade of 70% for the required courses. Admission procedures are further outlined in Policy AA04: Admissions.

Section 3.1: Admission Requirements for Direct Entry

Direct entry and or mature student applicants for the proposed Bachelor of Building Science program must demonstrate achievement of the admission requirements outlined in the table below as per the benchmarks.

	Program Admission Requirements

Academic	• Ontario Secondary School Diploma (OSSD) or equivalent with a minimum of six Grade 12 university (U) or university/college (M) courses.
	• The six Grade 12 credits to include
	  ○ one Grade 12 U English course,
	  ○ one Grade 12 U Mathematics course, and
	  ○ one Grade 12 U Science course (Physics preferred).
	• A minimum grade of 70% in the required courses and an overall average of 65% in the six Grade 12 U, or M courses.
	
	(Ontario Academic Courses (OAC) can replace or be used in combination with U or M courses.)

Related work/volunteer experience	Not Applicable
Other (e.g., portfolio, specialized testing, interview, G.R.E., etc.)	Not Applicable
Requirements for mature students *(19 years of age or older and without a high school diploma at the start of the program)*	Mature students are applicants who have not achieved the Ontario Secondary School Diploma (OSSD) or its equivalent and who are at least 19 years of age on or before the commencement of the program in which they intend to enrol. Mature students have demonstrated academic abilities equivalent to those of Ontario high school graduates, verified by successful completion of courses at the postsecondary level.

Section 3.2: Admission Policies and Procedures for Mature Students

Mature student admission requirements are noted below:

Requirements for mature students *(19 years of age or older and without a high school diploma at the start of the program)*	Mature students are applicants who have not achieved the Ontario Secondary School Diploma (OSSD) or its equivalent and who are at least 19 years of age on or before the commencement of the program in which they intend to enrol. Mature students have demonstrated academic abilities equivalent to those of Ontario high school graduates, verified by successful completion of courses at the postsecondary level.

The electronic policies file (Section 16: Policies), includes policies and procedures pertaining to the admission of mature students within the following:
Policy AA04: Admissions

Introductory Note Regarding (Section16: Policies) Electronic Policies File

Policies, directives and procedures are key documents which drive the day-to-day operations within any academic institution, Algonquin College being no exception. The College recognized that its existing directives required enhancement to a common format and identified it would benefit from consistent guidelines on the expected content of its policies. All College policies (previously called directives) are under review and redesign, and are being revised and formatted for consistency. The term *directive is* being retired. ***As such, the policy classification nomenclature is in flux.***The approval of the new Policy AN01: Administration of College Policies in February 2010 served as the official starting point of the policy review initiative to review, revise and re-classify existing policies and directives. The resulting documents are known as policies, and are categorized under explanatory sub-headings:

1. AA Academic Affairs
2. AC Accessibility
3. AD Administration
4. HR Human Resources
5. HS Health Safety and Security
6. PM Property Management
7. RE Research
8. SA Student Affairs

Following the framework provided by Policy AN01: Administration of College Policies, all College directives are being systematically reviewed and updated. Each resulting policy follows a standard template for content, has a visible mandatory revision date, and is accessible electronically from the College website at http://www2.algonquincollege.com/directives/. Policies included in (Section 16: Policies) Electronic Policies file are the most current available on the date of submission.

Section 3.3: Promotion and Graduation Requirements

Policies governing academic remediation, sanctions, and suspension for students who do not meet minimum achievement requirements are detailed broadly in Policy E29, Program Progression and Graduation Requirements. Individual course outlines specify course and/or program specific promotion requirements as well as requirements for supplemental exams where available. Policy E11, Grading System, provides details on the College's grading System that are easily understandable, meaningful and convertible to other postsecondary institutions and employers through the use of designated percent, letter, and numeric grade equivalents. Of note, is that the minimum pass grade for the Bachelor of Building Science program non-core and core courses differs from the College standard of 50%. The Grading System Policy allows for these variances as per the following excerpt:

> *… In some courses students may be required to achieve more than a minimal level of achievement in order to proceed in their program. For those courses, the course outline will stipulate the progression requirements, as will the supplementary program regulations. (E11 Excerpt p.2)*

The grading system also allows for a Grade Point Average (GPA) calculation as follows:

The grade point average is a weighted average. It is calculated as follows:

- *Each course is designated as having normative total instructional hours; that is the designated number of hours within which the course objectives may be achieved, regardless of variations in delivery. The number of grade points per course is determined by multiplying the normative total instructional hours of the course by the numeric value of the grade earned in that course. The resultant figure is called the grade point total.*
- *The grade point total is divided by the total number of normative instructional hours attempted for courses with grades having numeric value. Please note in such a computation '0' (F) is a numeric value. The resultant quotient is the grade point average.*

$$\frac{\text{Grade Point Total}}{\text{Total Normative Hours}} = \text{Grade Point Average (G.P.A.)}$$

(E11 Excerpt p.3)

Policy E33: Course Outlines and Course Section Information, includes provisions to ensure that regardless of the grading scheme, grades for acceptable performance correspond to student work that demonstrates the degree level standard has been achieved through alignment with degree level program outcomes and course learning requirements. Furthermore, the evaluation methods or instruments are linked directly to the course learning requirements being addressed in the course.

The proposed Bachelor of Building Science program promotion and graduation requirements have been aligned to meet the benchmark requirements depicted in the following table:

Program Requirement	Level of Achievement	
	Promotion	Graduation
Minimum overall average acceptable achievement in discipline-related requirements	**C- (60-62%)**	**C- (60-62%)**
Level of overall achievement expected in the core discipline(s) of study	**C (63-66%)**	**C (63-66%)**
Co-op Work Term	**Pass**	**Pass**
Minimum overall acceptable achievement for progression (across all degree requirements, including the breadth and discipline-related requirements)	**C- (60-62%)**	**C- (60-62%)**

Several policies govern promotion and graduation requirements. The electronic policies file (Section 16: Policies), includes policies and procedures pertaining to the promotion and graduation requirements within the following:

Policy AA13: Evaluation of Student Learning
Policy E11: Grading System
Policy E29: Program Progression and Graduation Requirements
Policy E31: Academic Advising
Policy E33: Course Outlines and Course Section Information

Section 3.4: Advanced Standing Policies and Requirements

Options for advanced standing and credit recognition are available to students with well established policies available to detail procedures and eligibility requirements. Respecting the guidelines set by the Postsecondary Education Quality Assessment Board, there is a limit on the number of credits to be awarded to diploma level study toward the degree program (excluding any work experience or internship requirements) such that the advanced standing is not to exceed:

- 65% degree level credit for a 4-year degree program from a completed 3-year diploma program; and,
- 40% degree level credit for a 4-year degree program from a completed 2-year diploma program.

The degree completion arrangements proposed which follow confirm that the limit on the number of credits to be awarded is respected.

Degree Completion Arrangements

Degree completion arrangements have been developed for five (5) Ontario College Credentials in a related field and that have program-level outcomes that ladder reasonably into the proposed degree-level learning outcomes. The following table provides the relevant admission information for those entering the proposed Bachelor of Building Science program through one of the five degree completion arrangements (See Table 3.4.1: Admission Details for Degree Completion Arrangements).

Table 3.4.1: Admission Details for Degree Completion Arrangements

	Program of Non-Degree Study	Courses Students Receive Towards The Degree	Special Requirements For Entry Into Arrangement	Point of Entry Into the Degree Program
1	***Architectural Technician*** Ontario College Diploma	14	An overall GPA of 2.7 (70%) minimum	Year 2, Semester 3
2	***Architectural Technology*** Ontario College Advanced Diploma	25	An overall GPA of 2.7 (70%) minimum & 560 hours of related work experience.	Year 3, Semester 5
3	***Construction Engineering Technician*** Ontario College Diploma	14	An overall GPA of 2.7 (70%) minimum	Year 2, Semester 3
4	***Civil Engineering Technology*** Ontario College Advanced Diploma	25	An overall GPA of 2.7 (70%) minimum & 560 hours of related work experience.	Year 3, Semester 5

Table 3.4.1: Admission Details for Degree Completion Arrangements

	Program of Non-Degree Study	Courses Students Receive Towards The Degree	Special Requirements For Entry Into Arrangement	Point of Entry Into the Degree Program
5	***Mechanical Engineering Technology*** Ontario College Advanced Diploma	13[3]	An overall GPA of 2.7 (70%) minimum	Year 2, Semester 3 with Bridging Course as an additional course in Semester 3

Students following one of these degree completion arrangements receive credit for either

- the first year of study (Ontario College Diploma programs) or
- the first and second year of study (Ontario College Advanced Diploma programs).

In addition, students receive credit for two (2) additional free elective choices that are part of the non-core curriculum. This is based on the General Education Requirement outlined in the Credentials Framework that is part of the Framework for Programs of Instruction Minister's Binding Policy Directive, and applies to all Ontario college credentials.

These degree completion arrangements comply with the Board's benchmarks surrounding advanced standing. Students entering the proposed program after completion of an Ontario College Advanced Diploma in Mechanical Engineering Technology (3-year diploma program) are awarded 30% degree level credit. Those entering after completion of an Ontario College Diploma in either Architectural Technician or Construction Engineering Technician (2-year diploma program) are awarded 32% degree level credit. Finally, those entering after completion of either an Ontario College Advanced Diploma in Architectural Technology or Civil Engineering Technology (3-year diploma program) are awarded 58% degree level credit.

The gap analysis (See Section 4.10: Gap Analysis) for each program of prior study demonstrates the means by which the degree program learning outcomes are met.

Advanced placement based on prior learning assessment is feasible with the understanding that degree program Prior Learning Assessment and Recognition (PLAR) candidates can be awarded no more than fifty percent (50%) of the total number of hours of the program of study based on PLAR. The eligibility criteria and procedures for PLAR are detailed in Policy E35.

The electronic policies file (Section 16: Policies), includes policies and procedures pertaining to advanced standing within the following:

Policy AA05: Advanced Standing
Policy AA06: Prior Learning Assessment and Recognition
Policy AA10: Transfer of Academic Credit (External)
Policy E9: Transfer of Academic Credit (Internal)

3 Students following a degree completion arrangement after graduating with an Ontario College Advanced Diploma in Mechanical Engineering Technology need to take one (1) bridging course that is part of the first year of study in the program. As a result, they receive one less credit than those following other degree completion arrangements.

Section 4: Program Content

This section with its subsequent sub-sections of supporting material demonstrates the rigor, breadth and depth that has been built into the proposed Bachelor of Building Science program to ensure that the program is consistent with the degree-level standard. The supporting materials speak to all twelve (12) of the Board's benchmarks for program content.

Throughout the development of the program, the degree-level standard and the Board's benchmarks have been a constant reference point. In fact, the decision to undertake the development of the proposed Bachelor of Building Science program was based not only on the employer demand for graduates in this discipline, but also on the natural alignment between the field of practice and the degree-level standards. Building science, as a discipline, is based on a balance of theory and practice and so the program needs to follow suit in order for graduates to be prepared for employment. The development has also adopted a layered approach where each consecutive year of study adds complexity to the knowledge and skills from previous years. Each year of the program includes at least one course that maintains a focus on the building as a system so that students do not lost sight of the integrated nature of current knowledge in building science: the components and systems must work together seamlessly for the building to be efficient.

The eleven (11) program learning outcomes are in line with these included in similar programs in Ontario. With the content related to sustainability and energy use and efficiency, graduates are well prepared for entry into their field of practice. As a discipline, there is no specific professional accreditation required for those working in the construction industry or construction-related industries. There are a variety of professional associations that represent the industry and its members and a number of these have provided letters of support for the proposed Bachelor of Building Science program (See Section 4.2: Professional Accreditation).

The structure of the program and the courses that make up the program of study have been designed for the achievement and demonstration of the learning outcomes that describe the knowledge and skills of graduates. As a result, the proposed program strikes a reasonable balance for the time spent on content that is appropriate to the stated learning outcomes. No one knowledge area within the discipline takes precedence over another and as students move through the first work experience and into the final two years of study, there is increased emphasis placed on using a variety of knowledge, skills and attitudes to solve current and emerging problems in the discipline. To further prepare students for their work experiences and future employment, a wide range of assessments are built into the courses that are a part of the proposed program of study. These assessments are aligned with the outcomes for each course (See Section 4.7: Course Outlines) to ensure that there is ample demonstration of stated outcomes and that students have consistent, regular, and meaningful feedback on their achievement levels.

It is, however, the work experiences that provide students with the most information about their ability to apply knowledge and skills in practice and their direction for future studies both within and beyond the program. The two fourteen-week work experiences, one between second year and third year, and one between third year and fourth year (See Section 4.6: Work Experience) allow students to connect their expanding knowledge and skills to the workplace. The articulated outcomes for each work experience speak to a progression in responsibility and performance as students move towards graduation. At the same time, the assessment methods

that are in place call upon the knowledge from both the core courses and the substantive and current content presented in the non-core curriculum.

The breadth requirement for the proposed Bachelor of Building Science program not only adheres to the Board's benchmarks for the balance of core and non-core studies, but it also does so to the benefit of the graduates and the broader community of which the graduates will be a part. This has been made possible through the development of detailed, focused non-core courses that, in addition to providing elective choices, demonstrate a serious commitment to the transferable skills found in a variety of modes of analysis outside the core field of study. Students have access to breadth and depth in their non-core studies. The learning opportunities in mandatory non-core courses ensure that students develop more than an introductory knowledge in a range of disciplines (See Section 4.7.2: Non-core Courses and Section 4.7.3: Elective Courses). Beginning in the first year, communication skills and critical thinking are addressed in discrete courses, and the development of these this knowledge and these skills are encouraged throughout the program. Using these skills, students have the opportunity through other mandatory non-core courses and free electives to examine society and culture in a way that will support civic engagement. Content related to Ontario and Canada will play a substantial role in this examination, but the realities of a global marketplace are also a part of the current knowledge in the breadth studies.

The Program Advisory Committee has provided additional assurance that the appropriate levels of Ontario and Canadian content are in place throughout the entire program, in both non-core and core courses. These experts in the field, employers and industry representatives have confirmed the currency of the curriculum and its relevance to the field. Moreover, they have unanimously endorsed the program (See Section 4.1: Program Advisory Committee).

The remainder of this section contains the supporting materials that provide the direct evidence of the ways in which the curriculum for the proposed Bachelor of Building Science program meets the Board's requirements.

Section 4.1: Program Advisory Committee

Name, Occupation	Employer	Related Credentials	Professional Affiliations
Stephen Pope, Architect	Sustainable Buildings & Communities, CanmetENERGY, NRC	CaGBC Ottawa Region Chapter (founding member)	OAA (member), RAIC (fellow)
Clément Guénard, Designer	Arborus Consulting	Diploma Architectural Technology, qualified as a designer under subsection 2.17.4 Ontario Building Code (BCIN # 24967), LEED AP BD+C	
George Torok, Building Consultant	GRG Building Consultants Inc.	Bachelor of Technology, Architectural Science (Ryerson), Certified Engineering Technologist (C.E.T., OACETT), Building Science Specialist Ontario (BSSO, Ontario Building Envelope Council, OBEC)	Member, Past President, OBEC; Member, Board of Directors, Building Envelope Council Ottawa Region (BECOR); Technical Advisor, Executive Committee, Siding and Window Dealers Association of Canada (SAWDAC)
Susan Keenliside, BIM Advisor	BIMSolutions, Inc., Department of National Defense	BA (Environment & Development), McGill University; Certificate of Architecture, Ryerson University; LEED AP; Autodesk Revit Certified Professional	CaGBC; buildingSMART Alliance
Melissa Creede, Consultant, Professional Engineer	Sapis Insight	Consultant in the Green Economy (energy, sustainability); 12 years hiring young professionals in Green Economy; former executive in sustainability/climate change	Professional Engineers of Ontario
Bill Wong, Professional Engineer	SAIC Canada	MASc, University of Toronto MBA, University of Ottawa	PEO Association of Energy Engineers (AEE)
Posy Healey, Inside Contracting Sales	HTS Engineering	LEED AP	
Erika Mayer, Sustainable Building Consultant	President, Lunchbox Consulting Inc.	Bachelor of Architecture Bachelor of Arts, English LEED AP BD+C	MRAIC

Name, Occupation	Employer	Related Credentials	Professional Affiliations
Penny Dockrill, Recruitment Manager	PCL Constructors Canada Inc.	Bachelor of Arts, Psychology Diploma in Social Service Worker	
Dany Levasseur, Regional Director	BLJC Facility Management Services	Bachelor of Architecture	MRAIC
Gary Schaefer, Director of Design	Tamarack Homes	Design Experience since 1964; employed in current position for the last 11 years	
Alex Leung, Architect	GRC Architects, Inc.	Bachelor of Architecture, Dip. B.T.	OAA, MRAIC, ORSA
Robin Hutcheson, Company President, Energy Engineer	Arborus Consulting, Inc.	Professional Engineer, LEED AP	Professional Engineers of Ontario, Canada Green Building Council (GBCI)

As a result of a recommendation from Algonquin's President's Executive Committee the program title was revised to **Bachelor of Building Science** from Bachelor of Applied Technology (Building Science). It was agreed that the revised title would be more easily understood and marketable. Advisory Committee support for the nomenclature revision was obtained in January 2011, confirmed via the email communications here captured *(emails excluded for web version):*

Building Science Advisory Committee

October 25, 2010

Draft Minutes

Present:	A. Leung, P. Dockrill, M. Pasini, E. Mayer, S. Keenliside, J. Moore, D. Levasseur, G. Schafer, W. Wong, G. Torok, M. Creede
Regrets:	R. Hutcheson, S. Cheer, S, Pope, P. Healey, J. McKay
College Resource People:	V. Coligan, Chair; M. Parra, Subject Matter Expert; D. Galway, Faculty; C. Guénard, Other than Full-time Faculty

Opening and Introductions

1. V. Coligan opened the meeting at 6:15 pm.

2. Roundtable introductions were completed.

Program Advisory Committee Membership Roles and Responsibilities

3. V. Coligan reviewed directive A1 with the committee. As part of the overview of the roles and responsibilities of the Program Advisory Committee (PAC), the time commitment required and the general topics of discussion were discussed. The interactive nature of the PAC's connection with the department and the College as a whole was re-enforced.

   The general model for terms of membership was highlighted, along with the need to establish a Chair for the committee. The role of College staff as resource people was underlined. Members were informed about the requirement for the annual advisory committee report, and the responsibility of the Chair for drafting this report for committee discussion and approval.

   Questions related to the role of Other than Full-time Faculty with respect to the Advisory Committee were clarified.

   Members took time to review the directive and complete the appointment forms.

   ACTION: Chair to be elected by membership at next meeting.

Proposal Status and Timelines

4. D. Galway provided an overview of the proposal status along with the related timelines
   - **March 10, 2010** – First focus group meeting to look at industry trends, and receive input on draft degree-level learning outcomes.
   - **April 15, 2010** – Curriculum Review Committee (CRC) grants Intermediate approval for program proposal.
   - **May 11, 2010** – Second focus group meeting to review and comment on Intermediate program proposal, including proposed program of study.
   - **October 25, 2010** – Advisory Committee Meeting to review draft Final program proposal and consider motion of support for program.
   - **November 4, 2010** – Target CRC meeting to present program for Final approval.

- **December 13, 2010** – Target Board of Governors (BOG) meeting to seek approval to offer program.
- **Late January/Early February 2011** – Target timeline for submitting program proposal to Post-Secondary Education Quality Assurance Board (PEQAB).

An overview of the changes to the program of study from the Intermediate proposal to the Final proposal was provided.

Questions emerged from the members about the role of graduates in the workplace. Discussion took place with additional information and clarification being provided by M. Parra and D. Galway.

As the discussion grew, it was decided that a more systematic look through the proposal would be practical.

Discussion of draft Final Proposal

5. D. Galway led members through the program of study providing some of the background planning that was not evident in the CRC proposal Template.

   M. Creede inquired about the admission requirements. The requirement of a single math and a single science course was of concern from the perspective of student preparedness for the program. On-going initiatives within the College to support students in the improvement of their literacy and numeracy skills were discussed.

   J. Moore queried the parallels between this program's admission requirements and comparable university programs. It was understood that there was some variation in requirements, but that the overall difference in admission requirements was more likely to be in the average mark required for admission.

   G. Schafer identified the Botany and Introduction to Criminology courses, and wondered about their role in the program. The PEQAB requirements for core and non-core courses was explained, and the non-core courses in the program, along with the free electives were listed.

   A. Leung recommended a History course as a valuable asset for today's students. Other committee members supported this idea. The development of the breadth requirement for existing and proposed degrees was explained. It was suggested that this recommendation could be shared with other degree development teams.

   ACTION: D. Galway to share recommendation with Academic Development.

   Once the program of study had been reviewed with members, discussion about the balance of topics and specific courses began.

   There was a feeling that the program had a heavy emphasis on energy and sustainability ("Green") topics. M. Parra provided details on the decisions in these areas, as well as some of the plans for the delivery of the specific courses. Members had some comfort with this material, but wanted to ensure that the fundamentals were adequately in place to ensure that this program would not perpetuate current challenges faced within the industry. The

goal needs to be an integrated approach to building design. The use of tools and technology in isolation leads to additional work and expense.

Annual curriculum review processes along with the modifications that take place in course delivery as the knowledge base evolves were discussed with members.

Members recognized that the discussion of specific courses could continue for quite some time.

There was agreement among the members that the program, as a whole, addresses a need in the industry and that the program, based on the information available, could be supported.

ACTION: Share specific course outlines with Advisory Committee when they are available.

Motion of Support

6. RESOLUTION:
   MOVED and SECONDED: W. Wong and J. Moore
   that the Building Science Advisory Committee has reviewed the curriculum as generally presented for the Bachelor of Applied Technology (Building Science) program, and supports the need for this program in the community, and recommends this program for approval to the President's Executive Committee and to the Board of Governors.

   The motion received unanimous support from the members.

Closure

7. V. Coligan thanked the members for their input and their valuable contribution of time to this program. The work completed to date by M. Parra, and D. Galway was also recognized.

The meeting adjourned at approximately 8:10 pm.

Section 4.2: Professional Accreditation

Although there are no officially recognized Building Science accreditation requirements, the following organizations represent the industry both in Ottawa and in Canada and, where indicated, identify standards of practice. Please also refer to Section 7: Credential Recognition where several of these bodies have indicated that they will recognize the credential being proposed by Algonquin College.

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

According to its web site, this society

> is an international organization … [and] fulfils its mission of advancing heating, ventilation, air conditioning and refrigeration to serve humanity and promote a sustainable world through research, standards writing, publishing and continuing education.[4]

The vision statement for this organization indicates the contribution it makes within the industry:

> ASHRAE will be the global leader, the foremost source of technical and educational information, and the primary provider of opportunity for professional growth in the arts and sciences of heating, ventilating, air conditioning and refrigerating. [5]

Canadian Association for Renewable Energies (c.a.r.e.)

According to its web site, this association

> was federally incorporated as a not-for-profit in March 1998, with a mandate to promote feasible applications of renewable energies. 'TRENDS in Renewable Energies' was launched in 1997 to provide an overview of renewable energy developments in Canada, and expanded in 2000 to produce the 'Solar Access' news for the U.S. and then, in 2002, to produce 'Refocus Weekly' for 28,000 global subscribers. C.A.R.E. still produces its daily news service on renewables in Canada, which is circulated without charge to 1,000 subscribers, while full story details and hyperlinks are provided each day to the growing list of members and paid subscribers.[6]

4 ASHRAE, "About Us," [ONLINE] (2010) Available: http://www.ashrae.org/aboutus/

5 ASHRAE, "About Us," [ONLINE] (2010) Available: http://www.ashrae.org/aboutus/

6 c.a.r.e., "Contact Section," [ONLINE] (2011) Available: http://www.renewables.ca/contact/contact.php

Canadian Construction Association (CCA)

Established in Ottawa in 1918, this association

> used their collective strength to shine a light on industry relationships and practices, standards for business ethics, education and labour matters. Their efforts have had a powerful voice and a source of support for the Canadian industry.[7]

Canada Green Building Council

This national group seeks to

lead and accelerate the transformation to high-performing, healthy green buildings, homes and communities throughout Canada.[8]

With this goal in mind,

> The Council will work to:
>
> - change industry standards,
> - develop best design practices and guidelines,
> - advocate for green buildings, and
> - develop educational tools to support its members in implementing sustainable design and construction practices. [9]

Canadian Housing and Renewal Association (CHRA)

According to its web site, this association

> is the only national voice in Canada speaking on the full range of issues related to affordable housing here and abroad; and we centre everything we do around four key pillars:
>
> - Keeping homes affordable
> - Ending homelessness
> - Renewing our communities
> - Supporting a sustainable housing profession[10]

7 Canadian Construction Association, "CCA Overview," [ONLINE] (2010) Available: http://www.cca-acc.com/overview/about/about_e.asp

8 CaGBC, "Our Mission," [ONLINE] (n.d.) Available: http://www.cagbc.org/AM/Template.cfm?Section=The_CaGBC

9 CaGBC, "Our Mission," [ONLINE] (n.d.) Available: http://www.cagbc.org/AM/Template.cfm?Section=The_CaGBC

10 CHRA, "about chra," [ONLINE] (2011) Available: http://chra-achru.ca/en/index.php/about-chra/about-chra/

Canada Mortgage and Housing Corporation (CMHC)

This corporation

> is Canada's national housing agency. Established as a government-owned corporation in 1946 to address Canada's post-war housing shortage, the agency is the country's foremost provider of mortgage loan insurance, mortgage-backed securities, housing policy and programs, and housing research.[11]

In more practical terms,

> CMHC works to enhance Canada's housing finance options, assist Canadians who cannot afford housing in the private market, improve building standards and housing construction, and provide policymakers with the information and analysis they need to sustain a vibrant housing market in Canada. [12]

Engineering Institute of Canada (EIC)

This institute has a wide range of objectives related to engineering in Canada. Captured in the organizations by-laws, they seek, among other things,

> To promote interaction between specific interest groups (societies, associations, government and other agencies) on national and international issues of social, economic, political, legal and human concern relevant to engineering; to develop information for both technical and public interest; to present this information along with recommendations to appropriate government and other agencies.[13]

Greater Ottawa Home Builder's Association (GOHBA)

This association has

> a vision of a strong and positive role for the housing industry; and a commitment to support the professionalism of [its] members; and provide affordability, quality and choice for consumers.[14]

11 CMHC, "About CMHC," [ONLINE] (2011) Available: http://www.cmhc-schl.gc.ca/en/corp/about/index.cfm

12 CMHC, "About CMHC," [ONLINE] (2011) Available: http://www.cmhc-schl.gc.ca/en/corp/about/index.cfm

13 Engineering Institute of Canada, "BY-LAWS," [ONLINE] (June 1999) Available: http://www.eic-ici.ca/bylaws06-99.pdf

14 Greater Ottawa Home Builders' Association, "Home," [ONLINE] (2009) Available: http://www.gohba.ca/

Ottawa Construction Association (OCA)

According to its web site, this association makes a valuable contribution to the local industry:

> Founded in 1889, the Ottawa Construction Association today is the third-largest regional construction association in Canada and the voice of Ottawa's non-residential construction industry.
>
> …
>
> We are an effective voice for our members before all levels of government, promoting suitable and desirable legislation affecting the construction industry. We work to maintain and promote industry best practices that, if followed, promote business decisions and relationships that respect the principles of fairness, ethics and teamwork and service to minimize costly misunderstandings, disputes and delays in the construction industry.[15]

The Ottawa Regional Society of Architects (ORSA)

According to its web site, this society

> is a non-profit volunteer organization and a society for the Ontario Association of Architects (OAA). It provides a forum for free discussion about professional matters; a focus in the community for activities involving architects; and a centre for educational, community, and social activities of its members.
>
> As a point of contact between the general public and the architectural profession, ORSA is actively involved in programs which enhance the general level of understanding of architecture and the architectural profession. It also assists the OAA Council in examining matters of interest to the profession throughout Ontario.[16]

Society of Energy Professionals (SEP)

According to its web site, this society

> represents more than 7,000 professional employees in the electricity industry in Ontario, including engineers, scientists, supervisors, finance specialists, and many others. Originally formed in 1948, [they have] been making improvements to the industry for more than fifty years. [They are] very concerned about the state of Ontario's electricity system: very little new generation has been built since the mid-80s, and we're rapidly approaching a supply-demand crunch.[17]

15 The Ottawa Construction Association, "About OCA," [ONLINE] (2006) Available: http://www.oca.ca/about/index.php

16 Ottawa Regional Society of Architects, "Home," [ONLINE] (2005) Available: http://www.orsa.ca/

17 Society of Energy Professionals, "About Us," [ONLINE] (2011) Available: http://www.thesociety.ca/secondmenu/aboutus/index.html

Section 4.3: Learning Outcomes

The proposed Bachelor of Building Science program has been developed to meet the following eleven (11) degree level learning outcomes:

Degree Level Learning Outcomes:

1. Integrate sustainable building practices and alternative energy solutions and present options that balance client specifications, site conditions, and human factors.
2. Use sound, acceptable engineering principles for the solution and documentation of situations encountered during the construction or rehabilitation of buildings.
3. Communicate effectively with all project stakeholders.
4. Read, interpret, and, with direction, modify documents related to building plans, including working drawings that involve structural, electrical, and mechanical features.
5. Formulate strategies for the efficient and effective commissioning and operation of buildings and building systems.
6. Evaluate the practical applications of primary and secondary theoretical research related to existing and emerging construction methods and materials.
7. Analyze, test, and comment on the functionality of alternative structural, mechanical, and electrical solutions proposed for integration in both new projects and renovations.
8. Contribute to the on-going economic viability of construction and engineering projects through the application of principles of estimating, accounting, and cost controls.
9. Facilitate partnerships and productive interactions within project teams that involve knowledge-workers and skilled trade workers.
10. Ensure work, activities, and practice are in compliance with established ethical and professional standards, as well as local, provincial, and national legislation.
11. Adapt to changes in employment requirements through the development, implementation, and updating of professional and personal development plans.

Alignment of Program Learning Outcomes with Degree Level Standard

	1. Depth and Breadth of Knowledge						2. Know-ledge of Methods	3. Application of Knowledge			4. Communi-cation Skills	5. Aware-ness of Limits of Know-ledge	6. Professional Capacity Autonomy		
	a)	b)	c)	d)	e)	f)		a)	b)	c)			a)	b)	c)
Degree level Learning Outcomes	Developed knowledge of key concepts, methodologies, current advances, theoretical approaches and assumptions in the discipline and in a specialized area of a discipline	Inter- and Intra-disciplinary knowledge and relationships	Research, analysis and assessment of hypotheses relevant to one or more of the major fields in a discipline	Research experience in an area of the discipline	Critical thinking and analytical skills inside and outside the discipline	Learning outside the discipline	Methods of enquiry or creative activity, or both, in their primary area of study. (evaluate and devise arguments, and comment on scholarship)	Critical use of qualitative and quantitative information	Use a range of established techniques	Critical use of scholarly reviews and primary sources	Communicate accurately and reliably, orally and in writing, to a range of audiences	Appreciation of the limits to their own knowledge and ability, of ambiguity and the limits to knowledge as it influences analyses and interpretations	Qualities and transferable skills in the area of personal and interpersonal skills	Manage lifelong learning, personally and professionally	Academic integrity and social responsibility
1. Integrate sustainable building practices and alternative energy solutions and present options that balance client specifications, site conditions, and human factors	X			X			X		X	X	X	X			X

	1. Depth and Breadth of Knowledge						2. Know-ledge of Methods	3. Application of Knowledge			4. Communi-cation Skills	5. Aware-ness of Limits of Know-ledge	6. Professional Capacity Autonomy		
	a)	b)	c)	d)	e)	f)		a)	b)	c)			a)	b)	c)
Degree level Learning Outcomes	Developed knowledge of key concepts, methodologies, current advances, theoretical approaches and assumptions in the discipline and in a specialized area of a discipline	Inter- and Intra-disciplinary knowledge and relationships	Research, analysis and assessment of hypotheses relevant to one or more of the major fields in a discipline	Research experience in an area of the discipline	Critical thinking and analytical skills inside and outside the discipline	Learning outside the discipline	Methods of enquiry or creative activity, or both, in their primary area of study. (evaluate and devise arguments, and comment on scholarship)	Critical use of qualitative and quantitative information	Use a range of established techniques	Critical use of scholarly reviews and primary sources	Communicate accurately and reliably, orally and in writing, to a range of audiences	Appreciation of the limits to their own knowledge and ability, of ambiguity and the limits to knowledge as it influences analyses and interpretations	Qualities and transferable skills in the area of personal and interpersonal skills	Manage lifelong learning, personally and professionally	Academic integrity and social responsibility
2. Use sound, acceptable engineering principles for the solution and documentation of situations encountered during the construction or rehabilitation of buildings.	X				X		X	X	X			X			
3. Communicate effectively with all project stakeholders.								X			X		X		X

	1. Depth and Breadth of Knowledge						2. Know-ledge of Methods	3. Application of Knowledge			4. Communi-cation Skills	5. Aware-ness of Limits of Know-ledge	6. Professional Capacity Autonomy		
	a)	b)	c)	d)	e)	f)		a)	b)	c)			a)	b)	c)
Degree level Learning Outcomes	Developed knowledge of key concepts, methodologies, current advances, theoretical approaches and assumptions in the discipline and in a specialized area of a discipline	Inter- and Intra-disciplinary knowledge and relationships	Research, analysis and assessment of hypotheses relevant to one or more of the major fields in a discipline	Research experience in an area of the discipline	Critical thinking and analytical skills inside and outside the discipline	Learning outside the discipline	Methods of enquiry or creative activity, or both, in their primary area of study. (evaluate and devise arguments, and comment on scholarship)	Critical use of qualitative and quantitative information	Use a range of established techniques	Critical use of scholarly reviews and primary sources	Communicate accurately and reliably, orally and in writing, to a range of audiences	Appreciation of the limits to their own knowledge and ability, of ambiguity and the limits to knowledge as it influences analyses and interpretations	Qualities and transferable skills in the area of personal and interpersonal skills	Manage lifelong learning, personally and professionally	Academic integrity and social responsibility
4. Read, interpret, and, with direction, modify documents related to building plans, including working drawings that involve structural, electrical, and mechanical features.		X			X		X		X			X			

	1. Depth and Breadth of Knowledge						2. Know-ledge of Methods	3. Application of Knowledge			4. Communi-cation Skills	5. Aware-ness of Limits of Know-ledge	6. Professional Capacity Autonomy		
	a)	b)	c)	d)	e)	f)		a)	b)	c)			a)	b)	c)
Degree level Learning Outcomes	Developed knowledge of key concepts, methodologies, current advances, theoretical approaches and assumptions in the discipline and in a specialized area of a discipline	Inter- and Intra-disciplinary knowledge and relationships	Research, analysis and assessment of hypotheses relevant to one or more of the major fields in a discipline	Research experience in an area of the discipline	Critical thinking and analytical skills inside and outside the discipline	Learning outside the discipline	Methods of enquiry or creative activity, or both, in their primary area of study. (evaluate and devise arguments, and comment on scholarship)	Critical use of qualitative and quantitative information	Use a range of established techniques	Critical use of scholarly reviews and primary sources	Communicate accurately and reliably, orally and in writing, to a range of audiences	Appreciation of the limits to their own knowledge and ability, of ambiguity and the limits to knowledge as it influences analyses and interpretations	Qualities and transferable skills in the area of personal and interpersonal skills	Manage lifelong learning, personally and professionally	Academic integrity and social responsibility
5. Formulate strategies for the efficient and effective commissioning and operation of buildings and building systems.	X		X		X			X	X						

	1. Depth and Breadth of Knowledge						2. Know-ledge of Methods	3. Application of Knowledge			4. Communi-cation Skills	5. Aware-ness of Limits of Know-ledge	6. Professional Capacity Autonomy		
	a)	b)	c)	d)	e)	f)		a)	b)	c)			a)	b)	c)
Degree level Learning Outcomes	Developed knowledge of key concepts, methodologies, current advances, theoretical approaches and assumptions in the discipline and in a specialized area of a discipline	Inter- and Intra-disciplinary knowledge and relationships	Research, analysis and assessment of hypotheses relevant to one or more of the major fields in a discipline	Research experience in an area of the discipline	Critical thinking and analytical skills inside and outside the discipline	Learning outside the discipline	Methods of enquiry or creative activity, or both, in their primary area of study. (evaluate and devise arguments, and comment on scholarship)	Critical use of qualitative and quantitative information	Use a range of established techniques	Critical use of scholarly reviews and primary sources	Communicate accurately and reliably, orally and in writing, to a range of audiences	Appreciation of the limits to their own knowledge and ability, of ambiguity and the limits to knowledge as it influences analyses and interpretations	Qualities and transferable skills in the area of personal and interpersonal skills	Manage lifelong learning, personally and professionally	Academic integrity and social responsibility
6. Evaluate the practical applications of primary and secondary theoretical research related to existing and emerging construction methods and materials.			X	X			X			X	X	X		X	

	1. Depth and Breadth of Knowledge						2. Know-ledge of Methods	3. Application of Knowledge			4. Communi-cation Skills	5. Aware-ness of Limits of Know-ledge	6. Professional Capacity Autonomy		
	a)	b)	c)	d)	e)	f)		a)	b)	c)			a)	b)	c)
Degree level Learning Outcomes	Developed knowledge of key concepts, methodologies, current advances, theoretical approaches and assumptions in the discipline and in a specialized area of a discipline	Inter- and Intra-disciplinary knowledge and relationships	Research, analysis and assessment of hypotheses relevant to one or more of the major fields in a discipline	Research experience in an area of the discipline	Critical thinking and analytical skills inside and outside the discipline	Learning outside the discipline	Methods of enquiry or creative activity, or both, in their primary area of study. (evaluate and devise arguments, and comment on scholarship)	Critical use of qualitative and quantitative information	Use a range of established techniques	Critical use of scholarly reviews and primary sources	Communicate accurately and reliably, orally and in writing, to a range of audiences	Appreciation of the limits to their own knowledge and ability, of ambiguity and the limits to knowledge as it influences analyses and interpretations	Qualities and transferable skills in the area of personal and interpersonal skills	Manage lifelong learning, personally and professionally	Academic integrity and social responsibility
7. Analyze, test, and comment on the functionality of alternative structural, mechanical, and electrical solutions proposed for integration in both new projects and renovations.		X			X				X	X		X			

Degree level Learning Outcomes	1. Depth and Breadth of Knowledge						2. Know-ledge of Methods	3. Application of Knowledge			4. Communi-cation Skills	5. Aware-ness of Limits of Know-ledge	6. Professional Capacity Autonomy		
	a)	b)	c)	d)	e)	f)		a)	b)	c)			a)	b)	c)
	Developed knowledge of key concepts, methodologies, current advances, theoretical approaches and assumptions in the discipline and in a specialized area of a discipline	Inter- and Intra-disciplinary knowledge and relationships	Research, analysis and assessment of hypotheses relevant to one or more of the major fields in a discipline	Research experience in an area of the discipline	Critical thinking and analytical skills inside and outside the discipline	Learning outside the discipline	Methods of enquiry or creative activity, or both, in their primary area of study. (evaluate and devise arguments, and comment on scholarship)	Critical use of qualitative and quantitative information	Use a range of established techniques	Critical use of scholarly reviews and primary sources	Communicate accurately and reliably, orally and in writing, to a range of audiences	Appreciation of the limits to their own knowledge and ability, of ambiguity and the limits to knowledge as it influences analyses and interpretations	Qualities and transferable skills in the area of personal and interpersonal skills	Manage lifelong learning, personally and professionally	Academic integrity and social responsibility
8. Contribute to the on-going economic viability of construction and engineering projects through the application of principles of estimating, accounting, and cost controls.	X	X			X			X	X			X			

Degree level Learning Outcomes	1. Depth and Breadth of Knowledge						2. Know-ledge of Methods	3. Application of Knowledge			4. Communi-cation Skills	5. Aware-ness of Limits of Know-ledge	6. Professional Capacity Autonomy		
	a)	b)	c)	d)	e)	f)		a)	b)	c)			a)	b)	c)
	Developed knowledge of key concepts, methodologies, current advances, theoretical approaches and assumptions in the discipline and in a specialized area of a discipline	Inter- and Intra-disciplinary knowledge and relationships	Research, analysis and assessment of hypotheses relevant to one or more of the major fields in a discipline	Research experience in an area of the discipline	Critical thinking and analytical skills inside and outside the discipline	Learning outside the discipline	Methods of enquiry or creative activity, or both, in their primary area of study. (evaluate and devise arguments, and comment on scholarship)	Critical use of qualitative and quantitative information	Use a range of established techniques	Critical use of scholarly reviews and primary sources	Communicate accurately and reliably, orally and in writing, to a range of audiences	Appreciation of the limits to their own knowledge and ability, of ambiguity and the limits to knowledge as it influences analyses and interpretations	Qualities and transferable skills in the area of personal and interpersonal skills	Manage lifelong learning, personally and professionally	Academic integrity and social responsibility
9. Facilitate partnerships and productive interactions within project teams that involve knowledge-workers and skilled trade workers.		X									X		X		
10. Ensure work, activities, and practice are in compliance with established ethical and professional standards, as well as local, provincial, and national legislation.												X	X		X

	1. Depth and Breadth of Knowledge						2. Know-ledge of Methods	3. Application of Knowledge			4. Communi-cation Skills	5. Aware-ness of Limits of Know-ledge	6. Professional Capacity Autonomy		
	a)	b)	c)	d)	e)	f)		a)	b)	c)			a)	b)	c)
Degree level Learning Outcomes	Developed knowledge of key concepts, methodologies, current advances, theoretical approaches and assumptions in the discipline and in a specialized area of a discipline	Inter- and Intra-disciplinary knowledge and relationships	Research, analysis and assessment of hypotheses relevant to one or more of the major fields in a discipline	Research experience in an area of the discipline	Critical thinking and analytical skills inside and outside the discipline	Learning outside the discipline	Methods of enquiry or creative activity, or both, in their primary area of study. (evaluate and devise arguments, and comment on scholarship)	Critical use of qualitative and quantitative information	Use a range of established techniques	Critical use of scholarly reviews and primary sources	Communicate accurately and reliably, orally and in writing, to a range of audiences	Appreciation of the limits to their own knowledge and ability, of ambiguity and the limits to knowledge as it influences analyses and interpretations	Qualities and transferable skills in the area of personal and interpersonal skills	Manage lifelong learning, personally and professionally	Academic integrity and social responsibility
11. Adapt to changes in employment requirements through the development, implementation, and updating of professional and personal development plans.							X							X	

Mapping of Core and Non-Core Courses to Degree Outcomes

Course Number	Course Name	1 Integrate sustainable building practices and alternative energy solutions and present options that balance client specifications, site conditions, and human factors.	2 Use sound, acceptable engineering principles for the solution and documentation of situations encountered during the construction or rehabilitation of buildings.	3 Communicate effectively with all project stakeholders.	4 Read, interpret, and, with direction, modify documents related to building plans, including working drawings that involve structural, electrical, and mechanical features.	5 Formulate strategies for the efficient and effective commissioning and operation of buildings and building systems.	6 Evaluate the practical applications of primary and secondary theoretical research related to existing and emerging construction methods and materials.	7 Analyze, test, and comment on the functionality of alternative structural, mechanical, and electrical solutions proposed for integration in both new projects and renovations.	8 Contribute to the on-going economic viability of construction and engineering projects through the application of principles of estimating, accounting, and cost controls.	9 Facilitate partnerships and productive interactions within project teams that involve knowledge-workers and skilled trade workers.	10 Ensure work, activities, and practice are in compliance with established ethical and professional standards, as well as local, provincial, and national legislation.	11 Adapt to changes in employment requirements through the development, implementation, and updating of professional and personal development plans.
Level 01												
DAT1100	Computer Applications for Design and Reporting I			X	X							
CON1100	Space and Place: Site Development and Built Environments	X	X				X					
BSC1100	Introduction to Building Science	X	X				X	X			X	X
ENG1100	Engineering Principles		X					X			X	
ENL6100	Communications & Academic Writing	This course is a non-core course that contributes to a breadth of knowledge outside the main field of study.										
MAT6443	Calculus I		X					X				

Course Number	Course Name	1 Integrate sustainable building practices and alternative energy solutions and present options that balance client specifications, site conditions, and human factors.	2 Use sound, acceptable engineering principles for the solution and documentation of situations encountered during the construction or rehabilitation of buildings.	3 Communicate effectively with all project stakeholders.	4 Read, interpret, and, with direction, modify documents related to building plans, including working drawings that involve structural, electrical, and mechanical features.	5 Formulate strategies for the efficient and effective commissioning and operation of buildings and building systems.	6 Evaluate the practical applications of primary and secondary theoretical research related to existing and emerging construction methods and materials.	7 Analyze, test, and comment on the functionality of alternative structural, mechanical, and electrical solutions proposed for integration in both new projects and renovations.	8 Contribute to the on-going economic viability of construction and engineering projects through the application of principles of estimating, accounting, and cost controls.	9 Facilitate partnerships and productive interactions within project teams that involve knowledge-workers and skilled trade workers.	10 Ensure work, activities, and practice are in compliance with established ethical and professional standards, as well as local, provincial, and national legislation.	11 Adapt to changes in employment requirements through the development, implementation, and updating of professional and personal development plans.
Level 02												
CAD1200	Computer Applications for Design and Reporting II			X	X							X
SCI1200	Materials Science		X				X	X				
ELE1200	Electricity and Power Generation Fundamentals	X	X					X				
DSN1200	Building Design Processes	X	X		X				X			X
PHI1000	Logic and Critical Thinking	This course is a non-core course that contributes to a breadth of knowledge outside the main field of study.										
MAT8202	Calculus II		X					X				
Level 03												
ENG2100	Geotechnical Engineering	X	X	X	X		X	X				
BSC2100	Building Frame and Structural Studies	X	X		X		X	X				
ENL8810	Technical Communication			X						X		X
SOC2000	Introduction to Sociology	This course is a non-core course that contributes to a breadth of knowledge outside the main field of study.										
MAT8203	Linear Algebra		X					X				

Course Number	Course Name	1 Integrate sustainable building practices and alternative energy solutions and present options that balance client specifications, site conditions, and human factors.	2 Use sound, acceptable engineering principles for the solution and documentation of situations encountered during the construction or rehabilitation of buildings.	3 Communicate effectively with all project stakeholders.	4 Read, interpret, and, with direction, modify documents related to building plans, including working drawings that involve structural, electrical, and mechanical features.	5 Formulate strategies for the efficient and effective commissioning and operation of buildings and building systems.	6 Evaluate the practical applications of primary and secondary theoretical research related to existing and emerging construction methods and materials.	7 Analyze, test, and comment on the functionality of alternative structural, mechanical, and electrical solutions proposed for integration in both new projects and renovations.	8 Contribute to the on-going economic viability of construction and engineering projects through the application of principles of estimating, accounting, and cost controls.	9 Facilitate partnerships and productive interactions within project teams that involve knowledge-workers and skilled trade workers.	10 Ensure work, activities, and practice are in compliance with established ethical and professional standards, as well as local, provincial, and national legislation.	11 Adapt to changes in employment requirements through the development, implementation, and updating of professional and personal development plans.
Level 04												
DSN2200	Sustainable Design	X	X		X	X	X	X			X	
BSC2200	Building Systems	X	X		X	X		X				
CON2200	Business Development for the Construction Industry			X					X	X	X	X
BSC4000	Elective	Students choose a non-core course that contributes to a breadth of knowledge outside the main field of study.										
MAT8204	Differential Equations		X					X				
HOS6105	Co-op Preparation Seminar											
Level 05												
BSC3100	Renewable Energy	X			X	X		X	X			
ENG3100	Advanced Engineering Principles		X			X		X				X
MAT8205	Statistics		X					X	X			
BIO3100	Botany	This course is a non-core course that contributes to a breadth of knowledge outside the main field of study.										

Course Number	Course Name	1 Integrate sustainable building practices and alternative energy solutions and present options that balance client specifications, site conditions, and human factors.	2 Use sound, acceptable engineering principles for the solution and documentation of situations encountered during the construction or rehabilitation of buildings.	3 Communicate effectively with all project stakeholders.	4 Read, interpret, and, with direction, modify documents related to building plans, including working drawings that involve structural, electrical, and mechanical features.	5 Formulate strategies for the efficient and effective commissioning and operation of buildings and building systems.	6 Evaluate the practical applications of primary and secondary theoretical research related to existing and emerging construction methods and materials.	7 Analyze, test, and comment on the functionality of alternative structural, mechanical, and electrical solutions proposed for integration in both new projects and renovations.	8 Contribute to the on-going economic viability of construction and engineering projects through the application of principles of estimating, accounting, and cost controls.	9 Facilitate partnerships and productive interactions within project teams that involve knowledge-workers and skilled trade workers.	10 Ensure work, activities, and practice are in compliance with established ethical and professional standards, as well as local, provincial, and national legislation.	11 Adapt to changes in employment requirements through the development, implementation, and updating of professional and personal development plans.
MGT3100	Introduction to Construction Project Management			X					X	X	X	X
Level 06												
BSC3200	Alternative Energy	X			X	X	X	X	X			
CON3200	Seminar in Constructability		X	X	X			X	X			
CAD3200	Building Information Modeling				X	X			X			
BSC3300	Energy Conservation and Auditing	X	X			X	X	X	X			
GEO3200	Principles of Urban Planning	This course is a non-core course that contributes to a breadth of knowledge outside the main field of study.										
Level 07												
CAD4100	Advanced Modeling and Simulation		X			X		X				
BSC4100	Applied Energy Management	X			X	X	X		X			
BSC4200	Professional Portfolio Development			X							X	X

Course Number	Course Name	1 Integrate sustainable building practices and alternative energy solutions and present options that balance client specifications, site conditions, and human factors.	2 Use sound, acceptable engineering principles for the solution and documentation of situations encountered during the construction or rehabilitation of buildings.	3 Communicate effectively with all project stakeholders.	4 Read, interpret, and, with direction, modify documents related to building plans, including working drawings that involve structural, electrical, and mechanical features.	5 Formulate strategies for the efficient and effective commissioning and operation of buildings and building systems.	6 Evaluate the practical applications of primary and secondary theoretical research related to existing and emerging construction methods and materials.	7 Analyze, test, and comment on the functionality of alternative structural, mechanical, and electrical solutions proposed for integration in both new projects and renovations.	8 Contribute to the on-going economic viability of construction and engineering projects through the application of principles of estimating, accounting, and cost controls.	9 Facilitate partnerships and productive interactions within project teams that involve knowledge-workers and skilled trade workers.	10 Ensure work, activities, and practice are in compliance with established ethical and professional standards, as well as local, provincial, and national legislation.	11 Adapt to changes in employment requirements through the development, implementation, and updating of professional and personal development plans.
BSC4000	Elective	Students choose a non-core course that contributes to a breadth of knowledge outside the main field of study										
BSC4300	Building Science Research Project I	X	X		X		X	X			X	
Level 08												
BSC4400	Seminar in Sustainable Solutions	X	X				X	X				
MGT4200	Scenarios in Team Leadership			X						X		
CON4200	Construction Methods for Renovation and Rehabilitation		X			X	X	X				
BSC4000	Elective	Students choose a non-core course that contributes to a breadth of knowledge outside the main field of study										
BSC4350	Building Science Research Project II	X	X	X	X		X	X			X	

Section 4.4: Course Descriptions

This section provides a listing of the course descriptions for all courses that are a part of the proposed Bachelor of Building Science program.

These are the course descriptions that would appear in the academic calendar, and other related documentation. For the presentation of these descriptions, the courses have been divided into

- Core courses,
- Non-core courses, and
- Free elective options.

The table below delineates the core, non-core and free elective courses within the program of study.

Year and Semester	Course Title	Core courses	Non-core courses	Free Electives
Year 1 Semester 1				
	Computer Applications for Design and Reporting I	X		
	Space and Place: Site Development and Built Environments	X		
	Introduction to Building Science	X		
	Engineering Principles	X		
	Communications & Academic Writing		X	
	Calculus I	X		
Year 1 Semester 2				
	Computer Applications for Design and Reporting II	X		
	Materials Science	X		
	Electricity and Power Generation Fundamentals	X		
	Building Design Processes	X		
	Logic and Critical Thinking		X	
	Calculus II	X		
Year 2 Semester 3				
	Geotechnical Engineering	X		
	Building Frame and Structural Studies	X		
	Technical Communication	X		
	Introduction to Sociology		X	
	Linear Algebra	X		

Year and Semester	Course Title	Core courses	Non-core courses	Free Electives
Year 2 Semester 4				
	Sustainable Design	X		
	Building Systems	X		
	Business Development for the Construction Industry	X		
	Elective			X
	Differential Equations	X		
	Co-op Preparation Seminar	X		
Year 3 Semester 5				
	Renewable Energy	X		
	Advanced Engineering Principles	X		
	Statistics	X		
	Botany		X	
	Introduction to Construction Project Management	X		
Year 3 Semester 6				
	Alternative Energy	X		
	Seminar in Constructability	X		
	Building Information Modeling	X		
	Energy Conservation and Auditing	X		
	Principles of Urban Planning		X	
Year 4 Semester 7				
	Advanced Modeling and Simulation	X		
	Applied Energy Management	X		
	Professional Portfolio Development	X		
	Elective			X
	Building Science Research Project I	X		
Year 4 Semester 8				
	Seminar in Sustainable Solutions	X		
	Scenarios in Team Leadership	X		
	Construction Methods for Renovation and Rehabilitation	X		
	Elective			X
	Building Science Research Project II	X		

Section 4.4.1: Course Descriptions for Core Courses

Year and Semester	Course Title	Calendar Course Description
YEAR 1 Semester 1	Computer Applications for Design and Reporting I	Office productivity suites and computer-aided design applications are an important part of the design and reporting that takes place in the construction industry. To be efficient and effective contributors in the workplace, employees must be both quick and accurate with their work. In this hands-on course, students develop and extend their knowledge and skills with current office productivity tools, such as word processors and spreadsheet applications, and begin to explore available tools for computer-aided design.
YEAR 1 Semester 1	Space and Place: Site Development and Built Environments	A wide array of variables play an important role in the on-going success of buildings after the construction phase has been completed. In this course, students begin to develop a critical eye in order to visualize and identify a range of functional attributes based on preliminary designs. An overview of theoretical principles related to site planning, including code requirements and legal questions, draws attention to a number of issues that affect the overall character and functionality of a building. Students also spend time observing the way people use and interact with buildings.
YEAR 1 Semester 1	Introduction to Building Science	In this introductory course, students explore buildings and the inter-connectedness of the constituent features and systems that make up a building. In addition to the scientific principles, students learn about the methodologies and approaches, such as LEED, used in this field of study while they broaden their use of disciplinary concepts and vocabulary. The theoretical and methodological framework developed in this course carries through the program striving for building performance optimization by promoting energy efficiency, structural durability, low environmental impact, and a healthy living environment.
YEAR 1 Semester 1	Engineering Principles	Engineering-related disciplines, such as building science, draw heavily on a variety of sciences in order to identify, describe, and solve problems presented by real-world situations. In order to engage in this approach to problem solving, students begin an exploration of theoretical and practical applications of a number of laws of science. Through exercises and research projects, students visualise solutions to problems that are supported both scientifically and mathematically.

Year and Semester	Course Title	Calendar Course Description
YEAR 1 **Semester 1**	Calculus I	This course provides foundations necessary for the further study of differential calculus. Students learn how to manipulate the limits and tangents of graphs, as well as the calculation of derivatives and definite integrals of algebraic and transcendental functions. Students solve minimum/maximum problems, related rates problems, plane area problems, and sketch curves using calculus tools. Basic use of numerical solutions to derivative problems is covered, and the anti-derivative as related to the derivative is introduced.
YEAR 1 **Semester 2**	Computer Applications for Design and Reporting II	Drawing on prior knowledge, students continue their work with computer-aided design tools. Through a combination of instructor-led and self-guided exercises, students develop a deeper familiarity with the capabilities of this design software, and the role it plays within the context of construction projects. Students also begin to work with software that facilitates the consolidation and reporting of information related to building operations. **Prerequisite:** DAT1100 - Computer Applications for Design and Reporting I
YEAR 1 **Semester 2**	Materials Science	In this laboratory course, students gain an up-close, hands-on sense of the physical, chemical, and aesthetic characteristics of materials used in the construction industry. Experiments and small research assignments ensure the application of the scientific method and the documentation of observations and results. Introduction to both the safety equipment and the procedures for the lab are also part of this course. **Prerequisite:** ENG1100 - Engineering Principles
YEAR 1 **Semester 2**	Electricity and Power Generation Fundamentals	In this introductory course, students acquire some fundamental knowledge of the way in which electricity is generated. Discussions and exercises focus on addressing questions of energy efficiency and energy savings. Students become proficient with a number of theoretical calculations for current and voltage. Practical labs and demonstrations supplement the theoretical knowledge.

Year and Semester	Course Title	Calendar Course Description
YEAR 1 **Semester 2**	Building Design Processes	Through a variety of team-based simulations, students engage in aspects of the building design process in order to develop both a feel for the stages in the design process and also an awareness of the time and work that culminates in a set of design plans. Discussions and presentations place code requirements and principles of LEED certification in their historical context. Students use a combination of hand drawing and models to present design concepts for evaluation by peers and instructors.
YEAR 1 **Semester 2**	Calculus II	This course provides an introduction to integral calculus. Students manipulate the integral as related to the derivative and as an area under the curve of a graph. Also, students apply single and multiple integrations to solve a variety of problems. Methods of integration, such as substitution, by parts, partial fractions, and the use of power series and partial derivatives is explored. Basic use of numerical solutions for derivative and integration problems is also covered. **Prerequisite:** MAT6443 - Calculus I
YEAR 2 **Semester 3**	Geotechnical Engineering	Accurate assessments of the sub-grade geological materials found on a given site are a vital part of the decision-making process related to the construction of foundations and other support mechanisms for buildings. Through a variety of activities, students investigate the ways in which scientific principles of physics interact with environmental principles to create risks that must be overcome in order for buildings to be safe. **Prerequisite:** SCI1200 - Materials Science
YEAR 2 **Semester 3**	Building Frame and Structural Studies	Building frames and structures endure a variety of different strains and stresses over the lifespan of a building. Additional expected and unexpected environmental factors can also erode stability over time. Many of these strains and stresses interact with building materials in different ways, and, in this course, students delve into the theoretical and mathematical principles that enable successful structural and framing design. Using case studies, scenarios, and some lab activities, involving living lab tools, students evaluate successful and not-so successful examples of building frames and structures. **Prerequisite:** SCI1200 - Materials Science

Year and Semester	Course Title	Calendar Course Description
YEAR 2 **Semester 3**	Technical Communication	Students develop an appreciation of both the applications and the implications of technical communication. Through a combination of written and oral assignments, the practical requirements of technical communication, along with some of its theoretical foundations are investigated. As a part of these investigations, students examine, discuss, and prepare the components of a formal technical report. Emerging developments in the field of technical communication are also discussed. **Prerequisite:** ENL6100 - Communications and Academic Writing
YEAR 2 **Semester 3**	Linear Algebra	This course provides an introduction to the basic concepts and techniques of linear algebra, including systems of linear equations, matrix operations, determinants, vectors in n-space, linear transformations, eigenvalues, and eigenvectors. Students work with selected applications, such as linear programming, economic models, least squares, and population growth. **Prerequisite:** MAT8202 - Calculus II
YEAR 2 **Semester 4**	Sustainable Design	Sustainable design is the conception and insight of an environmentally responsive expression as a part of the evolving matrix of nature. The integration of elements that contribute to LEED certification is an essential part of sustainable design. In this course, students connect their knowledge and skills in design and building systems to the requirements of the LEED pointing system. Working in teams, and using complete and partially complete plans, students analyse designs and propose opportunities to increase the level of LEED certification for a building. Within this context, students also explore passive solar design and low energy design. **Prerequisite:** DSN1200 - Building Design Process

Year and Semester	Course Title	Calendar Course Description
YEAR 2 **Semester 4**	Building Systems	Through readings, discussion, and primary research using living lab tools, students explore the electrical, plumbing and safety systems that add comfort and control to buildings of all types. Beyond tracing the historical development of these specialised fields, students develop an understanding of the role of skilled trades in the implementation and maintenance of these systems. Special attention is paid to both building code requirements, and interpretation of design drawings for these fields. **Prerequisite:** ELE1200 - Electricity and Power Generation Fundamentals
YEAR 2 **Semester 4**	Business Development for the Construction Industry	As a substantial economic sector, the construction industry reaches many facets of today's society. On the strength of a broad industry overview, students explore three specific business skills at play in the construction industry. With its focus on responding to clients and their requirements, students work with the concepts and principles of client relationship management from both an organizational and consulting perspective. To this service focus is added a financial edge in the form of estimating. Through guided exercises, students become familiar with valuable estimating skills that can make the difference between profit and debt. Finally, students balance these two seemingly contradictory elements with value engineering concepts that respond to client needs in a financial viable fashion. **Prerequisite:** BSC1100 - Introduction to Building Science
YEAR 2 **Semester 4**	Differential Equations	In this course, students develop the skills used to manipulate differential equations to solve problems related to their field of study. Also, students manipulate and solve certain first order and second order differential equations, both homogeneous and non-homogeneous. The use of the Laplace Transform, as well as Fourier series and frequency representations allows students to expand their knowledge of differential and integral calculus in the creation and solution of problems related to their field of study. **Prerequisite:** MAT8203 - Linear Algebra
YEAR 2 **Semester 4**	Co-op Preparation Seminar	This course is designed to prepare students for their first cooperative work term. Students research career opportunities, set goals and practice job search skills such as resume writing and interviewing techniques.

Year and Semester	Course Title	Calendar Course Description
YEAR 2 (Between Semester 4 & 5)	Co-op Work Term I	Immediately following semester four, the first co-op placement provides students with experiential opportunities within the construction industry and related industries. The first work term centres on attaining entry-level positions that immerse students in a variety of activities allowing them to apply principles and concepts developed over the first two years of study. Students returning from Co-op Placement I bring additional practical considerations to their third year of study.
YEAR 3 Semester 5	Renewable Energy	The energy demands of new and existing buildings are an expense that many building owners and managers have accepted as a requirement, but emerging sources of renewable energy are presenting new options. In this course, students work collaboratively to broaden their knowledge of renewable energy sources available for residential and commercial applications and conduct some tests with living lab tools. Beyond the question of generation and storage of this energy, students outline and investigate the benefits and drawbacks that currently exist with respect to integration of these sources with contemporary building systems. **Prerequisite:** ELE1200 - Electricity and Power Generation Fundamentals
YEAR 3 Semester 5	Advanced Engineering Principles	In this course, students further develop their problem-solving abilities through a continued exploration of the theoretical and practical applications of more complex laws of science. Assignments and discussions focus on the principles involving higher level mathematics to resolve problems that are more directly related to applications in building science, such as heat transfer, and energy systems. Students also begin an examination of the role of computer-based models and simulations. **Prerequisites:** ENG1100 - Engineering Principles MAT8204 - Differential Equations

Year and Semester	Course Title	Calendar Course Description
YEAR 3 **Semester 5**	Statistics	In this course, students review basic statistical operations, including probability, random sampling, variability, and binomial, normal, and Poisson's distributions. These statistical tools are used in hypothesis testing and in performing regressions and analysis. Students also work with statistical process control (SPC), and address tolerance and accuracy issues, particularly as they are related to manufacturing and design. **Prerequisite:** MAT8202 - Calculus II
YEAR 3 **Semester 5**	Introduction to Construction Project Management	It might reasonably be said that the only constant in a construction project is the variables. In this course, students focus their attention on the dynamic features of construction projects that make them both challenging and unique. From equipment to materials to environmental conditions to human resources, students explore the project management role as a means of appreciating the contribution they can make to a project.
YEAR 3 **Semester 6**	Alternative Energy	In this course, students extend their knowledge of energy sources through a consideration of non-fossil fuel options that are currently available or being researched for development. Beyond questions of generation, storage, and integration with contemporary building systems, students analyse the societal response and economic impact of alternative sources of energy that place a greater emphasis on reducing carbon emissions. **Prerequisites:** ELE1200 - Electricity and Power Generation Fundamentals BSC2200 - Building Systems
YEAR 3 **Semester 6**	Seminar in Constructability	Using the knowledge and skills acquired to date in the program, students solve problems that arise when construction practicality meets aesthetic design. Students contribute to this seminar through the presentation of solutions to case studies from a variety of contexts. Through this contribution, students both lead a case team and participate as a team member for other cases. **Prerequisites:** BSC2100 - Building Frame and Structural Studies BSC2200 - Building Systems

Year and Semester	Course Title	Calendar Course Description
YEAR 3 **Semester 6**	Building Information Modeling	In construction and the building life cycle process, alignment and improvement of both qualitative and quantitative metrics is guaranteed in building information modelling. In this hands-on course, students apply the theoretical and mathematical principles behind software tools designed to increase productivity in building design and construction. Students develop a three-dimensional model that allows them to add aspects of time and cost to a construction project. Information related to the properties of systems and materials are applied to enable the assessment of various aspects of building performance under particular scenarios. In addition, students develop a process that produces a building information model. This model can then be used for analysis during design and construction in order to forecast interior building conditions, comfort, energy use, illumination, or structural behaviour. **Prerequisite:** CAD1200 - Computer Applications for Design and Reporting II
YEAR 3 **Semester 6**	Energy Conservation and Auditing	In buildings of all sizes for all types of applications, essential components in the establishment and preservation of environmental comfort also play a role in a building's energy utilization. Mindful of code and LEED certification, students, with the support of living lab tools, further develop a picture of the built environment as a holistic system of integrated parts. Students use techniques to assess and improve opportunities to use energy efficiently and reduce energy consumption, while maintaining interior human comfort. Categorizing energy utilization through energy audits, students identify worthwhile energy-saving strategies. **Prerequisite:** BSC2200 - Building Systems ENG3100 - Advanced Engineering Principles
YEAR 3 **(between semester 6 & 7)**	Co-op Work Term II	Immediately following semester six, the second co-op placement provides students with experiential opportunities within the construction industry and related industries. The second work term centres on applying knowledge and skills developed since the last placement and accepting increasing responsibilities. Students returning from Co-op Placement II draw on their experience for a number of their final year seminars.

Year and Semester	Course Title	Calendar Course Description
YEAR 4 **Semester 7**	Advanced Modeling and Simulation	In this programming and modeling course, students explore a number of advanced software tools that use powerful analytical mechanisms to model the whole building during the design of new construction or during major renovations. With the emphasis on energy modeling and simulation students identify the cross-system impacts of individual decisions on building envelope, lighting, electrical power, ventilation, and mechanical heating and cooling system performance. **Prerequisite:** ENG3100 - Advanced Engineering Principles CAD3200 - Building Information Modeling
YEAR 4 **Semester 7**	Applied Energy Management	Using existing and emerging research available from a variety of related disciplines, students examine new and accredited hardware and software that enable a variety of approaches for the management of energy and the control of the interior environment. Some topics root the theories and concepts in the site planning stages, while others work from a retrofit or renovation perspective. **Prerequisites:** BSC2200 - Building Systems BSC3300 - Energy Conservation and Auditing
YEAR 4 **Semester 7**	Professional Portfolio Development	Using a guided workshop format, students review their experience and education to date and look ahead to the requirements for employment. The preparation of professional job search documents and a formal or informal portfolio assists students in the identification of professional and personal strengths. Additional discussions around workplace ethics and opportunities for membership in professional associations rounds out this preparation for graduation and employment. **Prerequisite:** ENL6100 – Communications and Academic Writing
YEAR 4 **Semester 7**	Building Science Research Project I	Working individually or in small teams, students engage in a research project that contributes to the body of knowledge in applied building science. In this course, students focus on the choice of topic, the design of the project, the development of the project proposal, and preliminary research and testing.

Year and Semester	Course Title	Calendar Course Description
YEAR 4 Semester 8	Seminar in Sustainable Solutions	In this collaborative learning experience, students research and hypothesize about the direction sustainable solutions may take in the years ahead. Reaching back through the many courses in the program, students look for avenues to integrate sustainability in the context of construction methods and materials, in structural components, the building envelope, building systems, and building operations. Students also strive to place any proposals in their historical context in order to consider the broadest application for their recommendations. In addition, students survey contemporary and new concepts, practices and strategies that promote the application of sustainable solutions by enhancing efficiencies and decreasing the demand for resources.
YEAR 4 Semester 8	Scenarios in Team Leadership	With the prevalence of team- and project-based organizational models in the construction industry, skills in team participation and leadership are integral for success. In this highly interactive course, students combine seminar discussions with simulated and real scenarios to build leadership skills and experience the challenges that can arise in high-stress, team-based work environments. **Prerequisite:** MGT3100 - Introduction to Construction Project Management
YEAR 4 Semester 8	Construction Methods for Renovation and Rehabilitation	Building from scratch is not always the most feasible solution in today's marketplace and so owners turn to renovation and rehabilitation as an alternative. Through the application of existing knowledge to cases and scenarios, students examine a variety of procedures, pitfalls, and concerns that emerge in these situations. Emphasis is placed not only on code requirements and environmental legislations, but also on accurate assessment of the existing systems, and structures in order to minimise the need to overhaul entire components without sacrificing the building's functionality.
YEAR 4 Semester 8	Building Science Research Project II	In this course, students complete the research project that was started in the previous semester. The research project is presented to peers and faculty in the form of both a written report and a presentation. Prior to the delivery of these submissions, students ensure that the necessary level of research and testing has been completed and documented. **Prerequisite:** BSC4300 - Building Science Research Project I

Section 4.4.2: Course Descriptions for Non-Core Courses

In the table below, the course descriptions for the Non-Core Courses are presented by semester for each academic year. The descriptions for the Elective options are presented in a sub-section 4.4.3.

Year and Semester	Course Title	Calendar Course Description
YEAR 1 **Semester 1**	Communications and Academic Writing	Effective communication is an integral component of success in the workplace and in lifelong learning. In this course, students review communication theory and its connection to expository writing. Frequent writing exercises encourage the development of content that is coherent, well organized and correct. Students consider and use strategies to generate ideas, to collect and organize information, to acknowledge sources, to identify and develop a thesis and to adapt format, style and tone for different purposes and audiences.
YEAR 1 **Semester 2**	Logic and Critical Thinking	Logic and critical thinking skills play an important role in both daily life and on-going academic studies. As foundational skills they support both the development and assessment of ideas, concepts and courses of action that are presented on a daily basis. Approaching the subject from both a theoretical and practical perspective, students hone their skills in analysis, argumentation, reasoning, and persuasion. A range of topics and philosophers provide material with which students can exercise and apply their critical thinking skills.
YEAR 2 **Semester 3**	Introduction to Sociology	When working with individuals and groups it is important to understand where they've come from and what influences them. In this introductory course, students develop a familiarity with sociological theories and methodological approaches used to study individual and group behaviours. Students examine variables that include culture, social class, race, and gender and how these variables may impact work with diverse individuals and groups.

Year and Semester	Course Title	Calendar Course Description
YEAR 2 **Semester 4**	Elective	Elective courses are intended to provide students with an opportunity to study in areas unrelated to the program focus. For the elective, students choose from a variety of courses that are at a bachelor's degree level and offered during the semester in which they are studying.
YEAR 3 **Semester 5**	Botany	Beginning with the biological features of plants, students investigate the diversity of plant life and the basis for distinction amongst various species. With a deeper knowledge of plant biology, students consider the impact of genetic manipulation on areas of plant and human interaction, including food production and medicine.
YEAR 3 **Semester 6**	Principles of Urban Planning	Increasingly cities and communities are feeling the pressure of expansion, and people from all walks of life feel disconnected from the processes, procedures, and decisions that are affecting their everyday lives. This course considers urban transformation and the resulting need for intervention, in terms of completion and renewal, with a focus on practicing sustainability by exploring innovations in land use, transportation, resource planning and economic development: principles that promote employment opportunities, as well as healthy and vibrant cities. Through this course, students use local and regional activities as a starting point for developing a knowledge base for future social and community involvement. Research projects and assignments encourage students to identify the gaps between theoretical approaches to urban planning and the practical applications as evidenced in their local surroundings.
YEAR 4 **Semester 7**	Elective	Elective courses are intended to provide students with an opportunity to study in areas unrelated to the program focus. For the elective, students choose from a variety of courses that are at a bachelor's degree level and offered during the semester in which they are studying.

Year and Semester	Course Title	Calendar Course Description
YEAR 4 **Semester 8**	Elective	Elective courses are intended to provide students with an opportunity to study in areas unrelated to the program focus. For the elective, students choose from a variety of courses that are at a bachelor's degree level and offered during the semester in which they are studying.

Section 4.4.3: Course Descriptions for Free Elective Options

The proposed Bachelor of Building Science program includes three (3) opportunities for students to choose additional, non-core courses to extend their knowledge in other fields of study. The course descriptions for these free elective courses are found below, and have been organized to demonstrate the potential for achieving depth outside of the main field of study.

Course Title	Calendar Course Description
General	
Introduction to Criminology	In this course, students work through an introduction to the social science perspective on crime. Presentations, discussions, and assignments allow students to investigate the various theoretical positions related to crime and criminal behaviour. Working forward from the types and definitions of crime, students trace some of the links between government policies and the impacts of these policies on both society and the individual.
General Astronomy	In this course, students develop insights into general concepts of planetary and stellar astronomy and cosmology. Topics include naked eye astronomy and astronomy with telescopes, the importance of light in the study of astronomy, the Earth and Moon, the nature and formation of our neighbouring rocky planets, gas giant planets, their moons and rings, and comets, asteroids and meteors, as well as planetary systems around other stars. Other topics include the formation of stars, how stars evolve and die, the structure of our Milky Way galaxy, and the population of galaxies throughout the observable Universe. The formation of our Universe, and concepts of its evolution and how it may end are also discussed. Classes are augmented with stargazing, library or Internet assignments, and video resources that bring the "sky" into the classroom.
Law	This course prepares the student for a business environment increasingly impacted by laws. Students develop an appreciation for how laws are interpreted and applied by business organizations in the conduct of business. Students have the opportunity to analyze a business issue from a general legal perspective. Emphasis is placed on intellectual property, employment law and other laws related to the workplace, contracts, torts, business organizations, debtor/creditor/bankruptcy, and insurance law.

Philosophy	
Philosophy and Popular Culture	Many facets of today's popular culture engage, directly or indirectly, with the concerns of a variety of philosophical traditions. Drawing on a number of examples, students explore both the way popular culture permeates and spreads through society and the way it interprets and presents philosophical questions. As part of this course, students develop skills and techniques for assessing the soundness and validity of thought experiments. **Prerequisite:** PHI1000 - Logic and Critical Thinking
Survival in the Information Age: Risk and the Media	On an almost daily basis, the media, through its various channels—television, radio, web sites, RSS, and podcasts—reports on issues that address human health and safety. Through discussions, readings, and assignments, students enhance their ability to interpret and question information presented by the media. Issues like genetically modified organisms, alternative medical remedies, transportation safety, and diet fads provide grounds for students to use principles from the sciences, social science, and mathematics as a means to think critically about real and perceived risks in daily life. **Prerequisite:** PHI1000 - Logic and Critical Thinking
Humanities	
History of Art I	This course is a broad-based survey of the history of art, design, and architecture as it is reflected in the prehistoric ancient Egyptian and Mesopotamian cultures through to the Renaissance and Reformation styles.
History of Art II	A continuation of History of Art I, this course provides a chronological survey of the history of the architectural and fine art periods from the Renaissance to the present day. **Prerequisite:** DSN4014 - History of Art I
World Religions	In this course, students explore world religions, the living embodiments of faith which transcend the cultural environments in which they exist. Students survey the major world religions, including but not limited to Judaism, Christianity, Islam, Hinduism, and Buddhism. They examine the nature of religious beliefs and their cultural expression as well as the transformations common when subjected to socio-cultural change. Students discuss the changed expression of religious beliefs when transplanted and expressed in a different cultural framework such as within contemporary Canadian society.

Literature	
Creative Writing	Whether for personal or public consumption, many people enjoy creative writing as a hobby or outlet for their creative energy. With a focus on short fiction, students examine the stylistic components that contribute to the excitement, atmosphere, and overall readability of fiction and creative writing. The latter part of the course is organized in a workshop format in which students share their work and provide formal feedback on the work of others. **Prerequisite:** ENL6100 - Communications and Academic Writing
New Worlds and Alternative Realities: Speculative Fiction	Speculative fiction gathers together all those works of fiction in which new worlds or alternative realities are envisioned. Within this category of prose, students have the opportunity to explore the various sub-genres that present readers with new ways of thinking about some of the issues that face society. Students also develop skills in critical analysis using a variety of approaches and methodologies from literary studies. **Prerequisite:** ENL6100 - Communications and Academic Writing
World Literature	This course provides a survey of key texts from 20th and 21st century World Literature. Readings provide an introduction to themes, styles, and writers from a variety of cultures. Critical analysis of texts supports the development of arguments related to the assigned readings.
Psychology	
Introductory Psychology	Studies in psychology provide insights into human behaviour helping us to better understand ourselves and others. In this introductory survey course, students learn common methodologies in the study of psychology. They explore fundamental concepts such as sensation/perception, cognition, states of consciousness, learning, motivation, emotion, psychological defense mechanisms, and personality. They apply this learning to analyze situations encountered in everyday life and to identify the psychological determinants of health and stress.
Developmental Psychology	Developmental factors influence human behaviour significantly throughout the life span. In this course, students examine human behaviour from a multidisciplinary perspective. They learn key biological, psychological, and social determinants of human behaviour using principles from these disciplines to explain and anticipate behaviour across the life span. Students develop an integrated understanding of life span development and learn to apply major theories of development to understand human behaviour. They identify developmental tasks, special challenges, and needs for each stage of human development.

Section 4.5: Course Schedules

Section 4.5.1: Course Schedule 1 – *excluded for web version*

ection 4.5.2: Course Schedule 2

Year and Semester	Course Title	Total Core Course Semester Hours	Total Non-Core Course Semester Hours	Course Prerequisites and Co-requisites	Highest Qualification Earned and Discipline of Study
YEAR 1 Semester 1	Computer Applications for Design and Reporting I	45		Not applicable	M.A.Sc. (Civil Engineering)
	Space and Place: Site Development and Built Environments	45		Not applicable	PhD (Architecture)
	Introduction to Building Science	45		Not applicable	PhD (Energy and Buildings)
	Engineering Principles	45		Not applicable	PhD (Energy and Buildings)
	Communications and Academic Writing		45	Not applicable	PhD (English)
	Calculus I	45		Not applicable	M.Sc. (Mathematics) PhD preferred
YEAR 2 Semester 2	Computer Applications for Design and Reporting II	45		Computer Applications for Design and Reporting I	M.A.Sc. (Civil Engineering)
	Materials Science	45		Engineering Principles	PhD (Energy and Buildings)
	Electricity and Power Generation Fundamentals	45		Not applicable	PhD (Computer Science)
	Building Design Processes	60		Not applicable	PhD (Architecture)
	Logic and Critical Thinking		60	Not applicable	MA (Philosophy)
	Calculus II	60		Calculus I	M.Sc. (Mathematics) PhD preferred

Year and Semester	Course Title	Total Core Course Semester Hours	Total Non-Core Course Semester Hours	Course Prerequisites and Co-requisites	Highest Qualification Earned and Discipline of Study
YEAR 2 Semester 3	Geotechnical Engineering	45		Materials Science	PhD (Geotechnical Engineering)
	Building Frame and Structural Studies	60		Materials Science	M.A.Sc. (Civil Engineering)
	Technical Communication	45		Communications and Academic Writing	MA minimum, PhD preferred
	Introduction to Sociology		60	Not applicable	PhD (Political Science) M. Crim. (Applied)
	Linear Algebra	45		Calculus II	M.Sc. (Mathematics) PhD preferred
YEAR 2 Semester 4	Sustainable Design	45		Building Design Processes	Master in Urban Planning and Design
	Building Systems	75		Electricity and Power Generation Fundamentals	PhD (Energy and Buildings)
	Business Development for the Construction Industry	45		Introduction to Building Science	M.Eng. (Civil Engineering)
	Free Elective		45	Not applicable	Masters minimum, PhD preferred
	Differential Equations	45		Linear Algebra	M.Sc. (Mathematics) PhD preferred
	Co-op Preparation Seminar	15		Not applicable	Masters minimum, PhD preferred

Year and Semester	Course Title	Total Core Course Semester Hours	Total Non-Core Course Semester Hours	Course Prerequisites and Co-requisites	Highest Qualification Earned and Discipline of Study
YEAR 3 Semester 5	Renewable Energy	45		Electricity and Power Generation Fundamentals	M.A.Sc. (Mechanical Engineering – Solar Energy)
	Advanced Engineering Principles	45		Engineering Principles; Differential Equations	PhD (Energy and Buildings)
	Statistics	45		Calculus II	M.Sc. (Mathematics) PhD preferred
	Botany		60	Not applicable	M.Sc. (Physiology and Biophysics) M.Sc. (Chemistry)
	Introduction to Construction Project Management	45		Not applicable	M.A.Sc. (Civil Engineering)
YEAR 3 Semester 6	Alternative Energy	45		Electricity and Power Generation Fundamentals	PhD (Energy and Buildings)
	Seminar in Constructability	45		Building Frame and Structural Studies; Building Systems	PhD (Geotechnical Engineering)
	Building Information Modeling	45		Computer Applications for Design and Reporting II	PhD (Computer Science)
	Energy Conservation and Auditing	45		Building Systems; Advanced Engineering Principles	PhD (Energy and Buildings)
	Principles of Urban Planning		60	Not applicable	Master in Urban Planning and Design

Year and Semester	Course Title	Total Core Course Semester Hours	Total Non-Core Course Semester Hours	Course Prerequisites and Co-requisites	Highest Qualification Earned and Discipline of Study
YEAR 4 Semester 7	Advanced Modeling and Simulation	45		Advanced Engineering Principles; Building Information Modeling	PhD (Computer Science)
	Applied Energy Management	45		Renewable Energy; Alternative Energy	PhD (Energy and Buildings)
	Professional Portfolio Development	30		Not applicable	M.Eng. (Civil Engineering)
	Free Elective		45	Not applicable	Masters minimum, PhD preferred
	Building Science Research Project I	60		Advanced Engineering Principles	PhD (Energy and Buildings)
YEAR 4 Semester 8	Seminar in Sustainable Solutions	45		Not applicable	PhD (Energy and Buildings)
	Scenarios in Team Leadership	30		Introduction to Construction Project Management	M.Eng. (Civil Engineering)
	Construction Methods for Renovation and Rehabilitation	45		Not applicable	PhD (Architecture)
	Free Elective		45	Not applicable	Masters minimum, PhD preferred
	Building Science Research Project II	60		Building Science Research Project I	PhD (Energy and Buildings)
Subtotal Course Hours		**1635**	**420**		
Total Program Hours		***2055***			

Section 4.6: Work Experience

This section provides details of the work experience requirements for the proposed Bachelor of Building Science program. In addition to the explanation of the integration of the work experiences within the program content, there is also information about the types of placements, the support for finding placements, and the outcomes for the placements.

Integration of Work Experiences

The proposed Bachelor of Building Science program includes two (2) mandatory co-op work terms that must be completed successfully to qualify for graduation. Both work terms are scheduled for the summer semester (May – August) when potential employer/supervisors are likely to be able to provide quality work experiences. These work terms will be fourteen (14) weeks in length.

The first co-op work term is after completion of the second year of study. It is expected that after four (4) semesters of study, students will have the foundational knowledge to make a reasonable contribution in the workplace, with supervision.

The second co-op work term is after completion of the third year of study. Building on the first work term experience, and adding another two (2) semesters of more advanced studies, students will be able to function with a greater sense of autonomy and demonstrate a greater level of contribution than in the first co-op work term.

The placement of the co-op work terms is part of a deliberate strategy to use the practical work experience as an educational tool in subsequent courses. As a result, it is believed that both third-year and fourth-year learning will be augmented based on participation in real-world projects and activities. Furthermore, ideas for the fourth-year capstone project may be derived from these co-op experiences.

Types of Placements

The diversity and quantity of organizations involved in construction or construction-related activities that draw upon the knowledge contained within the discipline of building science provides for a wide array of placement opportunities. With the proposed program located in Ottawa, there is the potential for placements with both the public sector and the private sector. There is also the potential for placements involving research and development, although the greater share of the placements will be related to construction projects.

During their placements, students are likely to be members of project teams engaged in either specialized tasks or focused on the general review, analysis and completion of one or more phases of a construction project. Although they are unlikely to have a specific job title, students will be engaged in consulting activities, analytical work, technical assessments, modeling and simulation exercises, as well as a variety of meetings related to design review, project management, and other emerging issues.

Support for co-op placements from local employers is high, with a variety of organizations already pledging a willingness to offer co-op placements to students enrolled in the proposed Bachelor of Building Science program. (See letters of support in Section 7: Credential Recognition).

These organizations include:

- Aecon,
- Arborus Consulting,
- J. L. Richards,
- Morley Construction,
- Mark Thompson Brandt Architect & Associates,
- PCL , and
- Revay and Associates Limited.

When the first year of the program delivery begins, the academic department, in collaboration with the Cooperative Education Department, will use established procedures and practices to connect with employers and encourage them to provide placements and to explore the benefits provided through co-op education. In order to ensure rich and meaningful work experiences for students, this will be an on-going initiative.

Support for Placements

Co-op work experiences are supported by Algonquin's Cooperative Education Department (see Section 6.3 Support Services). In more specific terms, staff from the Co-op Department facilitates the relationship between the employer/supervisor and the student, while ensuring that the College meets its responsibilities for the quality of the work experience.

In addition to the Co-op Preparation Seminar offered prior to the first co-op work term, students receive support and guidance from staff in the Co-op Department throughout the application process, including the submission of resumes, and the scheduling of interviews.

While students are on placement, there is further support from the Co-op Department through the monitoring of the work experience. In collaboration with faculty from the academic program, site visits are organized. Finally, staff in the Co-op Department mediate and guide the resolution of any issues that may arise during the work term. Algonquin's Cooperative Education Department details its services on the website: http://www.algonquincollege.com/coop/

Outcomes for Co-op Work Terms

There are two mandatory work terms in the proposed Bachelor of Building Science program. The outcomes for each work term are presented in the table below (See Table 4.6.1: Outcomes for Work Experience).

Table 4.6.1: Outcomes for Work Experience

Work Term	Co-op Work Term I	Co-op Work Term II
Hours	**560 hours**	**560 hours**
Calendar Description	Immediately following academic term four, the first co-op placement provides students with experiential opportunities within the construction industry and related industries. The first work term centres on attaining entry-level positions that immerse students in a variety of activities allowing them to apply principles and concepts developed over the first two years of study. Students returning from Co-op Work Term I bring additional practical considerations to their third year of study.	Immediately following academic term six, the second co-op placement provides students with experiential opportunities within the construction industry and related industries. The second work term centres on applying knowledge and skills developed since the last placement and accepting increasing responsibilities. Students returning from Co-op Work Term II draw on their experience for a number of their final year seminars.
Course Outcomes	**Upon successful completion students will have demonstrated an ability to:** • contribute to the practical application of building science concepts in a workplace environment. • perform assigned duties in a professional fashion. • obtain feedback on workplace performance. • compile a comprehensive report on placement activities. • identify areas for personal and professional development based on an analysis of the placement experience.	**Upon successful completion students will have demonstrated an ability to:** • propose solutions for issues that emerge during a project. • adopt proactive strategies for ensuring workplace performance meets expectations. • manage assigned resources and responsibilities professionally. • document placement activities using standard industry tools and approaches. • catalogue contributions made to projects during placement.

As can be seen in the side-by-side comparison of the outcomes for the work experience, a progressive level of knowledge, responsibility and professional autonomy are built into the work experiences.

Opportunities to achieve the outcomes will be available in a wide array of professional settings because of the project-based approach to work in the construction industry. Whether assigned to a specific project, or working across a number of different projects, students will have the opportunity to apply their knowledge and skills to the completion of activities and tasks assigned by the employer/supervisor.

Following established practices and procedures for cooperative education at Algonquin, evaluation of student performance during the placement will be based on input from the

employer/supervisor and on work completed by the student. The employer/supervisor will complete both a Midterm Progress Report and a Final Employer Evaluation. On both of these documents, students need to meet or exceed established criteria for the placement. In addition, students will write a Final Work Term Report that will be submitted to the academic department for grading. As part of this report, students need to connect their work experience with the learning objectives that were established for the work term. Once again, students need to meet or exceed established criteria for the report.

As previously noted the **Cooperative Education Department** facilitates the co-op process including the development of job opportunities and the preparation of students for the work force. The department acts as a liaison between the student, the employer and the participating academic departments and collects the relevant academic assignments. A departmental website facilitates access to student and employer related web-based forms http://www.algonquincollege.com/coop/ . The Student Learning Plan Form captured here is available from this site.

Student Learning Plan Form

(web-based form completed by students during the first few weeks of co-op placement)

Student Name: _____ Job Title: _____ Work Term: _____
(e.g. 08S - 2008, summer)

Program of Study: _____ Student Number: _____

Supervisor Name: _____ Supervisor tel. Number: _____ Name of Organization _____

During the course of the work term the student will develop and/or enhance the following employability skills:

Communication, thinking and learning	**Not met**	**Met**	**Exceeded**
For example: improve public speaking skills by delivering verbal reports/presentations at team meetings	○	○	○

Personal Management	**Not met**	**Met**	**Exceeded**
For example: develop abilities to set goals and priorities	○	○	◉

Teamwork	Not met	Met	Exceeded
For example: develop the ability to co-operate with others to achieve established goals and objectives			

Technical Skills	Not met	Met	Exceeded
For example: develop the ability to deploy, set up and configure Windows Vista operating system on staff computers			

The following is the web-base d Employer Evaluation available from the website that the co-op employer completes and submits for the Cooperative Education Department's review.

Employer Evaluation

Student: **This is required information.**

Employer/Supervisor: **This is required information.**

Job Title: **This is required information.**

Company/Department Name **This is required information.**

Employer/Supervisor Email address: **This is required information.**

Outstanding	Very Good	Good	Average	Needs Improve.	N/A	
						ATTITUDES TOWARD WORK
						Uses time effectively and looks for work to do
						Dresses appropriately for job setting
						Exhbits knowledge of company/department
						Demonstrates continual improvement in completing work
						RELATIONS WITH OTHERS
						Cooperates with supervisors; is respectful

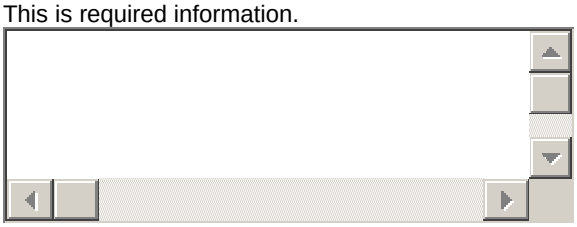
○	○	○	○	○	○	Works well with others and within a team
○	○	○	○	○	○	Accepts suggestions from others well; is courteous and helpful with public/customers
○	○	○	○	○	○	Overall communication skills
						DEPENDABILITY
○	○	○	○	○	○	Is on time to work; remains until required hours are completed
○	○	○	○	○	○	Alerts supervisor if absent or late for work
○	○	○	○	○	○	Plans ahead to rearrange work schedule
						JOB LEARNING/SKILL IMPROVEMENT
○	○	○	○	○	○	Shows continual improvement and speed in completing work
○	○	○	○	○	○	Can work independently
○	○	○	○	○	○	Exhibits adequate knowledge learned in classroom. Learns with ease; understands work/ responsibilities
						QUALITY OF WORK
○	○	○	○	○	○	Uses care with equipment and materials
○	○	○	○	○	○	Performs quality work
○	○	○	○	○	○	Able to follow and understand directions
○	○	○	○	○	○	Performs well under pressure
○	○	○	○	○	○	Can adapt to working conditions; is flexible

OVERALL PERFORMANCE
Please make a selection.

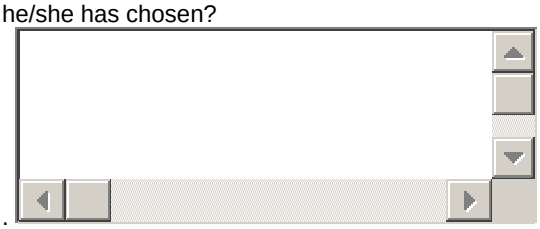
- ○ Outstanding
- ○ Very Good
- ○ Good
- ○ Average
- ○ Needs Improvement

What are some of the student's strengths?
This is required information.

What areas of work does the student need to improve?
This is required information.



What recommendations do you have to better prepare this student for the career he/she has chosen?



.

This evaluation has been completed, comparing this student to:
Please make a selection.

- Other Students
- Other employees
- Future Capability
- Other

Has this report been discussed with the student?
This is required information.

- Yes
- No

Work Term: Winter

Date:
This is required information.

Name:
This is required information.

Conclusion

In keeping with the Board's standards and benchmarks for program content, the proposed Bachelor of Building Science program includes two (2) mandatory co-op work terms that are scheduled in a block of fourteen (14) weeks. The first work term is in the summer semester (May – August) between the second and third year of study, and the second work term is one year later, in the summer semester between the third and fourth year of study. As indicated above, these work experiences

- are appropriate to the program;
- have articulated learning outcomes; and
- identify an appropriate method for both instructor and employer/supervisor assessment leading to the assignment of a grade.

Students in the proposed Bachelor of Building Science program, as well as employers in construction and construction-related industries, will benefit from Algonquin's established reputation for experiential learning as exemplified through co-operative education. Moreover, on-going collaboration between the academic department and Algonquin's Cooperative Education Department will ensure that there are rich and meaningful work experiences that contribute to both the breadth and depth of the knowledge and skills developed by the students.

Section 4.7: Course Outlines

This section contains the course outlines for all the core and non-core courses in the program. The content of this section is divided into three parts:

- previously assessed courses,
- core courses, and
- non-core courses.

For the proposed program, there are sixteen (16) courses that have been previously assessed, twenty-nine (29) core courses, and nine (9) non-core courses that contribute to the satisfaction of the Board's benchmark for breadth.

Identification of Previously Assessed Subjects

The following table lists the previously assessed subjects that are included in the proposed program of study, and for which the current course outlines are on file with PEQAB.

Subject Title	Type	Consent Program	Consent Granted (year)
Core Courses			
Technical Communication	Core	Bachelor of Applied Technology (Photonics)	2003
Calculus I	Core	Bachelor of Applied Technology (Photonics)	2003
Calculus II	Core	Bachelor of Applied Technology (Photonics)	2003
Linear Algebra	Core	Bachelor of Applied Technology (Photonics)	2003
Differential Equations	Core	Bachelor of Applied Technology (Photonics)	2003
Statistics	Core	Bachelor of Applied Technology (Photonics)	2003
Co-op Preparation Seminar	Core	Bachelor of Hospitality and Tourism Management	2010
Non-Core Courses			
Communications and Academic Writing	Non-Core	Bachelor of Hospitality and Tourism Management	2010
Law	Non-Core	Bachelor of Applied Business (e-Business Supply Chain Management)	2007
Introductory Psychology	Non-Core	Bachelor of Applied Technology (Photonics)	2003
Developmental Psychology	Non-Core	Bachelor of Applied Arts (Interior Design)	2007
General Astronomy	Non-Core	Bachelor of Applied Technology (Photonics)	2007
History of Art I	Non-Core	Bachelor of Applied Arts (Interior Design)	2007
History of Art II	Non-Core	Bachelor of Applied Arts (Interior Design)	2007
World Literature	Non-Core	Bachelor of Applied Arts (Interior Design)	2007
World Religions	Non-Core	Bachelor of Applied Arts (Interior Design)	2007

Section 4.7.1: Core Courses – *excluded for web version*

Section 4.7.2: Non-Core Courses – *course outlines excluded for web version*

The proposed program of study includes nine (9) non-core courses that contribute to the satisfaction of the Board's benchmark for breadth.

Of the nine (9) courses included in this submission, there are four (4) mandatory courses that all students must take as a requirement for graduation:

- Logic and Critical Thinking,
- Introduction to Sociology,
- Botany, and
- Principles of Urban Planning.

The remaining five (5) courses are additions to our existing pool of courses from which students are able to choose free elective courses:

- Introduction to Criminology,
- Creative Writing,
- Philosophy and Popular Culture,
- New Worlds and Alternative Realities: Speculative Fiction, and
- Survival in the Information Age: Risk and the Media

The schematic that follows depicts the College's proposed breadth curriculum reflective of core, non-core, elective options and non-core strands. The objective of this curriculum is to effectively allow for sufficient breadth of non-core offerings while facilitating access to depth in identified curriculum strands that are intended to be available across the College's degree program offerings.

Proposed College Breadth Curriculum

Year 1 – Semester 1
Communications & Academic Writing

Year 1 – Semester 2
Logic & Critical Thinking

Core
Discipline-specific Communications courses

Communications and Presentation Skills (B. HTM)
Business Communications (B. HTM)
Academic Writing II (B.A.A.)
Presentation Skills (B.A.A.)
Communications II (B.A.B.)
Speaking & Presentations (B.A.B.)
Technical Communications (B.B.S.)

Non-Core
Literature Courses

World Literature (B.A.A. & B. HTM)
Speculative Fiction (B.B.S.)

Core
Discipline-specific "Methods" courses

Research Methods II (B. HTM)
Applied Research (B.A.A.)
Critical/CreativeThinking Strategies (B.A.A.)

Non-Core
Philosophy Courses

Research Methods I (B. HTM)
Introduction to Research (B.A.A.)
Ethical Decision Making (B. HTM)
Ethics and the Environment (B.A.A.)
Philosophy & Pop Culture (B.B.S.)
Risk and the Media (B.B.S.)

LEGEND:
B.A.B.: Bachelor of Applied Business (e-Business Supply Chain Management)
B.A.A.: Bachelor of Applied Arts (Interior Design)
B.. HTM: Bachelor of Hospitality and Tourism
B.B.S.: Bachelor of Building Science (proposed)

Elective Options and Non-Core "Strands"

General

Interpersonal Communication
Law
General Astronomy
Introduction to Sociology
Criminology

Humanities

History of Art I
History of Art II
World Religions
Creative Writing

Environmental Studies

Environmental Science
Ethics and the Environment
Environmental Psychology
Environmental Economics

Psychology

Introductory Psychology
Developmental Psychology
Environmental Psychology

Global Studies

World Regional Geography
World Religions
World Literature
Canada's Cultural Diversity
Global Citizenship
Global Perspectives

Section 4.8: Bridging Course Descriptions

Based on the Gap Analysis conducted (Section 4.10) for the proposed degree completion arrangements, applicants with an Ontario College Advanced Diploma in Mechanical Engineering Technology enter into Semester 3 of the program and are also required to take one course from year 1 as part of the their program of study. This course is Building Design Processes. The structure of the program allows for the integration of the course that addresses the gap within the semester that students enter the program. As a result, the period of study for completion of the degree is not prolonged.

Year and Semester	Course Title	Calendar Course Description	Course Code
Year 1 course included in Program of Study for Mechanical Engineering Technology graduates	Building Design Processes	Through a variety of team-based simulations, students engage in aspects of the building design process in order to develop both a feel for the stages in the design process, and also an awareness of the time and work that culminates in a set of design plans. Discussions and presentations place code requirements and principles of LEED certification in their historical context. Students use a combination of hand drawing and models to present design concepts for evaluation by peers and instructors.	DSN1200

Section 4.9: Bridging Course Outlines – *excluded for web version*

The proposed degree completion arrangements outlined in the Gap Analysis (Section 4.10) includes the following course, Building Design Processes, as a means of addressing a gap in the knowledge and skills of students who have completed an Ontario College Advanced Diploma in Mechanical Engineering Technology.

Section 4.10: Gap Analysis

As outlined in the Advanced Standing Policies and Requirements (See Section 3.4: Advanced Standing Policies and Requirements, five (5) degree completion arrangements have been prepared for the proposed Bachelor of Building Science program. The gap analysis for each degree completion arrangement is presented in the following pages.

In four of the five arrangements, the alignment between the program outcomes of the prior study and the degree-level learning outcomes for the proposed degree program presents the opportunity for smooth transition or articulation into the degree program. Students receive recognition for their prior study such that they enter the degree program in either the second or third year of study. For those students entering in the third year, they must also demonstrate a minimum of 560 hrs of work experience. These students also receive recognition for two additional non-core, elective courses.

For the fifth degree completion arrangement, the outcomes of the prior study are not as aligned with the degree-level outcomes. Students who have graduated with an Ontario College Advanced Diploma in Mechanical Engineering Technology enter the proposed program of study in the second year and need to complete one (1) course from first year (See Section 4.9: Bridging Course Outline) as part of their course load during the second year of their degree studies. Depending on the academic aptitude of a given student applying for the degree completion arrangement, there may the opportunity to take the bridging course concurrently with the course for which it is a prerequisite. In addition, as with the other degree completion arrangements, students also receive recognition for two additional non-core, elective courses.

For all five of the degree completion arrangements, the gap analysis has been conducted with the degree-level learning outcomes for the proposed Bachelor of Building Science program and the Ministry of Training, Colleges, and Universities' published program standards for the programs of prior study. As a result, the degree completion arrangements are applicable for programs offered across Ontario and support greater mobility and articulation opportunities for students pursuing postsecondary studies throughout Ontario.

Section 4.10.1: Ontario College Diploma for Architectural Technician

The outcomes of prior study for this program are drawn from the Ministry of Training, Colleges, and Universities published program standards that "outline the essential skills and knowledge that a student must acquire and be able to reliably demonstrate in order to graduate from the program." [18]

Students graduating with an Ontario College Diploma in Architectural Technician will have acquired knowledge and skills in the area of building design, have developed proficiency with computer-aided design (CAD) tools, and have become familiar with the role of their discipline in the overall building process. This body of knowledge will make the transition into the proposed Bachelor of Building Science program a smooth one.

The degree completion arrangements for graduates of Architectural Technician require these students to complete the final three years of degree-level study successfully. In so doing, this will ensure that students achieve and demonstrate the depth of degree-level learning and acquire the additional knowledge and skills within the discipline of building science.

For this degree completion arrangement, the necessary academic rigour is in place to ensure that the degree level standard and the degree program outcomes are met.

Degree completion arrangements for graduates of *ARCHITECTURAL TECHNICIAN*

Outcomes of Prior Study	Degree Program Outcomes	Gap in Knowledge and Skills	Remediation of Gap
1. communicate with clients, contractors, other building professionals, and approval authorities.	3. Communicate effectively with all project stakeholders.	Experience discussing applied Building Science topics with diverse audiences.	Completion of courses in the appropriate knowledge area, including Technical Communications, Building Science Research Project I, Scenarios in Team Leadership, and Building Science Research Project II
2. assist in the preparation, reading, and interpretation of drawings, and other graphical representations used in building projects.	4. Read, interpret, and, with direction, modify documents related to building plans, including working drawings that involve structural, electrical, and mechanical features.	Analysis and evaluation of both building- related documentation and the impact that changes to drawings have on design and construction.	Completion of courses in the appropriate knowledge area, including Sustainable Design, Seminar in Constructability, Advanced Modeling and Simulation, and

[18] Ontario Ministry of Training, Colleges, and Universities, "What Does a Program Standard Contain?," [ONLINE] (22 February 2006) Available: http://www.tcu.gov.on.ca/eng/general/college/progstan/contain.html

Degree completion arrangements for graduates of *ARCHITECTURAL TECHNICIAN*

Outcomes of Prior Study	Degree Program Outcomes	Gap in Knowledge and Skills	Remediation of Gap
3. read and assist in the preparation of specifications and other project documents used in design and construction.			Construction Methods for Renovation and Rehabilitation
4. assist in the preparation of estimates of time, costs, and quantity.	8. Contribute to the on-going economic viability of construction and engineering projects through the application of principles of estimating, accounting, and cost controls.	Integration of economic principles within design and construction decisions, and the longer term impacts of choices related to methods and materials.	Completion of courses in the appropriate knowledge area, including Business Development for the Construction Industry, Introduction to Construction Project Management, and Applied Energy Management
5. assist in solving technical problems related to building projects through the application of principles of building science and mathematics.	2. Use sound, acceptable engineering principles for the solution and documentation of situations encountered during the construction or rehabilitation of buildings.	Increased responsibility for developing and documenting solutions that can arise during complex projects	Completion of courses in the appropriate knowledge area, including Building Systems, Advanced Engineering Principles, Seminar in Constructability, and Construction Methods for Renovation and Rehabilitation
6. collaborate with members of the building team.	9. Facilitate partnerships and productive interactions within project teams that involve knowledge-workers and skilled trade workers.	Development of broader sense of inter-professional collaboration, and the ability to take a greater leadership role on project teams.	Completion of courses in the appropriate knowledge area, including Technical Communications, Introduction to Construction Project Management, and Scenarios in Team Leadership
7. assist in the development of architectural designs.		Outcome from prior study supports the achievement of degree program outcomes, but is not specifically within the domain of the degree content and outcomes.	

Degree completion arrangements for graduates of *ARCHITECTURAL TECHNICIAN*

Outcomes of Prior Study	Degree Program Outcomes	Gap in Knowledge and Skills	Remediation of Gap
8. review and assist in the preparation of site planning documents.	4. Read, interpret, and, with direction, modify documents related to building plans, including working drawings that involve structural, electrical, and mechanical features.	Analysis and evaluation of both building- related documentation and the impact that changes to drawings have on design and construction.	Completion of courses in the appropriate knowledge area, including Sustainable Design, Seminar in Constructability, Advanced Modeling and Simulation, and Construction Methods for Renovation and Rehabilitation
9. comply with the legal and ethical requirements of an architectural technician in the practice of building design and construction.	10. Ensure work, activities, and practice are in compliance with established ethical and professional standards, as well as local, provincial, and national legislation.	Overview of the breadth of standards and legislation that apply to Building Science and that extend beyond previous area of study.	Completion of courses in the appropriate knowledge area, including Business Development for the Construction Industry, Advanced Engineering Principles, Energy Conservation and Auditing, and Seminar in Sustainable Solutions
10. assist in the assessment of buildings related to repurposing and renovation projects.	7. Analyze, test, and comment on the functionality of alternative structural, mechanical, and electrical solutions proposed for integration in both new projects and renovations.	Analysis and evaluation of new and emerging alternative and renewable sources of energy that impact plans for renovations and development of new projects.	Completion of courses in the appropriate knowledge area, including Renewable Energy, Alternative Energy, Energy Conservation and Auditing, Applied Energy Management, and Seminar in Sustainable Solutions

Degree completion arrangements for graduates of *ARCHITECTURAL TECHNICIAN*

Outcomes of Prior Study	Degree Program Outcomes	Gap in Knowledge and Skills	Remediation of Gap
11. ensure personal safety in the workplace.	10. Ensure work, activities, and practice are in compliance with established ethical and professional standards, as well as local, provincial, and national legislation.	Overview of the breadth of standards and legislation that apply to Building Science and that extend beyond previous area of study.	Completion of courses in the appropriate knowledge area, including Business Development for the Construction Industry, and Introduction to Construction Project Management.
12. identify sustainable design and building practices.	1. Integrate sustainable building practices and alternative energy solutions and present options that balance client specifications, site conditions, and human factors.	Integration of sustainable practices within the complete lifecycle of design and construction and the assumption of a greater leadership role	Completion of courses in the appropriate knowledge area, including Sustainable Design, Seminar in Constructability, Building Science Research Project I, Seminar in Sustainable Solutions, and Building Science Research Project II
13. use current and emerging technology to support building projects.	11. Adapt to changes in employment requirements through the development, implementation, and updating of professional and personal development plans.	Areas of potential employment and specialization upon graduation, along with the related training requirements to remain current.	Completion of courses in the appropriate knowledge area, including Building Information Modeling, Advanced Modeling and Simulation, and Professional Portfolio Development
14. assist in the administration of the construction phase of building projects.	8. Contribute to the on-going economic viability of construction and engineering projects through the application of principles of estimating, accounting, and cost controls.	Integration of economic principles within design and construction decisions, and the longer term impacts of choices related to methods and materials.	Completion of courses in the appropriate knowledge area, including Business Development for the Construction Industry, Introduction to Construction Project Management, and Applied Energy Management

Degree completion arrangements for graduates of *ARCHITECTURAL TECHNICIAN*

Outcomes of Prior Study	Degree Program Outcomes	Gap in Knowledge and Skills	Remediation of Gap
	5. Formulate strategies for the efficient and effective commissioning and operation of buildings and building systems.	Involvement in the transition of a building from construction company/contractor to owner/operator.	Completion of courses in the appropriate knowledge area, including Building Systems, Energy Conservation and Auditing, and Advanced Modeling and Simulation.
	6. Evaluate the practical applications of primary and secondary theoretical research related to existing and emerging construction methods and materials.	Development and exercising of research skills at a degree-level with an awareness of the value of both primary and secondary research, and the associated expectations.	Completion of courses in the appropriate knowledge area, including Technical Communication, Advanced Engineering Principles, Building Science Research Project I, and Building Science Research Project II

Section 4.10.2: Ontario College Advanced Diploma for Architectural Technology

The outcomes of prior study for this program are drawn from the Ministry of Training, Colleges, and Universities published program standards that "outline the essential skills and knowledge that a student must acquire and be able to reliably demonstrate in order to graduate from the program." [19]

Students graduating with an Ontario College Advanced Diploma in Architectural Technology will have acquired advanced knowledge and skills in the area of building design, have developed substantial proficiency with computer-aided design (CAD) tools, and have been prepared for a leadership role within their discipline as it contributes to the overall building process. This body of knowledge will make the transition into the proposed Bachelor of Building Science program a smooth one.

The degree completion arrangements for graduates of Architectural Technology require these students to demonstrate 560 hours of related work experience, and to complete the final two years of degree-level study successfully. In so doing, this will ensure that students achieve and demonstrate the depth of degree-level learning and acquire the additional knowledge and skills within the discipline of building science.

For this degree completion arrangement, the necessary academic rigour is in place to ensure that the degree level standard and the degree program outcomes are met.

Degree completion arrangements for graduates of *ARCHITECTURAL TECHNOLOGY*

Outcomes of Prior Study	Degree Program Outcomes	Gap in Knowledge and Skills	Remediation of Gap
1. communicate with clients, contractors, other building professionals, and approval authorities.	3. Communicate effectively with all project stakeholders.	Experience discussing applied Building Science topics with diverse audiences.	Completion of courses in the appropriate knowledge area, including Building Science Research Project I, Scenarios in Team Leadership, and Building Science Research Project II

[19] Ontario Ministry of Training, Colleges, and Universities, "What Does a Program Standard Contain?," [ONLINE] (22 February 2006) Available: http://www.tcu.gov.on.ca/eng/general/college/progstan/contain.html

Degree completion arrangements for graduates of *ARCHITECTURAL TECHNOLOGY*

Outcomes of Prior Study	Degree Program Outcomes	Gap in Knowledge and Skills	Remediation of Gap
2. prepare, read, interpret, and revise drawings, and other graphical representations used in building projects.	4. Read, interpret, and, with direction, modify documents related to building plans, including working drawings that involve structural, electrical, and mechanical features.	Analysis and evaluation of both building- related documentation and the impact that changes to drawings have on design and construction.	Completion of courses in the appropriate knowledge area, including, Seminar in Constructability, Advanced Modeling and Simulation, and Construction Methods for Renovation and Rehabilitation
3. obtain, analyze, prepare, and revise specifications and other project documents used in design and construction.			
4. prepare estimates of time, costs, and quantity, and participate in the tendering process.	8. Contribute to the on-going economic viability of construction and engineering projects through the application of principles of estimating, accounting, and cost controls.	Integration of economic principles within design and construction decisions, and the longer term impacts of choices related to methods and materials.	Completion of courses in the appropriate knowledge area, including Introduction to Construction Project Management, and Applied Energy Management
5. solve technical problems related to building projects through the application of principles of building science and mathematics.	2. Use sound, acceptable engineering principles for the solution and documentation of situations encountered during the construction or rehabilitation of buildings.	Increased responsibility for developing and documenting solutions that can arise during complex projects	Completion of courses in the appropriate knowledge area, including Advanced Engineering Principles, Seminar in Constructability, and Construction Methods for Renovation and Rehabilitation

Degree completion arrangements for graduates of *ARCHITECTURAL TECHNOLOGY*

Outcomes of Prior Study	Degree Program Outcomes	Gap in Knowledge and Skills	Remediation of Gap
6. collaborate with and coordinate information from structural, mechanical, and electrical building systems professionals.	9. Facilitate partnerships and productive interactions within project teams that involve knowledge-workers and skilled trade workers.	Development of broader sense of inter-professional collaboration, and the ability to take a greater leadership role on project teams.	Completion of courses in the appropriate knowledge area, including Introduction to Construction Project Management, and Scenarios in Team Leadership
7. contribute to the design of architectural projects.		Outcome from prior study supports the achievement of degree program outcomes, but is not specifically within the domain of the degree content and outcomes.	
8. contribute to the analysis, planning, and preparation of site planning documents.	4. Read, interpret, and, with direction, modify documents related to building plans, including working drawings that involve structural, electrical, and mechanical features.	Analysis and evaluation of both building- related documentation and the impact that changes to drawings have on design and construction.	Completion of courses in the appropriate knowledge area, including Seminar in Constructability, Advanced Modeling and Simulation, and Construction Methods for Renovation and Rehabilitation
9. comply with the legal and ethical requirements of an architectural technologist in the practice of building design and construction.	10. Ensure work, activities, and practice are in compliance with established ethical and professional standards, as well as local, provincial, and national legislation.	Overview of the breadth of standards and legislation that apply to Building Science and that extend beyond previous area of study.	Completion of courses in the appropriate knowledge area, including Advanced Engineering Principles, Energy Conservation and Auditing, and Seminar in Sustainable Solutions

Degree completion arrangements for graduates of *ARCHITECTURAL TECHNOLOGY*

Outcomes of Prior Study	Degree Program Outcomes	Gap in Knowledge and Skills	Remediation of Gap
10. assess buildings and their interiors, and make recommendations for their repurposing and renovation.	7. Analyze, test, and comment on the functionality of alternative structural, mechanical, and electrical solutions proposed for integration in both new projects and renovations.	Analysis and evaluation of new and emerging alternative and renewable sources of energy that impact plans for renovations and development of new projects.	Completion of courses in the appropriate knowledge area, including Renewable Energy, Alternative Energy, Energy Conservation and Auditing, Applied Energy Management, and Seminar in Sustainable Solutions
11. ensure personal safety and contribute to the safety of others in the workplace.	10. Ensure work, activities, and practice are in compliance with established ethical and professional standards, as well as local, provincial, and national legislation.	Overview of the breadth of standards and legislation that apply to Building Science and that extend beyond previous area of study.	Completion of courses in the appropriate knowledge area, including Introduction to Construction Project Management.
12. participate in sustainable design and building practices.	1. Integrate sustainable building practices and alternative energy solutions and present options that balance client specifications, site conditions, and human factors.	Integration of sustainable practices within the complete lifecycle of design and construction and the assumption of a greater leadership role	Completion of courses in the appropriate knowledge area, including Seminar in Constructability, Building Science Research Project I, Seminar in Sustainable Solutions, and Building Science Research Project II
13. use and evaluate current and emerging technology to support building projects.	11. Adapt to changes in employment requirements through the development, implementation, and updating of professional and personal development plans.	Areas of potential employment and specialization upon graduation, along with the related training requirements to remain current.	Completion of courses in the appropriate knowledge area, including Building Information Modeling, Advanced Modeling and Simulation, and Professional Portfolio Development

Degree completion arrangements for graduates of *ARCHITECTURAL TECHNOLOGY*

Outcomes of Prior Study	Degree Program Outcomes	Gap in Knowledge and Skills	Remediation of Gap
14. assist in the planning, scheduling, and monitoring of building projects. 15. apply business principles to design and building practices.	8. Contribute to the on-going economic viability of construction and engineering projects through the application of principles of estimating, accounting, and cost controls.	Integration of economic principles within design and construction decisions, and the longer term impacts of choices related to methods and materials.	Completion of courses in the appropriate knowledge area, including Introduction to Construction Project Management, and Applied Energy Management
	5. Formulate strategies for the efficient and effective commissioning and operation of buildings and building systems.	Involvement in the transition of a building from construction company/contractor to owner/operator.	Completion of courses in the appropriate knowledge area, including Energy Conservation and Auditing, and Advanced Modeling and Simulation.
	6. Evaluate the practical applications of primary and secondary theoretical research related to existing and emerging construction methods and materials.	Development and exercising of research skills at a degree-level with an awareness of the value of both primary and secondary research, and the associated expectations.	Completion of courses in the appropriate knowledge area, including Advanced Engineering Principles, Building Science Research Project I, and Building Science Research Project II

Section 4.10.3: Ontario College Diploma for Construction Engineering Technician

The outcomes of prior study for this program are drawn from the Ministry of Training, Colleges, and Universities published program standards that "outline the essential skills and knowledge that a student must acquire and be able to reliably demonstrate in order to graduate from the program." [20]

Students graduating with an Ontario College Diploma in Construction Engineering Technician will have acquired knowledge and skills in the area of building construction, and job site requirements, have developed proficiency with the data gathering and documentation processes that are in place for construction projects, and have become familiar with the role of their discipline in the overall building process. This body of knowledge will make the transition into the proposed Bachelor of Building Science program a smooth one.

The degree completion arrangements for graduates of Construction Engineering Technician require these students to complete the final three years of degree-level study successfully. In so doing, this will ensure that students achieve and demonstrate the depth of degree-level learning and acquire the additional knowledge and skills within the discipline of building science.

For this degree completion arrangement, the necessary academic rigour is in place to ensure that the degree level standard and the degree program outcomes are met.

Degree completion arrangements for graduates of *CONSTRUCTION ENGINEERING TECHNICIAN*

Outcomes of Prior Study	Degree Program Outcomes	Gap in Knowledge and Skills	Remediation of Gap
1. collect, interpret, and appropriately apply information from past construction projects including graphics, reports, performance and productivity analyses, and other documents.	4. Read, interpret, and, with direction, modify documents related to building plans, including working drawings that involve structural, electrical, and mechanical features.	Specific information related to specialized software programs, and a greater depth of knowledge related to systems and structures.	Completion of courses in the appropriate knowledge area, including Sustainable Design, Building Systems, Building Information Modeling, and Construction Methods for Renovation and Rehabilitation.

20 Ontario Ministry of Training, Colleges, and Universities, "What Does a Program Standard Contain?," [ONLINE] (22 February 2006) Available: http://www.tcu.gov.on.ca/eng/general/college/progstan/contain.html

Degree completion arrangements for graduates of *CONSTRUCTION ENGINEERING TECHNICIAN*

Outcomes of Prior Study	Degree Program Outcomes	Gap in Knowledge and Skills	Remediation of Gap
2. assist in the preparation of accurate estimates of time, cost, quality and quantity; tenders; and bids.	8. Contribute to the on-going economic viability of construction and engineering projects through the application of principles of estimating, accounting, and cost controls.	Integration of economic principles within design and construction decisions, and the longer term impacts of choices related to methods and materials.	Completion of courses in the appropriate knowledge area, including Business Development for the Construction Industry, Introduction to Construction Project Management, and Applied Energy Management
3. contribute to the collecting, processing, interpreting, and applying of survey and layout information related to construction projects.	2. Use sound, acceptable engineering principles for the solution and documentation of situations encountered during the construction or rehabilitation of buildings.	Increase knowledge of the breadth of engineering principles applied in building science.	Completion of courses in the appropriate knowledge area, including Building Frame and Structural Studies, Sustainable Design, Advanced Engineering Principles, Seminar in Constructability, and Advanced Modeling and Simulation
4. communicate construction project-related information effectively and accurately by interpreting and producing data in graphic, oral, and written formats.	3. Communicate effectively with all project stakeholders.	Experience discussing applied Building Science topics with diverse audiences.	Completion of courses in the appropriate knowledge area, including Technical Communications, Building Science Research Project I, Scenarios in Team Leadership, and Building Science Research Project II
5. work according to contractual obligations; the project manual; and applicable law, standards, bylaws, and codes.	10. Ensure work, activities, and practice are in compliance with established ethical and professional standards, as well as local, provincial, and national legislation.	Overview of the breadth of standards and legislation that apply to Building Science and that extend beyond previous area of study.	Completion of courses in the appropriate knowledge area, including Business Development for the Construction Industry, Advanced

Degree completion arrangements for graduates of *CONSTRUCTION ENGINEERING TECHNICIAN*

Outcomes of Prior Study	Degree Program Outcomes	Gap in Knowledge and Skills	Remediation of Gap
6. work in compliance with the theory and the accepted principles and practices of the construction industry.			Engineering Principles, Introduction to Construction Project Management, Energy Conservation and Auditing, and Seminar in Sustainable Solutions
7. assist in the coordination of time, cost, quantity, and quality performance for construction projects.	8. Contribute to the on-going economic viability of construction and engineering projects through the application of principles of estimating, accounting, and cost controls.	Integration of economic principles within design and construction decisions, and the longer term impacts of choices related to methods and materials.	Completion of courses in the appropriate knowledge area, including Business Development for the Construction Industry, Introduction to Construction Project Management, and Applied Energy Management
8. contribute to the evaluation of equipment use, materials, and of the methods employed to implement and complete construction projects.	6. Evaluate the practical applications of primary and secondary theoretical research related to existing and emerging construction methods and materials.	Development and exercising of research skills at a degree-level with an awareness of the value of both primary and secondary research, and the associated expectations.	Completion of courses in the appropriate knowledge area, including Technical Communication, Advanced Engineering Principles, Building Science Research Project I, and Building Science Research Project II
9. contribute to the maintenance of project records, logs, and inventories	2. Use sound, acceptable engineering principles for the solution and documentation of	Increase knowledge of the breadth of engineering principles applied in building science.	Completion of courses in the appropriate knowledge area, including Building

Degree completion arrangements for graduates of *CONSTRUCTION ENGINEERING TECHNICIAN*

Outcomes of Prior Study	Degree Program Outcomes	Gap in Knowledge and Skills	Remediation of Gap
10. apply the principles of building science and construction engineering to assist in solving technical problems related to construction projects.	situations encountered during the construction or rehabilitation of buildings.		Frame and Structural Studies, Sustainable Design, Advanced Engineering Principles, Seminar in Constructability, and Advanced Modeling and Simulation
11. recognize the interdependence of disciplines including architectural, structural, mechanical, electrical, and civil engineering, and others relating to construction projects.	7. Analyze, test, and comment on the functionality of alternative structural, mechanical, and electrical solutions proposed for integration in both new projects and renovations.	Analysis and evaluation of new and emerging alternative and renewable sources of energy that impact plans for renovations and development of new projects.	Completion of courses in the appropriate knowledge area, including Renewable Energy, Alternative Energy, Energy Conservation and Auditing, Applied Energy Management, and Seminar in Sustainable Solutions
12. cooperate with the project stakeholders involved in the design, implementation, and evaluation of construction projects.	9. Facilitate partnerships and productive interactions within project teams that involve knowledge-workers and skilled trade workers.	Development of broader sense of inter-professional collaboration, and the ability to take a greater leadership role on project teams.	Completion of courses in the appropriate knowledge area, including Technical Communications, Introduction to Construction Project Management, and Scenarios in Team Leadership
13. contribute to the human resource management of construction projects.	8. Contribute to the on-going economic viability of construction and engineering projects through the application of principles of estimating, accounting, and cost controls.	Integration of economic principles within design and construction decisions, and the longer term impacts of choices related to methods and materials.	Completion of courses in the appropriate knowledge area, including Business Development for the Construction Industry, Introduction to Construction Project Management, and Applied Energy Management

Degree completion arrangements for graduates of *CONSTRUCTION ENGINEERING TECHNICIAN*

Outcomes of Prior Study	Degree Program Outcomes	Gap in Knowledge and Skills	Remediation of Gap
14. use electronic technology to support construction projects.	11. Adapt to changes in employment requirements through the development, implementation, and updating of professional and personal development plans.	Areas of potential employment and specialization upon graduation, along with the related training requirements to remain current.	Completion of courses in the appropriate knowledge area, including Building Information Modeling, Advanced Modeling and Simulation, and Professional Portfolio Development
	1. Integrate sustainable building practices and alternative energy solutions and present options that balance client specifications, site conditions, and human factors.	Development of solutions from the design perspective with a view to integration within the construction process, and the balancing of specifications, conditions, and human factors.	Completion of courses in the appropriate knowledge area, including Sustainable Design, Building Systems, Energy Conservation and Auditing, Building Science Research Project I, Seminar in Sustainable Solutions, and Building Science Research Project II
	5. Formulate strategies for the efficient and effective commissioning and operation of buildings and building systems.	Involvement in the transition of a building from construction company/contractor to owner/operator.	Completion of courses in the appropriate knowledge area, including Building Systems, Energy Conservation and Auditing, and Advanced Modeling and Simulation.

Section 4.10.4: Ontario College Advanced Diploma for Civil Engineering Technology

The outcomes of prior study for this program are drawn from the Ministry of Training, Colleges, and Universities published program standards that "outline the essential skills and knowledge that a student must acquire and be able to reliably demonstrate in order to graduate from the program." [21]

Students graduating with an Ontario College Advanced Diploma in Civil Engineering Technology will have acquired advanced knowledge and skills in the area of building construction, and civil engineering projects, have developed substantial proficiency with the data gathering and analysis required for civil engineering projects, and have been prepared for a leadership role within their discipline as it contributes to the overall construction process. This body of knowledge will make the transition into the proposed Bachelor of Building Science program a smooth one.

The degree completion arrangements for graduates of Civil Engineering Technology require these students to demonstrate 560 hours of related work experience, and to complete the final two years of degree-level study successfully. In so doing, this will ensure that students achieve and demonstrate the depth of degree-level learning and acquire the additional knowledge and skills within the discipline of building science.

For this degree completion arrangement, the necessary academic rigour is in place to ensure that the degree level standard and the degree program outcomes are met.

Degree completion arrangements for graduates of *CIVIL ENGINEERING TECHNOLOGY*

Outcomes of Prior Study	Degree Program Outcomes	Gap in Knowledge and Skills	Remediation of Gap
1. assemble, analyse, and appropriately apply civil engineering data from existing graphics, reports, and other documents.	4. Read, interpret, and, with direction, modify documents related to building plans, including working drawings that involve structural, electrical, and mechanical features.	Specific information related to specialized software programs, and a greater depth of knowledge related to systems and structures.	Completion of courses in the appropriate knowledge area, including Building Information Modeling, Seminar in Constructability and Construction Methods

21 Ontario Ministry of Training, Colleges, and Universities, "What Does a Program Standard Contain?," [ONLINE] (22 February 2006) Available: http://www.tcu.gov.on.ca/eng/general/college/progstan/contain.html

Degree completion arrangements for graduates of *CIVIL ENGINEERING TECHNOLOGY*

Outcomes of Prior Study	Degree Program Outcomes	Gap in Knowledge and Skills	Remediation of Gap
2. coordinate and facilitate the collection, processing, and interpretation of technical data related to civil engineering projects.			for Renovation and Rehabilitation.
3. communicate information effectively and accurately by analysing, translating, and producing civil engineering documents.	3. Communicate effectively with all project stakeholders.	Experience discussing applied Building Science topics with diverse audiences.	Completion of courses in the appropriate knowledge area, including Building Science Research Project I, Scenarios in Team Leadership, and Building Science Research Project II
4. monitor that all work is completed in compliance with the rights and conditions of contractual obligations; applicable law, standards, bylaws, and codes; and the accepted principles and practices of civil engineering.	10. Ensure work, activities, and practice are in compliance with established ethical and professional standards, as well as local, provincial, and national legislation.	Overview of the breadth of standards and legislation that apply to Building Science and that extend beyond previous area of study.	Completion of courses in the appropriate knowledge area, including, Advanced Engineering Principles, Introduction to Construction Project Management, Energy Conservation and Auditing, and Seminar in Sustainable Solutions
5. schedule and coordinate civil engineering projects and monitor the quality and quantity of work.	8. Contribute to the on-going economic viability of construction and engineering projects through the application of	Integration of economic principles within design and construction decisions, and the longer term impacts of choices related to	Completion of courses in the appropriate knowledge area, including Introduction to Construction Project Management,

Degree completion arrangements for graduates of *CIVIL ENGINEERING TECHNOLOGY*

Outcomes of Prior Study	Degree Program Outcomes	Gap in Knowledge and Skills	Remediation of Gap
6. assist in planning, designing, inspecting, supervising, and constructing civil engineering projects.	principles of estimating, accounting, and cost controls.	methods and materials.	and Applied Energy Management
7. evaluate the methods employed and the use of equipment and materials involved in the implementation and completion of civil engineering projects.	6. Evaluate the practical applications of primary and secondary theoretical research related to existing and emerging construction methods and materials.	Development and exercising of research skills at a degree-level with an awareness of the value of both primary and secondary research, and the associated expectations.	Completion of courses in the appropriate knowledge area, including Advanced Engineering Principles, Building Science Research Project I, and Building Science Research Project II
8. use electronic technology to support civil engineering projects.	11. Adapt to changes in employment requirements through the development, implementation, and updating of professional and personal development plans.	Areas of potential employment and specialization upon graduation, along with the related training requirements to remain current.	Completion of courses in the appropriate knowledge area, including Building Information Modeling, Advanced Modeling and Simulation, and Professional Portfolio Development
9. apply the principles of mathematics and science to analyze and solve technical problems related to civil engineering projects.	2. Use sound, acceptable engineering principles for the solution and documentation of situations encountered during the construction or rehabilitation of buildings.	Increase knowledge of the breadth of engineering principles applied in building science.	Completion of courses in the appropriate knowledge area, including Advanced Engineering Principles, Seminar in Constructability, Advanced Modeling and Simulation, Construction Methods for Renovation and Rehabilitation.
10. manage and maintain systems for civil engineering project records, logs, and inventories.			

Degree completion arrangements for graduates of *CIVIL ENGINEERING TECHNOLOGY*

Outcomes of Prior Study	Degree Program Outcomes	Gap in Knowledge and Skills	Remediation of Gap
11. assist in the assessment of the political, social, and environmental impacts of civil engineering projects.	8. Contribute to the on-going economic viability of construction and engineering projects through the application of principles of estimating, accounting, and cost controls.	Integration of economic principles within design and construction decisions, and the longer term impacts of choices related to methods and materials.	Completion of courses in the appropriate knowledge area, including Introduction to Construction Project Management, Applied Energy Management, and Seminar in Sustainable Solutions
12. take into account the interdependence of the architectural, structural, mechanical, and electrical disciplines relating to civil engineering projects.	7. Analyze, test, and comment on the functionality of alternative structural, mechanical, and electrical solutions proposed for integration in both new projects and renovations.	Analysis and evaluation of new and emerging alternative and renewable sources of energy that impact plans for renovations and development of new projects.	Completion of courses in the appropriate knowledge area, including Renewable Energy, Alternative Energy, Energy Conservation and Auditing, Applied Energy Management, and Seminar in Sustainable Solutions
13. facilitate liaison among the project stakeholders involved in the design and implementation of civil engineering projects.	9. Facilitate partnerships and productive interactions within project teams that involve knowledge-workers and skilled trade workers.	Development of broader sense of inter-professional collaboration, and the ability to take a greater leadership role on project teams.	Completion of courses in the appropriate knowledge area, including Introduction to Construction Project Management, and Scenarios in Team Leadership
14. develop and use personal and professional strategies and plans to enhance professional growth and competence.	11. Adapt to changes in employment requirements through the development, implementation, and updating of professional and personal development plans.	Areas of potential employment and specialization upon graduation, along with the related training requirements to remain current.	Completion of courses in the appropriate knowledge area, including Building Information Modeling, Advanced Modeling and Simulation, and Professional Portfolio Development

Degree completion arrangements for graduates of *CIVIL ENGINEERING TECHNOLOGY*

Outcomes of Prior Study	Degree Program Outcomes	Gap in Knowledge and Skills	Remediation of Gap
	1. Integrate sustainable building practices and alternative energy solutions and present options that balance client specifications, site conditions, and human factors.	Development of solutions from the design perspective with a view to integration within the construction process, and the balancing of specifications, conditions, and human factors.	Completion of courses in the appropriate knowledge area, including Seminar in Constructability, Energy Conservation and Auditing, Building Science Research Project I, Seminar in Sustainable Solutions, and Building Science Research Project II
	5. Formulate strategies for the efficient and effective commissioning and operation of buildings and building systems.	Involvement in the transition of a building from construction company/contractor to owner/operator.	Completion of courses in the appropriate knowledge area, including Energy Conservation and Auditing, and Advanced Modeling and Simulation.

Section 4.10.5: Ontario College Advanced Diploma for Mechanical Engineering Technology

The outcomes of prior study for this program are drawn from the Ministry of Training, Colleges, and Universities published program standards that "outline the essential skills and knowledge that a student must acquire and be able to reliably demonstrate in order to graduate from the program." [22]

Students graduating with an Ontario College Advanced Diploma in Mechanical Engineering Technology will have acquired advanced knowledge and skills in the area of mechanical engineering and manufacturing, have developed proficiency in the design and analysis of mechanical systems and components, and have been prepared for a leadership role within their discipline. This body of knowledge, though related on the basis of some of the fundamental principles in the discipline, is not as related to the proposed Bachelor of Building Science program. As a result appropriate steps have been taken in the development of the degree completion arrangement.

The degree completion arrangements for graduates of Mechanical Engineering Technology require these students to complete a bridging course (Building Design Processes or an acceptable alternative) prior to their first work experience (See Section 4.9: Bridging Course Outline), and to complete the final three years of degree-level study successfully. In so doing, this will ensure that students achieve and demonstrate the depth of degree-level learning and acquire the additional knowledge and skills within the discipline of building science.

For this degree completion arrangement, the necessary academic rigour is in place to ensure that the degree level standard and the degree program outcomes are met.

Degree completion arrangements for graduates of *MECHANICAL ENGINEERING TECHNOLOGY*

Outcomes of Prior Study	Degree Program Outcomes	Gap in Knowledge and Skills	Remediation of Gap
1. analyze and solve complex technical problems related to mechanical environments through the application of engineering principles.	2. Use sound, acceptable engineering principles for the solution and documentation of situations encountered during the construction or rehabilitation of buildings.	Specific applications of engineering principles to complex problem-solving connected with the inter-related disciplines of building science.	Completion of courses in the appropriate knowledge area, including Building Frame and Structural Studies, Sustainable Design, Advanced Engineering Principles, Seminar in Constructability, and Advanced Modeling and Simulation

22 Ontario Ministry of Training, Colleges, and Universities, "What Does a Program Standard Contain?," [ONLINE] (22 February 2006) Available: http://www.tcu.gov.on.ca/eng/general/college/progstan/contain.html

Degree completion arrangements for graduates of *MECHANICAL ENGINEERING TECHNOLOGY*

Outcomes of Prior Study	Degree Program Outcomes	Gap in Knowledge and Skills	Remediation of Gap
2. design and analyze mechanical components, processes, and systems through the application of engineering principles and practices.	7. Analyze, test, and comment on the functionality of alternative structural, mechanical, and electrical solutions proposed for integration in both new projects and renovations.	Expand existing knowledge beyond strictly mechanical applications to include new and emerging options in structural and electrical applications.	Completion of courses in the appropriate knowledge area, including Renewable Energy, Alternative Energy, Energy Conservation and Auditing, Applied Energy Management, and Seminar in Sustainable Solutions
3. analyze and prepare graphics and other technical documents to appropriate engineering standards.	4. Read, interpret, and, with direction, modify documents related to building plans, including working drawings that involve structural, electrical, and mechanical features.	Using familiar software and tools for the development of documents used in construction applications.	Completion of courses in the appropriate knowledge area, including Sustainable Design, Building Systems, Building Information Modeling, and Construction Methods for Renovation and Rehabilitation.
4. use computer hardware and software to support the engineering environment.			
5. apply knowledge of manufacturing processes to the design of components.		Outcome from prior study supports the achievement of degree program outcomes, but is not specifically within the domain of the degree content and outcomes.	
6. apply knowledge of materials and engineering principles to manufacturing operations and processes.		Outcome from prior study supports the achievement of degree program outcomes, but is not specifically within the domain of the degree content and outcomes.	
7. apply knowledge of machinery, tools, and other equipment used in manufacturing processes.		Outcome from prior study supports the achievement of degree program outcomes, but is not specifically within the domain of the degree content and outcomes.	

Degree completion arrangements for graduates of *MECHANICAL ENGINEERING TECHNOLOGY*

Outcomes of Prior Study	Degree Program Outcomes	Gap in Knowledge and Skills	Remediation of Gap
8. specify, coordinate, and conduct quality control and quality assurance procedures.	8. Contribute to the on-going economic viability of construction and engineering projects through the application of principles of estimating, accounting, and cost controls.	Expand knowledge base to include broader economic requirements that influence construction projects.	Completion of courses in the appropriate knowledge area, including Business Development for the Construction Industry, Introduction to Construction Project Management, and Applied Energy Management
9. recognize the environmental, economic, legal, safety, and ethical implications of mechanical engineering projects.	10. Ensure work, activities, and practice are in compliance with established ethical and professional standards, as well as local, provincial, and national legislation.	Overview of the breadth of standards and legislation that apply to Building Science and that extend beyond previous area of study.	Completion of courses in the appropriate knowledge area, including Business Development for the Construction Industry, Advanced Engineering Principles, Introduction to Construction Project Management, Energy Conservation and Auditing, and Seminar in Sustainable Solutions
10. use and maintain documentation, inventory, and records systems.	3. Communicate effectively with all project stakeholders.	Experience discussing applied Building Science topics with diverse audiences.	Completion of courses in the appropriate knowledge area, including Technical Communications, Building Science Research Project I, Scenarios in Team Leadership, and Building Science Research Project II

Degree completion arrangements for graduates of *MECHANICAL ENGINEERING TECHNOLOGY*

Outcomes of Prior Study	Degree Program Outcomes	Gap in Knowledge and Skills	Remediation of Gap
11. participate in the management of an engineering project.	9. Facilitate partnerships and productive interactions within project teams that involve knowledge-workers and skilled trade workers.	Development of broader sense of inter-professional collaboration, and the ability to take a greater leadership role on project teams.	Completion of courses in the appropriate knowledge area, including Technical Communications, Introduction to Construction Project Management, and Scenarios in Team Leadership
12. develop strategies and plans to improve job performance and work relationships.	11. Adapt to changes in employment requirements through the development, implementation, and updating of professional and personal development plans.	Areas of potential employment and specialization upon graduation, along with the related training requirements to remain current.	Completion of courses in the appropriate knowledge area, including Building Information Modeling, Advanced Modeling and Simulation, and Professional Portfolio Development
	1. Integrate sustainable building practices and alternative energy solutions and present options that balance client specifications, site conditions, and human factors.	Development of solutions from the design perspective with a view to integration within the construction process, and the balancing of specifications, conditions, and human factors.	Successful completion of Building Design Processes (Bridge Course) or an acceptable related alternative. Completion of courses in the appropriate knowledge area, including Sustainable Design, Building Systems, Energy Conservation and Auditing, Building Science Research Project I, Seminar in Sustainable Solutions, and Building Science Research Project II

Degree completion arrangements for graduates of *MECHANICAL ENGINEERING TECHNOLOGY*

Outcomes of Prior Study	Degree Program Outcomes	Gap in Knowledge and Skills	Remediation of Gap
	5. Formulate strategies for the efficient and effective commissioning and operation of buildings and building systems.	Involvement in the transition of a building from construction company/contractor to owner/operator.	Completion of courses in the appropriate knowledge area, including Building Systems, Energy Conservation and Auditing, and Advanced Modeling and Simulation.
	6. Evaluate the practical applications of primary and secondary theoretical research related to existing and emerging construction methods and materials.	Development and exercising of research skills at a degree-level with an awareness of the value of both primary and secondary research, and the associated expectations.	Completion of courses in the appropriate knowledge area, including Technical Communication, Advanced Engineering Principles, Building Science Research Project I, and Building Science Research Project II

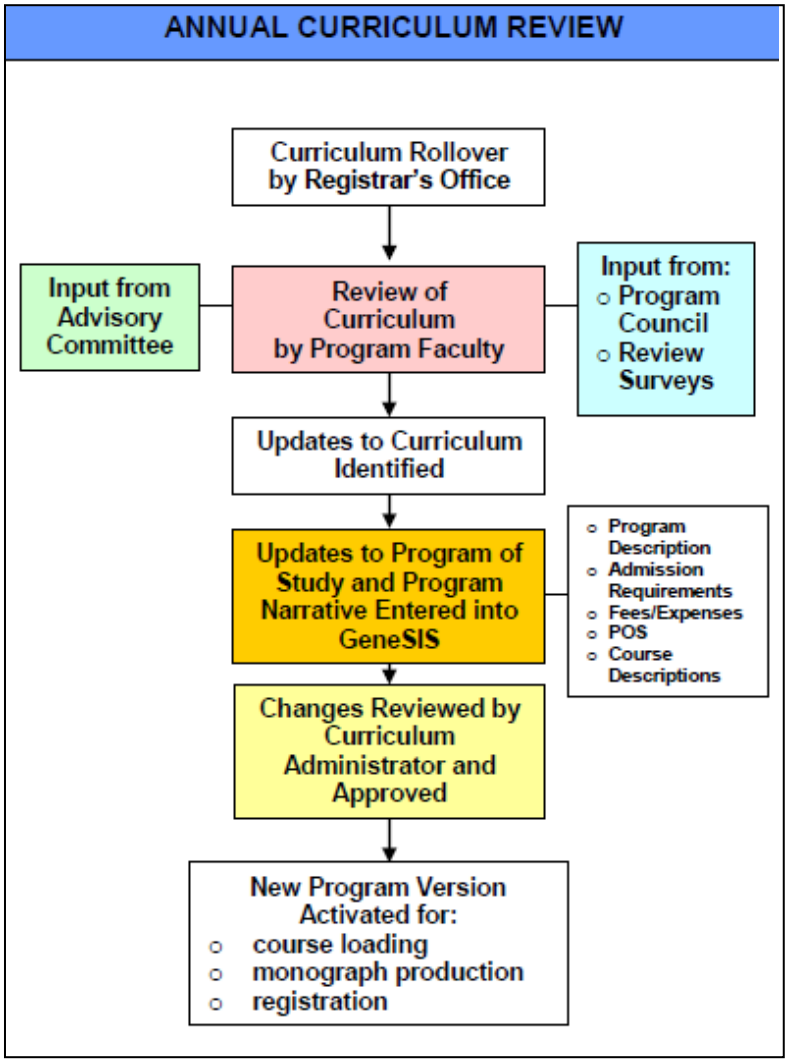
Section 5: Program Delivery

The methodologies proposed for the delivery of curriculum and other program elements and the associated quality assurance policies and procedures meet the Board's requirements as described in the following sections.

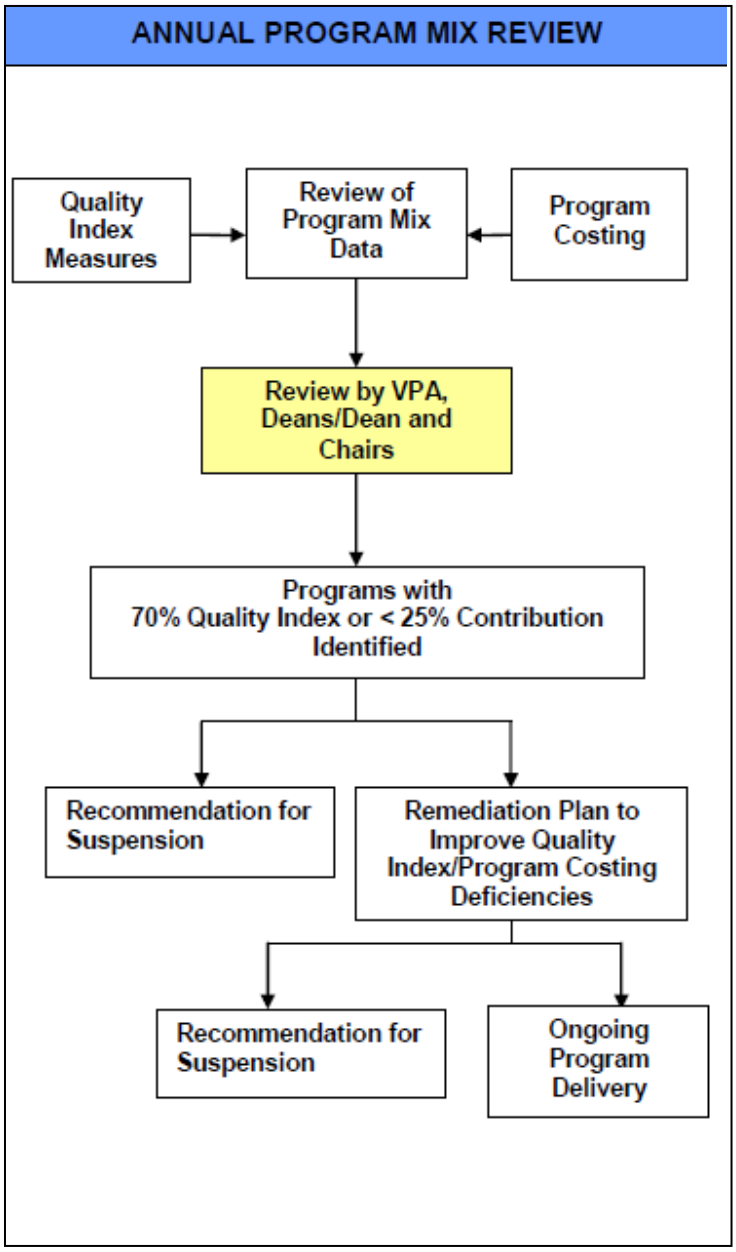
Section 5.1: Quality Assurance of Delivery

Algonquin College has a robust program quality assurance process consisting of three primary components, Annual Curriculum Review, Program Mix Review and Program Quality Review. These processes include evidence-based and participatory inquiry to determine whether courses and the program (whether delivered using traditional, web facilitated, blended, hybrid or online methods) are achieving the intended learning outcomes. Furthermore, the results of the quality assurance practises are used to guide curriculum design and delivery, pedagogy and educational processes as described here.

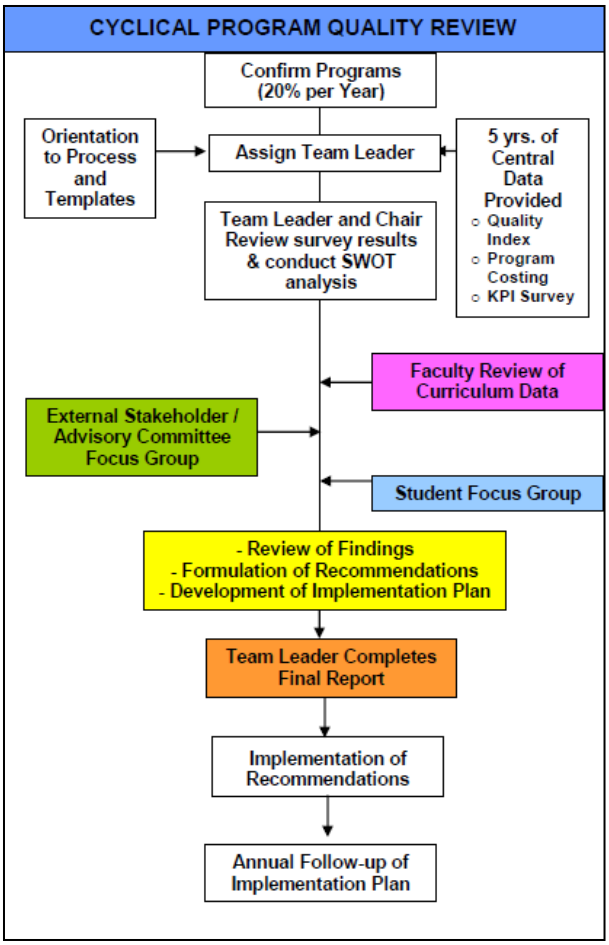
The **Annual Curriculum Review** process includes reviewing and revising the curriculum, incorporating input from recent Student Course Feedback and KPI surveys, advisory committees and program councils, and formalizing changes for the next academic year. This process enables the College to incorporate changes to policy or strategic directions on an annual basis as required.



Program Mix Review is undertaken at the end of each fiscal year. The program's fiscal data is reviewed annually along with the results of the KPI and Student Course Feedback surveys. The program is given a score based on both financial and qualitative measures. A Board of Governors' directive is that programs with a financial contribution of less than 25% or a Quality Index Score less than 70% develop remediation plans.



Program Quality Review is a comprehensive process occurring on a five year cycle at which time a program augments its Annual Program Review audit with an in depth review of historical survey data for the previous five years. Students, external stakeholders and faculty are invited to provide input during this review process. Curriculum is remapped to ensure it remains compliant with the College's overall quality assurance framework and degree level outcomes. Course outlines are reviewed to ensure they are complete and that there is congruency between course learning outcomes, learning activities and evaluation methods. Recommendations for improvement are made, and an implementation plan is developed. The implementation plan is tracked on an annual basis until all recommendations have been addressed.



These three quality assurance processes are depicted in a flow chart at http://www.algonquincollege.com/acad_dev/services_program_quality.htm ('Algonquin College Program Quality Assurance Model').

The electronic policies file (Section 16: Policies), includes policies and procedures pertaining to quality assurance within the following:
Policy AA03: Program Council
Policy E25: Program Quality Assurance
Policy E38: Course Assessment

Section 5.2: Student Feedback

Algonquin College believes that student feedback as to the quality and effectiveness of course/program delivery is an important component in the ongoing improvement of the delivery or programs. There are standardized and regular feedback mechanisms in place to gather quantitative and qualitative data to inform plans and actions. Student Course Feedback (previously Course Assessment) survey results provide quantitative data that is analyzed annually and compared year to year. Aligning with the College's desire to reach all students *anytime, anywhere*, Student Course Feedback surveys moved online in 2009. Instead of a traditional one-time in-class opportunity to provide feedback, surveys are open for a generous time period, with results available to individual course professors and Academic Administrators immediately at the end of the course. Furthermore, the archiving of survey results paves the way for efficient longitudinal analyses of this survey data enabling the College to determine whether improvement initiatives have made a change in the program from the students' perspective or indicating where improvements are necessary. Qualitative information is also obtained from Student Course Feedback surveys and Program Council meetings. All of this information is reviewed on an ongoing basis and responded to as appropriate.

Where student feedback and/or student performance are indicative of the need for support, academic advising and student support specialists are available to assist students. Academic Advising is available to students through the coordinator for the program, and, in some cases, through the services of faculty assigned an advising role. The role of the academic advisor is defined in Policy E31 Academic Advising as "...a faculty member whose role is to assist students to define their goals and understand program expectations, while facilitating the students' achievement throughout their experience at the College", i.e. to:

- assist the student to make sound academic decisions,
- assist the student to identify career goals,
- refer the student to appropriate college services,
- direct the student to the appropriate forum that will address their specific academic needs." (E31p.2)

Academic advising tools and other resources are available to faculty to assist in supporting students' needs: http://www.algonquincollege.com/acadvising/

Furthermore, the College has established a Student Success Centre housed in the new Mobile Learning Centre that is designed to make the Algonquin College experience a very positive and successful one by supporting students to meet their personal, academic and career objectives. Student support specialists are assigned to each Faculty to provide guidance for overall student issues and to provide support to students struggling with academics. http://www2.algonquincollege.com/mlc/mobile-learning-centre/student-success-centre/. Student Coaching is also available to help students identify solutions to difficulties with their English and math studies and computer resources through face-to-face coaching and virtual applications. http://www2.algonquincollege.com/mlc/mobile-learning-centre/student-coaching/

The electronic policies file (Section 16: Policies), includes policies and procedures pertaining to student feedback, academic advising and dealing with poor student performance or enhancing student performance within the following:

- Policy AA03: Program Council
- Policy E31: Academic Advising
- Policy E38: Course Assessment

Course Evaluation – Long Form

❖ **Capstone Questions - Course**

1. What did you like most about this course?

   _____

2. How could the course be improved to be of benefit to future students?

   _____

3. Overall, please rate the quality of this course.

   ○ Excellent ○ Very Good ○ Good ○ Satisfactory ○ Not Satisfactory ○ No Opinion

❖ **Capstone Questions - Professor**

4. What did you like most about the professor?

   _____

5. What, if anything, could the professor do differently to be of benefit to future students?

   _____

6. Overall, please rate the effectiveness of your course professor.

   ◉ Excellent ○ Very Good ○ Good ○ Satisfactory ○ Not Satisfactory ○ No Opinion

❖ **The Curriculum - Delivery**

7. This course integrates educational technologies (e.g. online learning tools, e-classroom audio visual equipment, etc) in support of my learning.

   ○ Strongly Agree ○ Agree ○ Undecided ○ Disagree ○ Strongly Disagree. ○ Does Not Apply

8. Course learning activities (e.g. lectures, discussions, practical work, group work, etc) are varied.

   ○ Strongly Agree ○ Agree ○ Undecided ○ Disagree ○ Strongly Disagree. ○ Does Not Apply

9. The core learning requirements for this course are clearly stated so that I know what to do to be successful in this course.

   ○ Strongly Agree ○ Agree ○ Undecided ○ Disagree ○ Strongly Disagree. ○ Does Not Apply

10. The required course materials (e.g. textbooks, manuals, software, etc.) are used in the course.

    ○ Strongly Agree ○ Agree ○ Undecided ○ Disagree ○ Strongly Disagree. ○ Does Not Apply

11. Opportunities exist to link the course material to the real world or workplace setting.

Strongly Agree Agree Undecided Disagree Strongly Disagree. Does Not Apply

12. The methods used to evaluate my performance are clearly outlined in writing.
    Strongly Agree Agree Undecided Disagree Strongly Disagree. Does Not Apply

13. Course learning activities are linked to the course learning requirements.
    Strongly Agree Agree Undecided Disagree Strongly Disagree. Does Not Apply

14. All of the course learning requirements are covered in the course.
    Strongly Agree Agree Undecided Disagree Strongly Disagree. Does Not Apply

15. The professor's expectations for this course are clearly states to that I know what to do to be successful in this course.
    Strongly Agree Agree Undecided Disagree Strongly Disagree. Does Not Apply

16. The methods used to evaluate my performances are linked to the course learning requirements.
    Strongly Agree Agree Undecided Disagree Strongly Disagree. Does Not

❖ **The Professor**

17. Covers all elements of the course outline.
    Strongly Agree Agree Undecided Disagree Strongly Disagree. Does Not

18. Demonstrates a good knowledge of the subject area.
    Strongly Agree Agree Undecided Disagree Strongly Disagree. Does Not

19. Relates to students in ways which promote mutual respect, supports student learning and success.
    Strongly Agree Agree Undecided Disagree Strongly Disagree. Does Not

20. Communicates clearly.
    Strongly Agree Agree Undecided Disagree Strongly Disagree. Does Not

21. Helps me understand and apply information.
    Strongly Agree Agree Undecided Disagree Strongly Disagree. Does Not

22. Provides opportunities for me to participate in the course.
    Strongly Agree Agree Undecided Disagree Strongly Disagree. Does Not

23. Provides timely feedback that helps me to improve my performance.
    Strongly Agree Agree Undecided Disagree Strongly Disagree. Does Not

24. Evaluates my performance fairly.
    Strongly Agree Agree Undecided Disagree Strongly Disagree. Does Not

25. Uses class time effectively including starting and ending.
    ○ Strongly Agree ○ Agree ○ Undecided ○ Disagree ○ Strongly Disagree. ○ Does Not

26. Is prepared and organized.
    ○ Strongly Agree ○ Agree ○ Undecided ○ Disagree ○ Strongly Disagree. ○ Does Not

27. Is available for consultation (e.e. email, office hours, appointments, phone, etc.)
    ○ Strongly Agree ◉ Agree ○ Undecided ○ Disagree ○ Strongly Disagree. ○ Does Not

❖ **The Student – Self Reflection**

28. I attend classes (e.g. lectures, theory)
    ○ Always (100%) ○ Most of the Time(>75%) ○ Often (>50%) ○ Seldom (<50%) ○ Never ○ NA

29. I attend labs (e.g. practical component)
    ○ Always (100%) ○ Most of the Time(>75%) ○ Often (>50%) ○ Seldom (<50%) ○ Never ○ NA

30. Outside of scheduled class and hybrid hours, I spend the following number of hours (on average each week) on this course:
    ○ None ○ 1-2 ○ 3-5 ○ 6-10 ○ More than 10

31. I expect to earn a final grade in the following range:
    ○ A ○ B ○ C ○ D ○ F

32. My first language is:
    ○ English ○ French ○ Other

Course Evaluation – Short Form

❖ **Capstone Questions - Course**

1. What did you like most about this course?

   _____

2. How could the course be improved to be of benefit to future students?

   _____

3. Overall, please rate the quality of this course.

   ○ Excellent ○ Very Good ○ Good ○ Satisfactory ○ Not Satisfactory ○ No Opinion

❖ **Capstone Questions - Professor**

4. What did you like most about the professor?

   _____

5. What, if anything, could the professor do differently to be of benefit to future students?

   _____

6. Overall, please rate the effectiveness of your course professor.

   ○ Excellent ○ Very Good ○ Good ○ Satisfactory ○ Not Satisfactory ◉ No Opinion

❖ **General Questions - The Course**

7. What do you feel would be most beneficial to future students of this course if it were improved?

   _____

8. Course learning activities (e.g. lectures, discussions, practical work, group work, etc.) are varied.

   ○ Strongly Agree ◉ Agree ○ Undecided ○ Disagree ○ Strongly Disagree. ○ Does Not

9. Course learning activities are linked to the course learning requirements.

   ○ Strongly Agree ◉ Agree ○ Undecided ○ Disagree ○ Strongly Disagree. ○ Does Not

10. All of the course learning requirements are covered in the course.

    ○ Strongly Agree ◉ Agree ○ Undecided ○ Disagree ○ Strongly Disagree. ○ Does Not

Section 5.3: Web-facilitated, Hybrid, and Online Delivery

Algonquin College has established an online academic community and has a history of integrating online learning elements in curriculum delivery. The College is well positioned to deliver the components of the Bachelor of Building Science program proposed for hybrid or online delivery. In fact, the College was previously reviewed by xxx *(excluded for web version)* on behalf of PEQAB, and received a report dated August 2009 that noted the following conclusion that is here excerpted:

> *' Algonquin is an established, publicly funded, respected Community College with a strong history of distance education provision internationally and a strong academic track record. I have no hesitation in recommending that its distance education/e-learning programs be supported by PEQAB – they have the ability to effectively design, develop, deploy and administer programs using distance education and blended learning.'*[23]

The full report and Algonquin's response are included in the Procedure/Supplemental Information folder within the electronic policies file (Section 16: Policies).

Historically, Algonquin College has been on the forefront in incorporating new technologies in teaching. The College has adopted Blackboard™ as its Learning Management System and recently moved to V9.0 which has added Wiki and Blog features. Every full-time course has a Blackboard™ site that is used for posting course outlines and for communicating other information, as well as for hybrid or online course delivery. The College currently delivers approximately 758 hybrid courses and 300 online course offerings. In addition, the College recently implemented lecture capture technology into every classroom on campus using Camtasia Relay software. Procedural information on the use of Blackboard™ is available to students and faculty at Algonquin College and has been included in the Electronic Policies file.

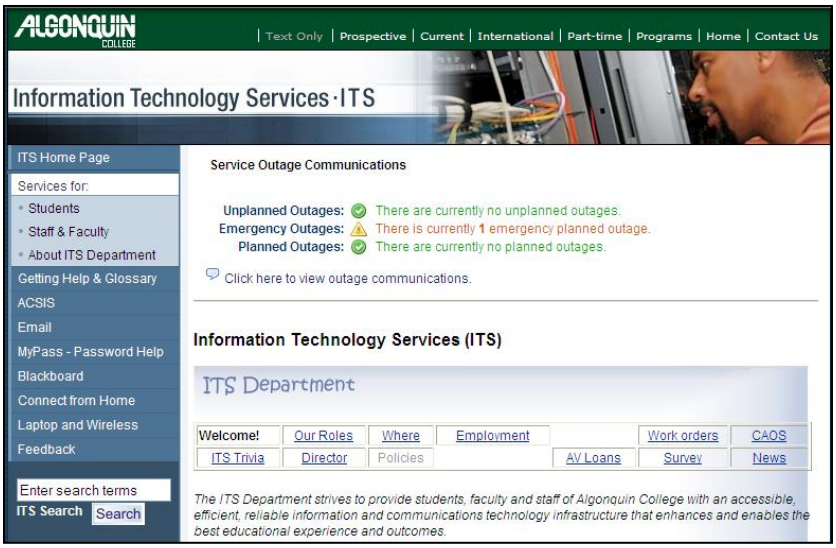
Numerous technologies and opportunities are available to achieve interaction amongst faculty and students including: communication via email, posting of announcement to course or homeroom Blackboard™ sites, discussion board with threaded topics, collaboration through Virtual Classroom or Chat, Group Pages, Blog or Wiki, phone (voice mail), fax, and scheduling an appointment with faculty. A Virtual Desktop Infrastructure is now in place which allows students and staff to have access to any College licensed software anywhere/anytime on any device, assisting with more flexible course delivery. An Innovation Station is available to staff to experiment with new teaching tools. It houses some of the latest hardware and software available as well as various books and resources related to innovation. Three workstations are available to all staff for innovating and experimenting.

In January 2011, a Mobile Learning Centre was officially opened at Algonquin that is responsive to the current learning environment needs of students. This new facility creates over 100 new mobile computing spaces for students to bring their laptop, iPad, netbook, smartphone, and virtually any other mobile device to work independently or collaborate with peers on class projects. More information on the Mobile Learning Centre is available at:http://www2.algonquincollege.com/mlc/

23 Algonquin College Offering a Bachelor of Applied Business (Hospitality and Tourism Management), Review of Distance Education Capabilities for Blended Learning" (August 2009), p.7.

The College has approximately 2500 computers accessible at the Woodroffe campus within a total of 49 combined general and specialized labs that are equipped on average with 34 computers. Additionally, there are four 24/7 Open Access Computer Labs individually equipped with 50, 53, 60, and 80 computers, in addition to 65 student accessible computers in the Woodroffe Library. All students may connect to the internet anytime and anywhere while on campus through the College's wireless infrastructure and, as mentioned, the College now has a Mobile Learning Centre that is accessible 24/7.

Information Technology Services provides an extensive range of services to students and staff to support the use of technology at the College as apparent from this website screen capture:



There are no consortial or other agreements relating to the delivery of this program that need to be described.

Algonquin College meets the Board requirements for online delivery in that reliable, sufficient and scalable course-management systems to meet current and projected needs are provided, including:

i) a robust and secure technical infrastructure, providing maximum reliability for students and faculty

Algonquin College provides a robust, secure, highly-available technical infrastructure including online systems for student accounts, timetables, grades and course changes. Algonquin also provides a highly available, robust, redundant learning management system based on Blackboard™.

ii) emergency backup provisions

Algonquin backs up all critical data every night; storing it offsite so that recovery would be possible in the event of a disaster. To further improve the ability to recover, the College is currently in the process of reviewing options for Disaster Recovery using Cloud-based services. The data center that houses Algonquin's systems is physically secured and was designed to handle multiple failures. Should there be a short term power failure, each of the systems will continue to operate through an uninterrupted power supply. If the failure is a longer term one, the data center is powered by a Diesel generator that will automatically start in the event of a failure.

iii) accessible technical assistance for students and faculty for all hardware, software and delivery systems specified by the college as required for the program
Technical support is provided by the Information Technology Service Centre and the Educational Technology Support Centre through in-person, telephone and email, as well as through extensive online support materials. Both students and faculty are provided one-on-one, email based, and web based assistance with the College's LMS. In addition, support is offered for students' personal mobile computing devices as well as for Algonquin-owned equipment.

iv) 24 hrs per day, 7 days per week access to secure online databanks for web-delivered courses
All of Algonquin online systems are available 7/24 subject only to normal maintenance periods and backup cycles.

v) well-maintained, current and appropriate hardware, software and other technological resources and media
The College annually reviews the requirements for updating and evergreening of all hardware and technology resources. The College has in place an evergreening policy that outlines the processes to be followed. The Colleges Technology Committee reviews all requests for new hardware and hardware upgrades and annually allocated funds to ensure the systems are current and well maintained.

vi) risk assessment and planning that includes:

i) a disaster recovery plan to ensure consistency of operational capacity
The College received a full review on its business continuity processes and is in the process of examining processes and options for disaster recovery using cloud-based services

ii) back-up and storage technology protocols
The College performs nightly backups of all critical systems and cycles data to off site locations.

iii) a requirement for historical logs and physical documentation of exceptions, breaches, capacity usage, upgrades, workarounds, bolt-ons etc.
Every year, Algonquin's technical infrastructure is audited to ensure sufficient physical and digital security is in place. Logs are maintained of all servers and services and are analysed regularly to ensure that any breaches or unauthorized use is quickly understood and addressed. In addition, each new system added is audited.

The electronic policies file (Section 16: Policies), includes policies, procedures and supplemental information pertaining to technology, computer and online learning modes of delivery:

Policy A16: Acceptable Use of Algonquin Computer Networks And Accounts
Policy A23: Information Technology Scheduled System Maintenance
Policy A25: College Information Security
Policy E1: Evaluation of Student Learning
Policy B7: Evergreening Policy
Policy B8: Deployment of Computing Devices to Faculty and Staff
Policy C4: Voice Communication

Policy E39: Use of Electronic Devices in the Academic Environment
Policy E46: Protection of and Access to Student Information and Online Course Materials
Procedure: Use of Blackboard at Algonquin College - Student Information
Procedure: Use of Blackboard at Algonquin College - Faculty Information
Procedure: Appendix B – Curriculum Implementation Services Unit
Supplemental Information: Learning Technologies & Support at Algonquin

Professional Development

The College offers a wide range of professional development activities for staff throughout the year. The varied offerings may be viewed at: http://www.algonquincollege.com/employee-pd/. The Centre for Organizational Learning within Human Resources offers ongoing professional development for faculty. Whenever new technologies are adopted professional development is provided for faculty through the Centre for Organizational Learning.

Algonquin offers support and orientation activities for both full- and part-time faculty. Professional development activities aligned with performance appraisals are also provided. Algonquin has established a set of competencies expected of faculty titled the *Professor of the 21st Century*. This document communicates the College's expectations of faculty in their role as teachers and provides a framework for continuous professional development.

To facilitate the ongoing professional development of faculty Algonquin College offers numerous ongoing professional development activities many of which are associated with the seven competencies of the Professor of the 21st Century as follows:

The Performance Institute
The Performance Institute provides performance training (body language and voicing) and many other tips and tricks for new and experienced teachers. It is delivered over one-semester, 3 hours per week. Faculty are released from teaching one course to participate in this.

Teaching Adult Lifelong Learners (T.A.L.L.) Program
This is a certificate program offered to part-time professors who are interested in furthering their professional credentials as an adult educator. The program is delivered in a hybrid format using a combination of workshops and online learning experiences. The different courses in the program are offered at a rate of two per semester (for those wishing to complete it in a shorter period of time.)

Kaleidoscope Conference
Algonquin College's annual three-day professional development conference held in May features speakers and workshops of interest to all College employees.

Workshops and Online PD
Numerous workshops are offered throughout the year and may be viewed on the Centre for Organizational Learning Website. Online PD is offered on current topics of interest such as Camtasia Relay, Blackboard™ 9.0 and Hybrid Course Development.

Faculty can also arrange for one-on-one coaching with Learning and Teaching Services staff if they are experiencing challenges relative to teaching, classroom management, technology use, among others. Additionally, participation in orientation activities is an expectation of newly hired full and part-time faculty.

Curriculum Implementation Service
A new Curriculum Implementation Service was introduced to the College in Fall 2010. This is an outreach service, with members dedicated to specific areas of the College. It supports the development of hybrid and on-line courses, as well as other PD needs.

Full-time Faculty Orientation
New full-time faculty participate in five primary orientation activities:

1. New Employee College Orientation
New employees of Algonquin College attend a College orientation and welcome session. Held bi-weekly, these sessions are designed to provide new employees with an overview of the College's mission, vision, policies, and procedures. Information about health and safety, staff ID cards, parking, personnel benefits, and union membership is also provided.

2. Departmental Orientation
New employees will meet with their departmental supervisor or a departmental representative on their first day of work for departmental orientation. Topics covered include: course information, time sheets, work hours, class schedules, departmental communications etc. New hires are also introduced to departmental colleagues.

3. Teaching @ Algonquin
These sessions take place typically during August and September of the school year. They provide an introduction to the learning and teaching environment at Algonquin.

4. Focus on Learning (FOL) (Parts I and II)
This program is organized by a committee of professors from Eastern Region colleges and provides the opportunity to explore ways of developing teaching practice within a collaborative and creative environment. All new faculty from these colleges are invited to attend. It involves attending Part I for 5 days in August and Part II for 3 days in the spring of the following year.

5. Mentoring Program
During the orientation process, new professors are paired up with an experienced mentor.

Part-Time Faculty Orientation
New part-time faculty are required to participate in the five module 'Teaching Part-Time at the College' program:
1. Creating Positive Learning Environments (3 hours)
2. Teaching is More Than Talking (3 hours)
3. Getting Started With Blackboard™ (3 hours)
4. The Nuts and Bolts of Evaluation (3 hours)
5. Finding Your Way Around Algonquin College (3 hours)

Professional Development Funds
The College budgets a portion of its professional development funds centrally. This fund is used to run the activities offered through the Centre for Organizational Learning. Additionally, to maintain faculty currency, each School/Faculty also budgets some professional development funds for staff to participate in events related to their field (courses, conferences, meetings) from

year to year. Usually, these funds are kept in a central envelope within each School. The funds are disbursed, following receipt of requests from faculty members with the proper justification.

The College periodically offers update/renewal fund by which a professor can be freed from part or all of his/her load in order to gain experience or maintain currency in the field. This is usually for a short period of time (typically 4 months).

Additionally, the College provides sabbatical opportunities whereby faculty that have been with the College for more than 7 years can make a request to be freed from their teaching duties for one year in order to perform other duties which will benefit them in their professional growth.

The College further allows each faculty member 10 working days leave per year for professional development. This professional development can be in relation to in-house teaching methodologies/learning tools, as well as, activities related to the faculty member's field.

Algonquin College's Learning Resource Centre also supports the development of both staff and students and offers a full range of services and provides access to over 50 databases.

The electronic policies file (Section 16: Policies), includes policies and procedures pertaining to faculty within the following:

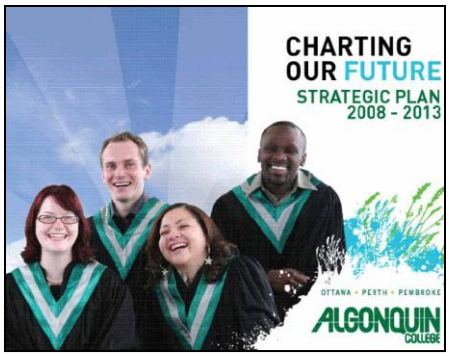
- Policy D2: Professional Development Leave
- Policy D3-B: Professional Development- College Courses- Non-Credit
- Policy D9: Staff Update/Renewal
- Policy G1: Learning Resource Centre
- Policy HR03: Tuition Assistance-Algonquin College Course
- Policy HR04: Tuition Assistance-Degree Completion
- Policy HR10: New Employee Orientation

Section 5.3.1: Curriculum Vitae of Online Learning Professionals and Technical Staff – *excluded for web version*

Section 6: Capacity to Deliver

Algonquin College's Strategic Plan, ***Charting our Future: Strategic Plan 2008-2013*** may be reviewed at the following link:
http://www.algonquincollege.com/reports/pdf/Strategic_Plan_web.pdf**.**

Pertinent excerpts have been extracted from the current Strategic Plan to demonstrate the College's strategic directions and the alignment with the proposed Bachelor of Building Science program with them and these are included below:



2.0 OUR VISION, MISSION AND CORE VALUES

Algonquin College's organizational philosophy is defined by our vision, mission and core values. These critical elements describe who we are, what we want to achieve, and what will guide our decision-making on a daily basis. The vision sets out the ideal state that we want to achieve and the mission identifies our purpose, while the core values articulate our most fundamental beliefs and the behaviours expected of employees and students. Combined, the vision, mission and values, set the context for the development and evaluation of the Strategic Plan for 2008-2013 and for the long-term development of the College.

VISION STATEMENT
Algonquin College will be a leading Canadian college recognized for its unique programs, services and support systems which lead to student success.

MISSION STATEMENT
Algonquin College will prepare students to achieve academic and career success.

CORE VALUES

- **CARING**
  We have a sincere and compassionate interest in the well-being of the individual.
- **LEARNING**
  We believe in the pursuit of knowledge, personal growth and development.
- **INTEGRITY**
  We believe in trust, honesty and fairness in all relationships and transactions.

- **RESPECT**
  We value the dignity and uniqueness of the individual.
  We value equity and diversity in our community. (p.3)

4.0 CHARTING OUR FUTURE

ACADEMIC PROGRAMS

Algonquin College is committed to being one of the most comprehensive colleges in Ontario, offering a broad variety of programs, subject matter, delivery modes and program durations. Algonquin is also the only publicly-funded English-language college in Ottawa, Perth and Pembroke and will continue to service the needs of these areas and their surrounding communities. As a result, Algonquin will continue to expand its program offerings which include a full range of products including academic upgrading, apprenticeship, certificate, graduate certificate, diploma, advanced diploma and degree programs, as well as corporate learning solutions and international education and projects. As the province's labour needs evolve, so will the program mix of the College. (p.7)

5.0 NEXT STEPS

ACADEMIC LEADERSHIP

Algonquin is committed to enhancing student success by providing an enriching and challenging learning experience delivered by engaged employees and supported by quality curriculum and resources. Goals within this theme include:

1. Enhance College processes which ensure that Algonquin is a leader in student retention and graduation rates in Ontario.
2. Offer programs that are designed to meet the needs of the workplace and ensure that employers have the skilled workforce needed for the future of a knowledge-based economy.
3. Increase the community's awareness of the College by enhancing linkages to businesses, school boards, universities, agencies and the employer community in new and unique ways and by expanding cooperative education and other workplace experience opportunities.
4. Increase the flexibility of program offerings to accommodate Government policy and directions and to address the changing needs of the student population.
5. Increase the environmental sustainability content in programs.
6. Create opportunities for students to develop the skills, knowledge and attitudes necessary to succeed in the global economy.
7. Expand applied research activities to enhance staff development, enrich student learning, improve student preparedness for the workplace and support innovation in the external community.(p.10)

This application for Ministerial consent to offer a Bachelor of Building Science program demonstrates Algonquin College's commitment towards achieving both its mission, vision and academic goals. The program will add another learning opportunity at a College with existing and proven expertise in delivering a rich repertoire of education designed to meet the needs of employers in the construction sector. In so doing, it will also allow students graduating from five existing programs offered by the Faculty of Technology and Trades the opportunity to articulate to a baccalaureate degree in an applied area of study for the following programs:

- *Architectural Technician Ontario College Diploma*
- *Architectural Technology Ontario College Advanced Diploma*
- *Construction Engineering Technician Ontario College Diploma*
- *Civil Engineering Technology Ontario College Advanced Diploma*
- *Mechanical Engineering Technology Ontario College Advanced Diploma*

Both diploma graduates and direct entry students alike will benefit from this new program offering. The Bachelor of Building Science program will prepare students through theoretical studies, practical application; and cooperative education workplace experience to succeed in a knowledge-based global economy. Students will learn within the new Algonquin Centre for Construction Excellence, in state-of-the-art facilities, and will be taught by experienced faculty who are subject matter experts and/or skilled practitioners.

Algonquin's mission statement denotes that the College will prepare students to achieve academic and career success. The Bachelor of Building Science program has been designed to facilitate the attainment of career success. The program will enhance existing partnerships and build new partnerships with industry experts in the construction sector. This will facilitate seamless on-boarding for graduates, as well as, ensure that faculty is tuned in to best practices and current industry trends. Furthermore, through the Bachelor of Building Science program and industry partnerships, Algonquin College will be contributing towards the government priority of addressing the growing labor and skills shortage in the construction industry.

Section 6.1: Learning and Physical Resources

Relevant Library Resources

Print and in-house resources

- **Books**
  The Algonquin library collection totals about 65,000 volumes. From this collection the following areas will directly support the Building Science program:
  - Architecture (NA) – 2025 volumes
  - Technology, general (T) – 663 volumes
  - Civil Engineering (TA) – 867 volumes
  - Environmental Technology (TD) – 584 volumes
  - Building Construction (TH) – 3198 volumes
  - Mechanical Engineering (TJ) – 873 volumes
  - Electrical Engineering (TK) – 1789 volumes

  Included in the above are over 300 audio visual items.

  The library also provides resources for support subject areas such as Mathematics, Communications (Language/Writing/Presentations), Critical Thinking, Basic Computing, among others.

- **Periodicals** (Journals)
  The library has fewer print journal titles as the convenience of online resources becomes more attractive to the student population. The Algonquin collection contains about 385 print journal titles. Of these, about 40 will help support the new Building Science program in the areas of Building, Architecture, HVAC, Engineering, among others.

Electronic/Online Resources

- **Databases**
  The Algonquin library provides access to over 50 databases. Many of these databases include journal titles of relevance to a Building Science degree program. Database titles of specific interest would be:
  - Academic OneFile
  - Academic Search Complete
  - Art and Architecture Complete
  - Business Source Complete
  - Canadian NewsStand
  - Career and Technical Education
  - Canadian Business and Current Affairs
  - CPI.Q (Canadian Periodical Index)
  - Greenfile
  - Masterfile Elite
  - Science Journals

- **Journals**
  Online journal titles available through our various electronic databases include the following areas:

  Building Construction - 118 titles – including topics such as “Details in building design and construction”, “Environmental engineering of buildings”, Heating and ventilation”, “Air conditioning”, “Illumination, Lighting”, “Maintenance and repair”, “Plumbing and pipefitting”, Protection of buildings”, “Systems of building construction”

  Chemical Technology - 240 titles – including topics such as “Cement industries”, “Clay industries, Ceramics, Glass”, “Fuel”, “Gas industry”, “Paints, pigments, varnishes”

  Civil Engineering 261 titles -- including topics such as “Acoustical engineering”, “Engineering design”, “Engineering geology, Rock mechanics, Soil mechanics, Underground construction”, “Environmental engineering”, “ Human engineering”, “Materials of engineering and construction, Mechanics of materials”, “Mechanics of engineering”, “Structural engineering”, “Surveying”

  Environmental Technology – 76 titles -- including topics such as “Environmental protection”, “Hazardous substances and their disposal”, “Solid wastes”, ”Special types of environment”, ”Water supply for domestic and industrial purposes”

  Mechanical Engineering – 105 titles -- including topics such as “Energy conservation”, “Power resources”, “Renewable energy sources”

  Architecture – 53 titles -- including topics in “Architectural drawing and design”, “Special classes of buildings”

- **Audio Visual – Streamed Video**
  Algonquin library provides access to online streamed video from Films on Demand. There are several subject area packages available, the most useful of which is “Technical Education” which includes the following areas:

  Building and Technical Trades – 173 video titles
  Engineering Technology – 88 video titles
  Technical Communication – 45 video titles

  Other subject areas of interest are “Science and Mathematics” and “Business and Economics”.

- **Electronic Books**
  The Library’s e-Book collection contains about 360 in the Technology/Engineering field as well as 15 in Architecture. Other areas of interest covered in the various e-books collections include Mathematics, Business, Computing, English Communications, among others.

- **General Information**

  Algonquin's main campus is well situated in the National Capital Region. This gives our students the advantage of being close to many specialized libraries. The Algonquin library has local agreements with many area libraries which permit direct student borrowing or Inter-library loan service. The libraries covered under these agreements include Carleton University, Ottawa University, Canadian Institute for Scientific and Technical Information (including the Institute for Research in Construction, Institute for Research in Construction), Canadian Mortgage and Housing Corporation, Canadian Conservation Institute and many others.

  In addition to individual library agreements, Algonquin College Library is a partner in the National Capital **Sm@rtLibrary** which includes numerous member institutions. This partnership facilitates students' access to resources available at partner institutions. Current partners include:

  University of Ottawa
  Carleton University
  Ottawa Public Library
  Canadian Institute for Scientific and Technical Information
  Canadian Museum of Civilization
  Canadian War Museum
  Canadian Mortgage and Housing Corporation
  National Gallery
  Bibliothèque municipal de Gatineau

  Algonquin College Library is also a member of **askON** www.askon.ca, a real-time chat reference service developed by Ontario's libraries and Knowledge Ontario. Students can request online assistance and receive research help from our partners in other Ontario College libraries.

  Real people.
  Real info.
  Real time.

  askON
  online research help

Laboratory Space

Laboratory classes for the proposed Bachelor of Building Science program will take place in the new Algonquin Centre for Construction Excellence (ACCE). This new building scheduled to open in the fall of 2011 incorporates features that will provide students with exceptional learning experiences that will contribute to greater preparation for the evolving trends in the construction industry. The uniquely green, 180,000 square-feet building will house 600 additional seats in 23 programs in construction-related skilled trades and occupations, and be a showcase and teaching laboratory for sustainable construction. Federal, provincial, and municipal governments as well as the support of industry in the capital campaign have contributed towards this $79 million dollar investment.

One of the more notable features of the ACCE is the fact that the entire building has been constructed as a laboratory for students:

> ACCE will serve as a living laboratory that will be used to augment student learning and applied research. A five-storey biowall made up of living plants will filter the air, providing oxygen to the atrium space and all five connected floors. Built-in sensors located throughout the building will provide real-time and historical building diagnostics via on-site LCD screens and a unique website, allowing students to monitor the building's temperature, humidity, air quality, structural load, and more.[24]

In addition to this living laboratory space, students will also be working in a number of other learning spaces that provide hands-on, practical learning experiences that enable the achievement of the degree-level learning outcomes. Specifically, students in the proposed Bachelor of Building Science program will be working in drafting labs, architectural CAD computer labs, and the Construction/Civil lab.

The drafting labs are a classroom environment where students use a drafting table as their workspace. The 42" x 31" working surface of the drafting table can be tilted to suit normal drawing or plan reading or remain flat for model building. Each work station has an additional surface to avoid cluttering the drafting table with disposables or other reference materials required by students. In the new ACCE building, there are at least two (2) drafting labs.

The architectural CAD computer labs are specialized computer lab environments. The networked desktop computers used by the students exceed the College standard hardware configuration for traditional computer labs in order to accommodate the requirements of computer-aided design software and building information modeling software. Faster central processing units and larger amounts of random access memory support the rendering and analytical computation undertaken during the course. In the new ACCE building, there are at least two (2) of these computer labs.

The Construction/Civil lab is a laboratory environment that provides access to a variety of construction-related testing equipment (See Table 6.2: Existing and Proposed Equipment Available to Students). The lab benches provide work space for note-taking, conducting experiments, model building, and sample preparation. As required, students also have access

[24] Algonquin College, "Inside the Algonquin Centre for Construction Excellence," [ONLINE] (2010) Available: http://www.algonquincollege.com/acce/whats-inside.html

to project lockers for materials related to research occurring over a longer time frame. There is one (1) Construction/Civil Lab in the new ACCE building.

The table below summarized the classroom and laboratory space the ACCE building will house:

Table 6.1: Algonquin Centre for Construction Excellence (ACCE) Learning Spaces

Space	Description	#
Classroom - General	Classroom – E-classroom	13
	Classroom - Laptop	1
Classroom - Reservation		3
Computer Lab - General	Computer Lab - CAD ARCI	2
	Computer Lab - CAD Interior Design	2
Lab - Construction	Lab - Construction	1
	Lab - Construction / Civil	1
	Shop - Cabinet Making	1
	Shop - Carpentry	2
	Shop - Frame/Form	2
	Shop - Heat/Ref/AC/Plumb	8
	Shop - Plumbing	2
	Shop - Ref/AC	2
	Shop - Sheet Metal	1
	Shop - Welding	1
Lab - Drafting	Drafting Lab	2
Lab - Electronics	Lab - Basic Wiring	1
	Lab - Electrical Machinery	1
	Lab - Industrial Electronics	1
	Lab - Motor Control	1
Lab - Media	Studio - Design	4

Specialized Equipment

During their studies in the proposed Bachelor of Building Science program, students will have access to a variety of specialized equipment to support their learning and prepare them for the workplace. Much of this equipment will be in the Construction/Civil lab; however, some of the smaller, handheld equipment will be on trolleys so that it can be transported and used in standard classroom environments.

The following table provides a list of equipment that either exists or will be acquired for the proposed program:

Table 6.2: Existing and Proposed Equipment Available to Students

AC Current Transducer Air Quality Meter–Indoor Albedometer Ambient Noise Sensor Asphalt Tester Calorimeter Compression Machine Concrete Mixer Control Energy Saver Package–Intelligent Control Converter RS485 to RS232 Curing Tanks Data Logger – Temperature and Humidity Digital Shear Dissolved Oxygen Meter Drying Oven Flow Meter (Ultrasonic) Forecast Station with Pressure History–Wireless Heat Flux Plate Heat Pump Heat Stress Meter	Infrared Sensor Attachment – EZ Faucet Light Meter Line Voltage Monitor – Plug-In Manometer Melting Pot Moisture Analyzer with Microprocessor – Automated Motion Detector Multi-Function Meter Multimeter Multi-Speed Press Newton Meter pH Meter Porosimeter Psychrometer – Aspirating Psychrometer – Sling Pyranometer Pyrheliometer Scales Sieve Shaker Spectrometer – Low-Resolution Surface Thermometer	Temperature Calibrator Thermal Conductivity Measurement System Thermal Mass Flowmeter Thermal Properties Sensor Thermal Resistance Measurement System–High Accuracy Thermocouple Temperate Probes Thermo-Hygrometer Thermometer Thermostat – Programmable Toilet Flushing System–Automatic Sensor Torsion Test Demonstrator Tri-Axial Panel Turbidimeter Venturi Meter Viscometer Water Pressure Gauge Wind Speed Sensor

In addition, there will be a wide range of disposable materials (i.e., concrete, wood, aggregate, and general building materials) that will either be available to students or that students will need to purchase in order to complete projects and conduct research.

Section 6.2: Resource Renewal and Upgrading

Library Resources
With respect to the Learning Resource Centre, the College plans and invests in library acquisitions on an annual basis. Library resource needs are identified by the librarians as well as faculty members. Faculty members review existing acquisitions, typically in the May/June timeframe. New resources (text, video, journal, electronic) that will be of benefits are prioritized and purchasing recommendations submitted to the Learning Resource Centre for consideration as per yearly funding allocations. Policy G1 further details Learning Resource Centre's mandate and is included in Section 16 the electronic policies file.

Computers and Computer Access
The College establishes an instructional computing and technology renewal and upgrading plan on an annual basis. A process for renewal of computers and their deployment to staff has been established as detailed in Policy B7-Evergreening Policy and Policy B8-Deployment of Computing Devices to Faculty and Staff. Typically, all lab computers for students (approximately 2500 at the Woodroffe campus) are renewed every 4 years or as required. The College currently has has a total of 49 combined general and specialized labs that are equipped on average with 34 computers. Additionally, there are four 24/7 Open Access Computer Labs individually equipped with 50, 53, 60, and 80 computers, in addition to 65 student accessible computers in the Woodroffe Library. All students may connect to the Internet anytime and anywhere while on campus through the College's wireless infrastructure. The College also has a Mobile Learning Centre that is accessible 24/7.

Laboratories/Equipment
New capital equipment new and renewal requirements are identified and prioritized on an annual basis in conjunction with capital equipment planning. The College Space and Infrastructure Committee (CSIC) develop plans to address strategic directions, needs and areas for improvement. On an annual basis, Schools are requested by the CSIC to bring forward requests for renovations and/or space requirements to improve the learning environment. These requests are prioritized by a sub-committee of CSIC.

Allocation of funds for environmental and learning resources is an annual process as per the budget approved by Algonquin College's Board of Governors. Capital funds are distributed amongst the Faculties/Schools in the College and the allocation varies from year to year, based on funds available. The Faculty of Technology and Trades receives funds allowing the annual upgrading of its facilities and equipment on a priority basis and as per allocation.

Classrooms
The College upgrades and enhances facilities on an ongoing basis taking into account enrolments, faculty support needs, and the growing use of web-based technologies for learning and teaching. There are currently 135 classrooms at the Woodroffe campus (excluding the new ACCE Building) that are upgraded according to the needs identified through an annual established Learning Environment Quality identification, prioritization, and funding process. Lecture rooms vary in size and seat from 20-140 students. All classrooms at Algonquin College have e-learning capabilities that can be used for course delivery and online access. E-classrooms are all equipped with video equipment, a speaker system, a high-resolution projector, a computer with access to high speed internet, and a white or black board.

The electronic policies file (Section 16: Policies), includes policies and procedures pertaining to resource renewal and upgrading as follows:

Policy B7: Evergreening Policy
Policy B8: Deployment of Computing Devices to Faculty and Staff
Policy G1: Learning Resource Centre
Procedure: College Technology Committee Terms of Reference
Procedure: College Space and Infrastructure Committee Terms of Reference

Section 6.3: Support Services

Support Service	Brief Description of Service
Academic Advising	Algonquin College's Academic Advising Policy E31 defines an advisor as "...a faculty member whose role is to assist students to define their goals and understand program expectations, while facilitating the students' achievement throughout their experience at the College". Role of the Academic Advisor : • assist the student to make sound academic decisions, • assist the student to identify career goals, • refer the student to appropriate college services, • direct the student to the appropriate forum that will address their specific academic needs. Each program is to have academic advisors in place for students.
Student Success Specialists	Student Success Specialists assist students in achieving career, academic and personal objectives. They work closely with faculty, program coordinators and Student Services to determine and provide guidance for student issues ranging from specific course challenges to student-transition through their college experience. They can advise students how to access appropriate resources and services offered at the College as well as assist with articulation agreements for university-bound students. There are 12 Student Success Specialists at the College. They are located in the various faculties and schools. The Student Success Centre is housed within a new Mobile Learning Centre established in January 2011 with assistance from and/or referral to the appropriate Student Success Specialist.
Counselling: Career and Personal	Counselling Services (Woodroffe Location) is staffed by 9 full-time counsellors, 2 part-time counsellors, 1 full-time and 2 part-time support staff. This department provides a variety of support services to assist with academic, career or personal challenges. Services include, but are not limited to: ▪ Vocational and aptitude testing ▪ Academic/career guidance ▪ Residence life workshops ▪ Parent Resource Network ▪ Emergency walk-in ▪ Aboriginal Counsellor ▪ Short term and Supportive counselling for a variety of mental health issues including anxiety, depression, suicide intervention, and relationship issues ▪ Proactive Mental Health Outreach through in classroom presentations on team building, effective group work, communication skills, and information booths. ▪ Study skills ▪ Tragic Event Response Team ▪ Cross cultural and settlement counseling ▪ Test Centre

Support Service	Brief Description of Service
Financial Aid	The Financial Aid Office is staffed with 1 manager, 1 front office supervisor, 10 full-time employees and 4 part-time employees who administer various government financial assistance programs to eligible full-time and part-time students. Services include, but are not limited to: • Administration of the Ontario Student Assistance Program (OSAP) • Determination of an individual student's eligibility for the various types of funding • Administration of the student bursary programs for students • Interpretation of the rules and regulations of the Ontario Ministry of Training, Colleges and Universities
Student Employment Services	Student Employment Services offers professional cost-free services to both students and employers. The department is staffed with 3 full-time employees including 2 Employment Officers and 1 Employment Relations Officer. Employment Services staff promote College programs to the community and offers a comprehensive job matching program ensuring employers and qualified students/graduates are connected. Services include, but are not limited to: • General job postings (online, print, and class presentations) • CSEP and OWSP job postings • Job search techniques • Resume writing • Interview preparation • Labour market information
Services for Students with Disabilities	The Centre for Students with Disabilities provides disability-related counselling and advising, including specialized academic and personal counselling that is developed specifically for students with disabilities and not duplicated by regular counselling and advising services available to all students. The Centre is staffed with 1 manager and 11 full-time employees including 5 Disability Counselors, 1 Learning Strategist, 1 Intake and Assessment Advisor, 2 Assistive Technology support staff, 1 Test Room support facilitator, 1 Office Administrator and numerous additional part-time staff. Services include, but are not limited to: • Interpreters, readers and reading technologies • Test accommodations • Transcription services (ie: Braille, large print) • Specialized instructional and tutoring services • Note-takers and electronic note taking for course-related activities • Access to, and arrangements for, assistive devices • Access to the Dr. John Burton Adaptive Technology Lab • Specialized orientation to acquaint students with the campus environment • Consultation with faculty for students with disability-related needs • Liaison with and referral to other Student Support Services and agencies • Liaison with campus and community agencies on the students' behalf
Tutoring	The Counselling Service's 'Peer Tutoring' provides the one-on-one opportunity for students experiencing difficulties in a particular course to be matched with a senior student (nominal fee applies) for academic assistance. In addition to the tutors, one part-time peer tutoring clerk and two proctors are staffed in this area.

Support Service	Brief Description of Service
Other Services:	
Cooperative Education Department	The Cooperative Education Department facilitates the co-op process including the development of job opportunities and the preparation of the students for the work force. The department acts as a liaison between the student, the employer and the participating academic departments and collects the relevant academic assignments. The department includes is 4 full-time employees and one part time employee. Services include, but are not limited to: • Job posting process, distribution of applications to employers • Arranging interviews on or off campus, process job offers • Site visits with the employer and student during the work placement • Consultation with co-op professionals to mitigate issues encountered during the job search or while on placement
Health Services	Health Services provides professional, confidential medical services for students. Physicians are available by appointment and walk-in and Registered Nurses provide assessment and treatment of minor illnesses or injury. Health Services is staffed with both full and part-time physicians, nurses and support staff. There are 6 combined full and part-time physicians and 5 nurses on staff. Services include, but are not limited to: • Allergy injections • Birth control information and prescriptions • Blood tests • Emergency treatment for accidents/illnesses • Health counseling (nutrition, stress, exercise, smoking, drugs, alcohol) • Treatment for acute illness (headaches, colds, etc.) • Vaccinations
Mamidosewin Centre for Aboriginal Students	The Mamidosewin Centre provides Aboriginal students with a supportive and welcoming environment for career, academic and personal counselling, as well as traditional and cultural gatherings. Services include, but are not limited to: • Individual and group counselling • Educational and social workshops • Mental health services • Student placement opportunity referrals
College Ombudsperson	The Ombudsperson is independent and impartial, and has effective access to both College and Students' Association officials and can assist students with concerns related to any aspect of student life at the College – from policies and procedures to rights and responsibilities. Guidance may be provided in the following areas: • Making appropriate choices based on unique and/or personal circumstances • Assistance in dealing with negative conduct/behaviour of another person that adversely impacts student life • Facilitate communication between the student and another member of the College community

Support Service	Brief Description of Service
Residence Life	Residence Life supports the holistic development of students through individual, interpersonal, intellectual and community education and empowers students to live, learn and lead in an inclusive and safe community. The Manager – Residence Life and the Residence Life Coordinator supervise the Senior Residence Advisor, the Residence Programmer and 20 Residence Advisors. Services include, but are not limited to: • Educational Programming and Building Wide Events • Residence Orientation • Algonquin Residence Council • Student Outreach • Community Patrol
Registrar's Office	The Registrar's Office maintains student records and provides relevant support from admission to graduation. Services include, but are not limited to: • Admissions, fees, registrations, withdrawals • Applications for course exemptions • Academic records and transcripts • Scheduling (timetables)
Safety and Security Services	Safety and Security Services ensures the College provides a safe and secure learning environment. Services include, but are not limited to: • Communication and Patrol Services (24 hrs/day) • Campus Watch • Lost and Found • Incident and Emergency Response • Student Crime Stoppers • Workshops and presentations on a variety of safety issues
Student Affairs and Orientation	Student Affairs and Orientation provides a welcoming community for new students and provides a variety of orientation activities to assist students in adjusting to College life. The SAO also provides the 'Student Leader Program' Returning students are also invited to special events and information fairs.

Section 6.4: Faculty

Enrolment Projections and Staffing Implications

	Cumulative Enrollment Full-time	Contact Hours	Cumulative Full-time Faculty Equivalents (F.T.E.)	Cumulative Part-time Faculty Equivalents (F.T.E.)	Contact Hours taught by Full-time Faculty	Contact Hours taught by Part-time Faculty	Ratio of Full-time Students: Full-time Faculty	Technical Support Full-time Equivalent (F.T.E.)
Year 1 2012-13	75	600	0.5	1.7	220	380	150:1	0.5
Year 2 2013-14	138	1125	2	2.4	490	635	69:1	0.5
Year 3 2014-15	194	1605	3.5	2.7	1045	560	55:1	0.5
Year 4 2015-16	245	2055	5	3.0	1495	560	49:1	0.5

The table above depicts both the enrolment and staffing projections for the program. The figures are based on a plan to hire a full-time faculty member in each of the second, third and fourth years following the launch of the program and on the assumption that a full-time technician will be shared within the academic department and will dedicate half of his/her time to the provision of support to the Bachelor of Building Science program. Note that additional full-time faculty members who will teach some of the breadth courses are also captured in the table above. Finally, the College plans to hire a 4th full-time faculty member dedicated to the program in Year 5 following the program's launch. This will result in a full-time student to full-time faculty member ratio of 41:1.

Faculty Selection

Requirements to teach in the Bachelor of Building Science program meet the Board requirement as no fewer than 50% of faculty teaching in the professional or main field of study as well as those teaching in the breadth courses hold the terminal academic credential in the field or in a closely related field of study. Faculty selection and orientation are detailed within Policy D7: Full Time Hiring Process and Policy HR10: New Employee Orientation.

Review of Faculty Performance

The Academic Chair conducts regular reviews of faculty performance which includes student feedback on teaching (Policy E38-Course Assessment) and supervision. Formal performance appraisals of faculty are conducted no less than once every three years and as often as yearly. However, Student Course Feedback (student questionnaire) is reviewed following each semester and any areas for improvement are addressed with faculty on an ongoing basis. Performance appraisals of faculty are conducted to ensure that student needs are being adequately met, as well as, to discuss the ongoing needs and professional development of faculty.

New professors are subject to a two-year probationary period during which time they will be evaluated by the Chair at regular intervals (every 4 months). A final, more detailed, evaluation is completed by the Chair immediately prior to the end of the probationary period to formally acknowledge and confirm the faculty member's suitability.

Though the College has a practice whereby every faculty member must receive a performance appraisal from his/her Chair, the College does not presently have a standard form for this purpose. Typically, the faculty member is asked to reflect on the past 1-2 years and highlight achievements and objectives for the upcoming year. A meeting is then held to discuss the period being assessed and subsequently a summary document is prepared by the Chair, with any documents provided by the faculty member attached and any applicable professional development recommendations noted. Once reviewed by the faculty member, the summary document is further discussed with the Chair, if required, and then signed by the Chair, faculty member and Executive Dean. The faculty member may comment on the final summary document, should they so choose. The original copy with signatures is retained in Human Resources within the employee's file.

Faculty Currency and Professional Development

The College offers a wide range of professional development activities for staff throughout the year. The varied offerings may be viewed at: http://www.algonquincollege.com/employee-pd/. The Centre for Organizational Learning within Human Resources offers ongoing professional development for faculty.

Algonquin offers support and orientation activities for both full- and part-time faculty. Professional development activities aligned with performance appraisals are also provided. Algonquin has established a set of competencies expected of faculty titled the Professor of the 21st Century. This document communicates the College's expectations of faculty in their role as teachers and provides a framework for continuous professional development.

To facilitate the ongoing professional development of faculty Algonquin College offers numerous ongoing professional development activities many of which are associated with the seven competencies of the Professor of the 21st Century as follows:

The Performance Institute
The Performance Institute provides performance training (body language and voicing) and many other tips and tricks for new and experienced teachers. It is delivered over one-semester, 3 hours per week. Faculty are released from teaching one course to participate in this.

Teaching Adult Lifelong Learners (T.A.L.L.) Program
This is a certificate program offered to part-time professors who are interested in furthering their professional credentials as an adult educator. The program is delivered in a hybrid format using a combination of workshops and online learning experiences. The different courses in the program are offered at a rate of two per semester (for those wishing to complete it in a shorter period of time.)

Kaleidoscope Conference
Algonquin College's annual three-day professional development conference held in May features speakers and workshops of interest to all College employees.

Workshops and Online PD
Numerous workshops are offered throughout the year and may be viewed on the Centre for Organizational Learning Website. Online PD is offered on current topics of interest such as Camtasia Relay, Blackboard™ 9.0 and Hybrid Course Development.

Faculty can also arrange for one-on-one coaching with Learning and Teaching Services staff if they are experiencing challenges relative to teaching, classroom management, technology use, among others. Additionally, participation in orientation activities is an expectation of newly hired full and part-time faculty.

Curriculum Implementation Service
A new Curriculum Implementation Service was introduced to the College in Fall 2010. This is an outreach service, with members dedicated to specific areas of the College. It supports the development of hybrid and on-line courses, as well as other PD needs.

Full-time Faculty Orientation
New full-time faculty participate in five primary orientation activities:

1. New Employee College Orientation
New employees of Algonquin College attend a College orientation and welcome session. Held bi-weekly, these sessions are designed to provide new employees with an overview of the College's mission, vision, policies, and procedures. Information about health and safety, staff ID cards, parking, personnel benefits, and union membership is also provided.

2. Departmental Orientation
New employees will meet with their departmental supervisor or a departmental representative on their first day of work for departmental orientation. Topics covered include: course information, time sheets, work hours, class schedules, departmental communications etc. New hires are also introduced to departmental colleagues.

3. Teaching @ Algonquin
These sessions take place typically during August and September of the school year. They provide an introduction to the learning and teaching environment at Algonquin.

4. Focus on Learning (FOL) (Parts I and II)
This program is organized by a committee of professors from Eastern Region colleges and provides the opportunity to explore ways of developing teaching practice within a collaborative and creative environment. All new faculty from these colleges are invited to attend. It involves attending Part I for 5 days in August and Part II for 3 days in the spring of the following year.

5. Mentoring Program
During the orientation process, new professors are paired up with an experienced mentor.

Part-Time Faculty Orientation
New part-time faculty are required to participate in the **five** module 'Teaching Part-Time at the College' program:
1. Creating Positive Learning Environments (3 hours)
2. Teaching is More Than Talking (3 hours)
3. Getting Started With Blackboard™ (3 hours)
4. The Nuts and Bolts of Evaluation (3 hours)
5. Finding Your Way Around Algonquin College (3 hours)

Professional Development Funds

The College budgets a portion of its professional development funds centrally. This fund is used to run the activities offered through the Centre for Organizational Learning. Additionally, to maintain faculty currency, each School/Faculty also budgets some professional development funds for staff to participate in events related to their field (courses, conferences, meetings) from year to year. Usually, these funds are kept in a central envelope within each School. The funds are disbursed, following receipt of requests from faculty members with the proper justification.

The College periodically offers update/renewal fund by which a professor can be freed from part or all of his/her load in order to gain experience or maintain currency in the field. This is usually for a short period of time (typically 3 months).

Additionally, the College provides sabbatical opportunities whereby faculty that have been with the College for more than 7 years can make a request to be freed from their teaching duties for one year in order to perform other duties which will benefit them in their professional growth.

The College further allows each faculty member 10 working days leave per year for professional development. This professional development can be in relation to in-house teaching methodologies/learning tools, as well as, activities related to the faculty member's field.

Faculty Innovation

Algonquin supports experimentation with new teaching methods and is an advocate for innovation. Innovation is specifically referenced in the College's 2008-2013 Strategic Plan and defined as, *"…the successful implementation of creative ideas which includes initiatives related to staff, programs, technology and business processes."* As such an Academic Innovation Fund was established in 2009 to formally support experimentation with new teaching methodologies. The Faculty Innovation Fund link allows one to view the array of projects that have been funded and undertaken for the past two years. Budget permitting, it is expected that another call for proposals will be announced for the 2011/2012. A few examples of projects funded in the 2010-11 academic year are listed below. Specific project descriptors are available via the links provided:

- A Virtual 3D World to Create an Engaging Learning Environment - Part II
- Interactive Math for the Trades: SMART Board interactive whiteboard
- Multi-disciplinary Collaboration: The Algonquin College iFiTHOME
- Computer Animated Interactive Tutorials for the Building Trades
- Communication in Difficult Situations for Inter-professional Groups: a virtual experience PART II
- 2010 Integrated Professional Education Pilot

An Innovation Station is available to staff to experiment with new teaching tools that houses some of the latest hardware and software available as well as various books and resources related to innovation. Three workstations are available to all staff for innovating and experimenting.

Historically, Algonquin College has been on the forefront in experimenting with new teaching methods, most notably in the area of technology incorporation within curriculum delivery. For example Algonquin's Simulation Centre for Health Studies is one of the most elaborate in

Canada within which faculty have been pioneering the use of simulation in delivery of health studies programming. A Video Conferencing Centre originally established through the Health Studies division, is also available facilitating alternative course delivery options.

The College has adopted Blackboard™ as its Learning Management System and recently moved to V9.0 which has added Wiki and Blog features. Every full-time course has a Blackboard™ site that is used for posting course outlines and other information as well as for hybrid or online course delivery. The College currently delivers approximately 758 hybrid courses and 300 online course offerings. The College has also recently implemented lecture capture technology into every classroom on campus using Camtasia Relay software.

Whenever new technologies are adopted professional development is provided through the COL. Typically prior to adopting system wide technologies, the College will pilot/experiment, using off-site hosting services when necessary, and rollout the professional development support in tandem. This process was used with Adobe Connect adoption and will be used prior to adopting Blackboard™ 9.1 and Elluminate. A Virtual Desktop Infrastructure is now in place which allows students and staff to have access to any College licensed software anywhere/anytime on any device assisting with more flexible course delivery.

Faculty Teaching and Supervision Loads

Faculty teaching and supervision loads are assigned in accordance with the Academic Employees Collective Agreement's Standard Workload Formula (SWF) defined in Article 11 – Workload. The pertinent workload excerpt is in included in the electronic policies file.

The total workload assigned and attributed by the College to a teacher shall not exceed 44 hours in any week for up to 36 weeks in which there are teaching contact hours for teachers in post-secondary programs. The balance of the academic year is reserved for complementary functions and professional development. Workload factors include:
(i) teaching contact hours
(ii) attributed hours for preparation
(iii) attributed hours for evaluation and feedback
(iv) attributed hours for complementary functions

An allowance of a minimum of six hours of the 44 hour maximum weekly total is to allow for four hours for routine out-of-class assistance to individual students. The teacher is expected to inform students of their availability for out-of-class assistance in keeping with the academic needs of students. The College has also established provisions for student academic advising.

The electronic policies file (Section 16: Policies), includes policies and procedures pertaining to faculty within the following:
Policy D2: Professional Development Leave
Policy D7: Full Time Hiring Process
Policy D9: Staff Update/Renewal
Policy E31: Academic Advising
Policy E32: Faculty Consultation with Students
Policy E38: Course Assessment
Policy HR03: Tuition Assistance – Algonquin College Courses
Policy HR04: Tuition Assistance – Degree Completion
Policy HR10: New Employee Orientation
Procedure: Credential Evidence and Release of Information
Procedure: Ontario Colleges of Applied Arts and Technology Academic Employees Collective Agreement (Effective From: September 1,2009 to August 31, 2012)-Excerpt Article 11 Workload

Section 6.5: Curriculum Vitae Release

The College has on file and available for inspection, from all faculty and staff whose CVs are included in this submission, signatures that attest to the truthfulness and completeness of the information contained in their CV and agreeing to the inclusion of their curriculum vitae in any documents/web sites associated with the submission, review, and final status of the program application.

Section 6.6: Curriculum Vitae of Faculty Assigned to the Degree Program *- excluded for web version*

Section 7: Credential Recognition

The program has been designed to maximize the graduates' potential for employment and promotion in their field and for further study as evidenced by the following communications from employers, professional associations and academic institutions.

Included in this section are letters of support from:

- Aecon Buildings Ottawa
- Arborus Consulting
- BECOR Building Envelope Council Ottawa Region
- Boucher Architectural Design
- Canadian Construction Association
- Engineering Institute of Canada
- Greater Ottawa Home Builders' Association
- GRB Building Consultants Inc.
- JL Richards & Associates Limited
- Morley Construction Inc.
- MTBA
- National Research Council Canada
- Ottawa Construction Association
- PCL Constructors Canada Inc.
- Revay and Associates Limited
- Ryerson University
- The Society of Energy Professionals
- Talpen Construction Inc.
- TRINITY
- Uniform Urban Development

AECON

October 5th, 2010

Aecon Buildings Ottawa supports the Bachelor of Applied Business Technology program in Building Science for construction Excellence Program at Algonquin College and will (as appropriate):

X Offer placements for students for the required paid co-op work experience component of the program

X Hire graduates

Sincerely,

Anders Persson
Senior Vice President & General Manager
Aecon Buildings Ottawa

Aecon Buildings Ottawa, a division of Aecon Construction Group Inc.
495 March Road, suite 100, Kanata, Ontario, Canada K2K 3G1 Tel: 613.591.3007 Fax: 613.591.1138 www.aecon.com

Arborus
CONSULTING

January 13, 2010

To Whom this May Concern,

Re: Algonquin College Bachelor of Applied Technology

Arborus Consulting supports the Bachelor of Applied Technology (Building Science) degree program at Algonquin College and will offer placements for students for the required paid co-op work experience component of the program and/or hire graduates wherever possible.

Arborus Consulting

Robin Hutcheson, P.Eng., LEED AP
President

76 Chamberlain Avenue
Ottawa, Ontario, Canada
K1S 1V9

T: 613-234-7178
F: 613-234-0740
E: admin@arborus.ca
www.arborus.ca

BECOR
Building Envelope Council Ottawa Region

c/o 12 – 2615 Lancaster Road
Ottawa, ON K1B 5N2

December 10th, 2010

Vertha Coligan, Chair
Architecture/Civil Department
School of Advanced Technology
Algonquin College

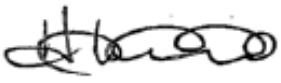
Re: Bachelor of Building Science

The Building Envelope Council Ottawa Region (BECOR) is pleased to offer this letter in support for the application of the degree proposal Bachelor of Applied Technology (Building Science) at Algonquin College.

The mix of building systems, construction, design and building information technology courses, practical experience and leadership content make this program a unique offering in Ontario. The importance of greater sustainability in building design and performance is influencing the way the building industry is evolving to a great degree. A program like the one proposed will provide the technological and practical tools to graduates to face the challenges of this evolution.

BECOR fully supports this application and wishes the College success with this significant curriculum endeavor.

Sincerely,



Hélène Roche, P.Eng.
President
Building Envelope Council Ottawa Region
Tel: (613)-991-2437 Fax: (613)-952-0268

Boucher Architectural Design
better building performance
Rene Boucher, CCCA
President

7 Bernadette Place
Ottawa, ON K2H 9A3

Tel: 613.721.9183
Cell: 613.862.1954

rene.boucher@rogers.com
Design and Renovation Services of Custom Homes & Multi-Residential
BuildingsGreen Building ScienceBuilding Envelope RemediationConstruction
Contract AdministrationDrawings, Specifications & Project Manuals

Date: 2011-01-06

Vertha Coligan, Chair
Architecture/Civil Department
School of Advanced Technology
Algonquin College

Re: Bachelor of Building Science

Boucher Architectural Design is pleased to offer this letter in support for the application of the degree proposal Bachelor of Applied Technology (Building Science) at Algonquin College.

The mix of building systems, construction, design and building information technology courses, practical experience and leadership content make this program a unique offering in Ontario. The importance of greater sustainability in building design and performance is influencing the way the building industry is evolving to a great degree. A program like the one proposed will provide the technological and practical tools to graduates to face the challenges of this evolution.

Boucher Architectural Design fully supports this application and wishes the College success with this significant curriculum endeavor.

Sincerely,

Rene Boucher, CCCA

President, Boucher Architectural Design

Canadian Construction Association | Association canadienne de la construction

January 4, 2011

Ms Vertha Coligan
Chair, Architecture/Civil Department
School of Advanced Technology
Algonquin College
1385 Woodroofe Avenue
Ottawa, ON K2C 0C6

Dear Ms. Coligan:

Re: Bachelor of Building Science

The Canadian Construction Association is pleased to offer this letter in support of the application for a degree program of study at Algonquin College entitled Bachelor of Building Science.

There is no question that programs such as these are vital to our industry if we are to successfully meet our growing labour supply and training challenges. A study released by the Construction Sector Council (CSC) in June 2010 concluded that the construction industry in Canada will need to recruit and train some 15,500 new supervisory personnel by the year 2025 just to replace retirees due to our aging workforce. This is a staggering number when one realizes that the 15,500 figure represents about 21% of the industry's current supervisory workforce! In addition, the study says the industry needs to engage and train by 2018 some 395,000 new workers in some 30 trade occupations.

The mix of building systems, construction, design and building information technology courses, practical experience and leadership content make this program a unique offering in Ontario. The importance of greater sustainability in building design and performance is influencing the way the building industry is evolving to a great degree. A program like the one proposed will provide the technological and practical tools to graduates to face the challenges of this evolution.

The Canadian Construction Association fully supports this application and wishes the College success with this significant curriculum endeavor.

Sincerely,

Michael Atkinson
President

GOHBA
Greater Ottawa Home Builders' Association
Association des constructeurs d'habitations d'Ottawa
#108 – 30 Concourse Gate, Nepean, ON K2E 7V7
Tel: (613)723-2926 Fax: (613)723-2982

February 1st, 2011

Vertha Coligan, Chair
Architecture/Civil Department
School of Advanced Technology
Algonquin College

Dear Ms Coligan,

Re: Bachelor of Building Science

The Greater Ottawa Home Builders Association is pleased to offer this letter in support for the application of the degree proposal Bachelor of Building Science at Algonquin College.

The mix of building systems, construction, design and building information technology courses, practical experience and leadership content make this program a unique offering in Ontario. The importance of greater sustainability in building design and performance is influencing the way the building industry is evolving to a great degree. A program like the one proposed will provide the technological and practical tools to graduates to face the challenges of this evolution.

The Greater Ottawa Home Builders Association fully supports this application and wishes the College success with this significant curriculum endeavor.

Sincerely,

Mr. John Herbert
Executive Director
Greater Ottawa Home Builders' Association

Website: www.gohba.ca E-mail: info@gohba.ca

GRG

Building Science Specialists
Contract Administrators
Reserve Fund Planners
Consulting Engineers

BUILDING CONSULTANTS

Principals
Gerald R. Genge, P.Eng., BDS, C. Arb.
Dale D. Kerr, M.Eng., P.Eng., ACCI, BSSO.
www.grgbuilding.com

George R. Torok, B.Tech.(Arch.Sci.), C.E.T., BSSO
Cellular: (613) 850-4740
Email: gtorok@grgbuilding.com

September 24, 2009

Re: Proposed Bachelor of Applied Technology in Building Science
Algonquin College, Ottawa
Letter of Support

We would like to express out support for the proposed Bachelor of Applied Technology in Building Science program at Algonquin College. Our firm provides services to building owners of various types (private rental, condominium, social housing co-operative and non-profit, municipalities). We carry out research and development activities for the public sector (CMHC, NRCan, etc.) and the private sector (SAWDAC, Sto, and others) and participate in standards development (various CGSB, CSA, ASTM committees). We provide litigation support to public and private sector clients. We rely on staff who are knowledgeable and experienced in building science, such as Professional Engineers, Architectural and Engineering Technologists and Technicians.

We look forward to a source of future employees in the National Capital Region. Existing undergraduate level programs are, for the most part, located in the GTA (Ryerson, Humber College) and benefit largely that region. Like the GTA, Ottawa is growing quickly and would benefit from locally-trained graduates to assist in design and construction quality control of new buildings, as well as to assist in maintaining and improving the existing housing stock (the latter being our primary focus). We look forward to hiring graduates in summer, / co-op and full-time positions, as work loads permit.

We encourage the Postsecondary Education Quality Assessment Board and the Minister of Training to support the Bachelor of Applied Technology in Building Science program at Algonquin College.

Yours truly,

George Torok, B.Tech.(Arch.Sci.), C.E.T., BSSO
National Capital Region Manager / Technical Specialist

FILE NO: C:\USERS\GTOROK\DOCUMENTS\ASSOCIATIONS\ALGONQUIN COLLEGE\BAT ADVISORY COMMITTEE\SUPPORT LETTER SEPTEMBER 24 2010.DOC

GRG BUILDING CONSULTANTS INC.
30 Concourse Gate – Unit 27, Ottawa, ON K2E 7V7, TELEPHONE: (613) 746-2245; (800) 838-8183, FAX: (613) 746-9443

J.L. Richards
& Associates Limited
864 Lady Ellen Place
Ottawa, ON Canada
K1Z 5M2
Tel: 613 728 3571
Fax: 613 728 6012

October 1, 2010

J.L. Richards & Associates Limited supports the Bachelor of Applied Technology (Building Science) degree program at Algonquin College and will (as appropriate):

__X__ Offer placements for students for the required paid co-op work experience component of the program

__X__ Hire graduates

Sincerely,

J.L. RICHARDS & ASSOCIATES LIMITED

Guy A. Cormier, P.Eng.
Vice-President, Chief Civil Engineer

GAC:jd

MORLEY CONSTRUCTION INC.
135 Walgreen Road
Carp, Ontario K0A 1L0

Phone (613) 831-5490
Fax (613) 831-0067
www.morleyhopper.com

Sept 30, 2010

Re: **INDUSTRY SUPPORT OF PROGRAM AND PLACEMENT OFFERINGS**

To Whom it may concern:

Morley Construction Inc. supports the Bachelor of Applied Technology (Building Science) degree program at Algonquin College and will:

__X__ Offer placements for students for the required paid co-op work experience component of the program

__X__ Hire graduates

Sincerely,

Brad Morley, P. Eng.
President
Morley Construction Inc.

MTBA
• Architecture • Urbanism • Conservation •

September 30, 2010

To Whom it May Concern,

MTBA Mark Thompson Brandt Architect & Associates supports the Bachelor of Applied Technology program in Building Science degree program at Algonquin College, and intends to, as appropriate and available:

[X] Offer placement for students for the required paid co-op work experience component of the Program.

[X] Hire graduates of the program.

Yours truly,

MARK THOMPSON BRANDT ARCHITECT & ASSOCIATES

Mark T. Brandt, OAA, MRAIC, LEED AP, CAHP
Senior Conservation Architect & Urbanist

MARK THOMPSON BRANDT ARCHITECT & ASSOCIATES
mtbarch.com • T 613-244-2323 • F 613-244-3602 • 112 Nelson Street Studio 102 • Ottawa Canada

National Research Council Canada
Institute for Research in Construction
Building Envelope and Structure
Ottawa, Canada
K1A 0R6

Conseil national de recherches Canada
Institut de recherche en construction
Enveloppe et structure du bâtiment

NRC·CNRC

October 1, 2010

Vertha Colligan
Chair, Architecture/Civil/GIS/Technical Writer
Algonquin College
1385 Woodroffe Avenue
Ottawa, Ontario
K2G 1V8

Ms. Colligan,

Re: Bachelor of Applied Technology Program in Building Science

Just a short note to say that it is great to hear that you are developing a program in Building Science. A 4-year Degree program with a more applied perspective (regarding knowledge and regarding research) will be of interest to the industry. In particular, it is commendable that the program will focus on the Building Envelope (Energy Performance & Management) as well as sustainability and net zero energy performance. The topics you are proposing to address including Sustainable Architectural Design and Building Information Technology for building performance optimization (during construction & during operation through its functional life until retrofitting, or recycling), will help provide qualified graduates in the field of building science and help industry address this important theme in construction.

Good luck with the program.

Sincerely,

Dr. Ralph M. Paroli
Director, Building Envelope &
Structure Program

Canada

THE OTTAWA CONSTRUCTION ASSOCIATION
L'ASSOCIATION DE LA CONSTRUCTION D'OTTAWA
SERVING THE NATIONAL CAPITAL REGION
SINCE 1889

February 1, 2011

Ms. Vertha Coligan
Chair, Architecture/Civil Department
School of Advanced Technology
Algonquin College
1385 Woodroffe Avenue
Ottawa, ON K2C 0C6

Dear Ms. Coligan:

Bachelor of Building Science

Thank you for your presentation to the OCA Board of Directors outlining the College's application for the first ever degree program of study entitled Bachelor of Building Science offered at a Canadian College.

As a result of your presentation, the Board has a finer appreciation of where this unique 4 year Degree program fits in relation to the current Algonquin Technician and Technology programs and also where it fits in relation to the Engineering programs offered locally at Carleton University and the University of Ottawa.

The program therefore appears to be a wonderful new addition to the construction educational offerings in the region and therefore the OCA provides our enthusiastic support for your application.

Yours truly,

John DeVries
President

196 BRONSON AVE.,
OTTAWA, ONT.,
K1R 6H4
TEL (613) 236-0468
FAX (613) 238-6124

ETHICS AND TEAM-WORK

CONSTRUCTION LEADERS

June 23, 2010.

RE: BAT Program

PCL Constructors Canada Inc. would like to put forth its support for the new Algonquin College BAT- (Bachelor of Applied Technology) Building Sciences Program.

We feel this program is able to provide students with a broad knowledge base that is very well suited for our industry and will therefore offer the following:

1- Student placements for the paid Co-op portion of the program
2- Hire graduates

Should you require further information, please feel free to contact the undersigned.

Sincerely,

Penny Dockrill
Recruitment Manager
PCL Constructors Canada Inc.

PCL CONSTRUCTORS CANADA INC.
49 Auriga Drive, Nepean, Ontario, K2E 8A1 Telephone: (613) 225-6130 Fax: (613) 225-6176

Revay and Associates Limited

Project Management and Construction Claims Services

Revay and Associates Limited
39 Robertson Road, Suite 230
Nepean, Ontario K2H 8R2
Tel.: (613) 721 - 6801
Fax.: (613) 596 - 8172
E-mail: ottawa@revay.com
www.revay.com

Other Offices:
Montreal, QC
Toronto, ON
Calgary, AB
Vancouver, BC
Wilmington, DE, USA

September 24, 2010.

Revay and Associates Limited would like to put forth its support for the new Algonquin College Bachelor of Applied Technology (BAT) Building Sciences Program.

We feel this program will be able to provide graduates with a broad knowledge base that will be well suited for our industry and will therefor offer the following:

1. Student placement for the paid Co-op portion of the program
2. Hire graduates

Should you require any further information please contact the undersigned

Sincerely,

John Owens
Ottawa Branch Manager
Revay and Associates Limited

RYERSON UNIVERSITY

DEPARTMENT OF ARCHITECTURAL SCIENCE
FACULTY OF ENGINEERING, ARCHITECTURE & SCIENCE

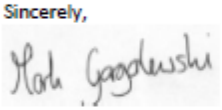
Maria Parra, PhD
Architecture/Civil Department
School of Advanced Technology
Algonquin College

February 1st, 2011

Maria

Thanks for your information about the new building science program at Algonquin College, which sounds interesting and valuable. We need more building science graduates in the industry. With regard to entry for your graduates into our building science graduate program, the policy of Ryerson University Yeates School of Graduate Studies is that any student with a suitable undergraduate degree with a minimum B average grade in their last 2 years is generally able to apply to our program, and your graduates would be considered along with all other applicants. We have on occasion accepted graduates from other undergraduate college degree programs, and your students would be considered in a similar way.

Sincerely,



Dr Mark Gorgolewski
Professor & Director for graduate program in building science
Ryerson University, Department of Architectural Science
Tel: 416- 979-5000 Ext. 6494
E-mail: mgorgo@ryerson.ca

350 Victoria Street, Toronto, Ontario, Canada, M5B 2K3 Tel 416-979 5360 Fax 416 979 5353 E-mail archsci@ryerson.ca www.ryerson.ca

THE SOCIETY
OF ENERGY PROFESSIONALS
IFPTE LOCAL 160

December 13, 2010

Vertha Coligan, Chair
Architecture/Civil Department
School of Advanced Technology
Algonquin College
1385 Woodroffe Avenue
Nepean, ON
K2G 1V9

Re: Bachelor of Building Science

The Society of Energy Professionals is pleased to offer this letter in support of the proposal for a degree program in Bachelor of Building Science at Algonquin College.

The Society of Energy Professionals represents more than 8,000 professionals in the Ontario electricity sector, including scientists, engineers, system analysts, market analysts and planners at Ontario Power Generation, Hydro One, the Ontario Energy Board and the Independent Electricity System Operator. Our union is deeply concerned with conservation, and actively promotes sustainability in the electricity generation and transmission systems where most of our members work. At the same time, we recognize that true sustainability is ultimately dependant on end user demand and creating a physical infrastructure which tempers that demand and leads to genuine conservation gains.

Sustainable and efficient design in residential, commercial and industrial buildings is one of the areas in which the highest practical potential for conservation exists. Indeed, if we are to achieve the ambitious conservation goals of an additional 5000MW of conservation by 2030, as laid out in the Ontario government's newly released Long Term Energy Plan, greater efficiency of building design must be an integral part of our plan.

The mix of building systems, construction, design and building information technology courses, practical experience and leadership content in this proposed program would put Algonquin College in a unique position in this important and emerging field. Ontario desperately needs hubs of innovation in the building sciences, and we believe that Algonquin College is well positioned to become such a hub. A program like the one proposed will provide the technological and practical tools to graduates to face the challenges of this evolution. This can only benefit us all in the end.

The Society of Energy Professionals fully supports this application and wishes the College success with this significant curriculum endeavor.

Sincerely,

Rodney Sheppard
President
The Society of Energy Professionals

425 Bloor Street East, Suite 300
Toronto, Ontario M4W 3R4
www.thesociety.ca
Tel 416-979-2709
Toll Free 1-866-288-1788
Fax 416-979-5794

TAPLEN
Construction Inc.

September 29, 2010

Taplen Construction Inc.supports the Bachelor of Applied Technology (Building Science) degree program at Algonquin College and will support by offering an endorsement.

Sincerely,

Michael Assal
President
Taplen Construction Inc.

Design - Build | General Contracting | Project Management | Construction Management
6 Antares Drive, Phase II, Suite 206, Ottawa, ON K2E 8A9
Tel: +613.521.2550 Fax: +613.521.8945
www.taplenconstruction.com

TRINITY

2275 Lake Shore Blvd. W., Suite 400
Toronto, ON Canada M8V 3Y3
t: 416.255.8800 f: 416.255.8355

December 16, 2010

VIA EMAIL: parram@Algonquincollege.com

Algonquin College Architecture/ Civil Department

Attention: M.L. Parra

Dear Ms. Parra,

Re: Bachelor of Applied Technology Building Sciences Program

Trinity Development Group Inc. would like to put forth its support for the new Algonquin Bachelor of Applied Technology (Building Sciences) Degree Program at Algonquin College.

When deemed appropriate, we may be able to offer placements for students for the required paid co-op work experience component of the program.

Should we have future staffing opportunities, we would consider hiring a graduate.

Sincerely

Michael Bottigoni
Senior Vice President Construction

Trinity Development Group Inc.

uniform
URBAN DEVELOPMENTS

October 18, 2010

Attention: Maria Parra, PhD
Architecture/Civil Department
School of Advanced Technology
Algonquin College

Dear Ms. Parra

Please accept this letter as confirmation that Uniform Urban Developments supports the Bachelor of Applied Technology program in Building Science at Algonquin College and will provide:

- Placements for students for the required co-op work experience component of the program
- Hiring potential for graduates should the opportunity present itself.

Sincerely,

George Georgaras
General Manager
Uniform Urban Developments

Uniform Urban Developments Ltd.
300-117 Centrepointe Dr. Ottawa, Ontario K2G 5X3 T 613.225.0770 F 613.723.1675 www.uniformdevelopments.com

Section 8: Regulation and Accreditation

The proposed Bachelor of Building Science program does not lead to an occupation that is subject to government regulations nor is it designed to prepare students to meet the requirements of a particular accreditation.

Section 9: Nomenclature

The Bachelor of Building Science program title meets the Board nomenclature requirements. This title follows one of the typical approaches to nomenclature for Bachelor degrees in applied areas, available for designating college degrees, the Bachelor of Subject.

The degree title conveys accurate information about the degree level since 'Bachelor' is reflected in the title, which is congruent with degree level learning. The natures of the degree and discipline, and/or subject of study, are both clearly reflected with the inclusion of 'Building Science' in the nomenclature. The term *'Building Science'* is recognized by industry and self-explanatory, in that it is simply the science or "from the Latin, scientia meaning "knowledge"[25] of buildings. As such the title facilitates the public's understanding, assist students, employers, and other postsecondary institutions in recognizing the level, nature and discipline of study. The title has been supported by the Building Science program Advisory Committee.

25 en.wikipedia.org/wiki/**Science**

Section 10: Program Evaluation

Algonquin College has a formal, institutionally approved policy and procedure for the periodic review of programs that embodies the characteristics required of the Board. As previously explained in Section 5.1 Quality Assurance of Delivery, Algonquin has an effective Program Quality Assurance process detailed in Policy E25: Program Quality Assurance.

The program evaluation process consists of three primary components, Annual Curriculum Review, Program Mix Review and Program Quality Review. Please refer back to Section 5.1 for details and schematics for each of these components. A *'Program Quality Assurance at Algonquin College'* schematic is also included in the electronic policies file (Section 16:Policies).

The three prong quality review process includes two annual reviews, each with a different focus, and one in depth review every five years. The current process was originally designed for postsecondary programs leading to Ontario College credentials and the criteria parallel those used by the Provincial Program Quality Assurance Process Audit (PQAPA). This external audit of the College review processes ensures that the College has a process in place that assures continuous quality improvement.

The Program Quality Review (PQR) process at the College has been adapted for our degree programs. The Program Quality Assurance Administrator worked with coordinators and chairs of the Degree programs to determine how our current process needed to be modified to meet the needs of our degree programs. The relevant criteria against which to evaluate the programs are identified using the Handbook for Ontario Colleges.[26]

EVALUATION AGAINST THE QUALITY CRITERIA

The criteria against which the program is evaluated are provided below. First, a listing of the evaluation criteria and its corresponding elements is provided. This is followed by a listing with help text to assist in the evaluation of each element of the quality criteria.

Evaluation Criteria Listing

Criterion 1. Admission, credit for prior learning, promotion, graduation, and other related academic policies support program development and student achievement of program learning outcomes.

1.1 The qualifications and prerequisites required of the applicant are published and are appropriate to allow the student to be successful without limiting access to the program.
1.2 Students have adequate information to allow them to make informed choices about: selecting the correct program to meet their career aspirations; the financial commitment needed; the workload commitment needed; and the study options available to them.
1.3 Students know how to get internal and external transfer of academic credits and recognition for prior learning.
1.4 Students know what is needed to ensure they will be able to demonstrate program outcomes and complete the program.
1.5 Students know how they will be evaluated.
1.6 Students indicate the learning requirements are relevant and meaningful.
1.7 Students indicate that assessment methods relate to the learning requirements.

26 Postsecondary Education Quality Assessment Board. (2010). Handbook for Ontario Colleges – Applying for ministerial consent under the Post-secondary Choice and Excellence Act, 2000. Toronto: PEQAB.

Criterion 2. The program conforms to the *Postsecondary Education Quality Assessment Board Handbook for Ontario Colleges*, is consistent with accepted nomenclature principles for baccalaureate degrees in applied areas of study, and maintains relevance.

2.1 The duration and structure of the program are consistent with the program learning outcomes and the credential offered.
2.2 Appropriate credits are allocated for each component of the program, and transfer and laddering options are stated.
2.3 Prerequisites do not unnecessarily hinder progress in the program.
2.4 Program learning outcomes are consistent with the credential granted, the title of the credential awarded, the benchmarks, and the minimum essential expectations of the workplace.
2.5 Program learning outcomes are reflected in course outlines.
2.6 Program learning outcomes are used in prior learning assessment.
2.7 Changes to courses and program outcomes are introduced on a timely basis and are designed to maintain the relevance of the program.
2.8 The program has established agreements for further study, e.g., articulation agreements.
2.9 The program conforms to the College policy for the number of English courses.
2.10 All curriculum documentation is up-to-date including course outlines and the program monograph information.
2.11 There is congruency between the course learning requirements and the program learning outcomes.
2.12 There is a match between course learning requirements, course learning activities, and learning resources.
2.13 Concepts of social, economic, and environmental sustainability are embedded in the program curriculum.
2.14 Students have opportunities to develop the skills, knowledge, and attitudes necessary to succeed in a global economy.

Criterion 3. Methods of program delivery and student evaluation are consistent with the program learning outcomes.

3.1 Program delivery, including that which takes place off-site, is consistent with the nature of the program, the learning outcomes, and the needs of the students.
3.2 There is a range of instruction methods consistent with a variety of learning styles and learner needs and abilities.
3.3 Learning methods are published and are matched to the learning outcomes.
3.4 College designated targets regarding hybrid courses are met.
3.5 Learners are provided the skills necessary to be successful with the learning strategies selected.
3.6 Evaluation criteria are published and students are aware of how and when they are going to be evaluated.
3.7 There is a match between course learning requirements and evaluation methods, i.e., evaluation methods allow students to demonstrate the course learning requirements.
3.8 Evaluation methods are valid and reliable.
3.9 Students indicate that feedback is timely and allows them to build on their learning.
3.10 Students perceive evaluation to be fair.
3.11 Opportunities for resubmissions, supplementals, and appeals are published, appropriate, fair, valid, and consistent.

3.12 Student workload and assessment is balanced across the term at both the course and program level.
3.13 There is a range of evaluation methods used consistent with a variety of learning styles.
3.14 Learners can earn credit for up to 50% of the program's courses using the PLAR process.
3.15 Academic policies and practices that provide for the development and continuous improvement of teaching and learning methods are valued, documented, and supported.
3.16 Graduate capabilities, including knowledge, skills, and attitudes are consistent with program outcomes.

Criterion 4. Human, physical, financial, and support resources to support student achievement of program learning outcomes are available and accessible.

4.1 The program faculty members, as a whole have adequate academic preparation and workplace experience to deliver a quality program.
4.2 Faculty members are formally evaluated every three years.
4.3 Faculty members engage in professional development activities that ensure they are current in their field and developing teaching expertise.
4.4 Students consider faculty to be available.
4.5 Students consider faculty to be adequately prepared for class.
4.6 All students are assigned an academic advisor.
4.7 Academic Advisors contact their students early in the term with an invitation to meet and to ensure that students know who their advisor is.
4.8 Labs, clinical facilities and placement facilities are complementary to, and integrated into, the program and allow the learner to demonstrate the learning outcomes.
4.9 Students indicate that there are adequate and accessible learning resource materials to allow them to be successful including: textbooks in the bookstore; online materials; print resources; equipment; and student support services.
4.10 The program is financially viable.
4.11 The demand for the program has been sustained for the last five years.
4.12 There is a future demand for graduates of this program.
4.13 The learning environment is safe.
4.14 The students are provided with the information they need to know to function safely in both the College and workplace learning environments.

Criterion 5. Regular program quality assessment that involves faculty, students, industry representatives, and others as appropriate for the purpose of continual improvement is in place and happens.

5.1 Students indicate that they are satisfied with the program.
5.2 Issues raised at Program Councils are addressed in a timely fashion and feedback is provided to the Council.
5.3 Learners progress through the program, achieve program outcomes and graduate in a timely fashion.
5.4 Learners with a wide range of abilities demonstrate the expected learning outcomes.
5.5 Graduates are satisfied with the overall program experience.
5.6 Graduates obtain employment in their fields.
5.7 Graduates are successful in obtaining external licenses or credentials where relevant.
5.8 Employers are satisfied with graduate performance.

Following a gap analysis of the Board's self-study requirements against the established criteria for Ontario College credentials PQR two additions to the criteria elements are to be made in order to fully meet the PEQAB Program Evaluation Standard:

- Explicit analysis of the OSAP (and/or equivalent) student loan default rate
- That assessment of individual student work in the terminal stage of the program, that reflects exemplary, average, and minimally acceptable performance, demonstrates that the degree-level standard has been achieved.

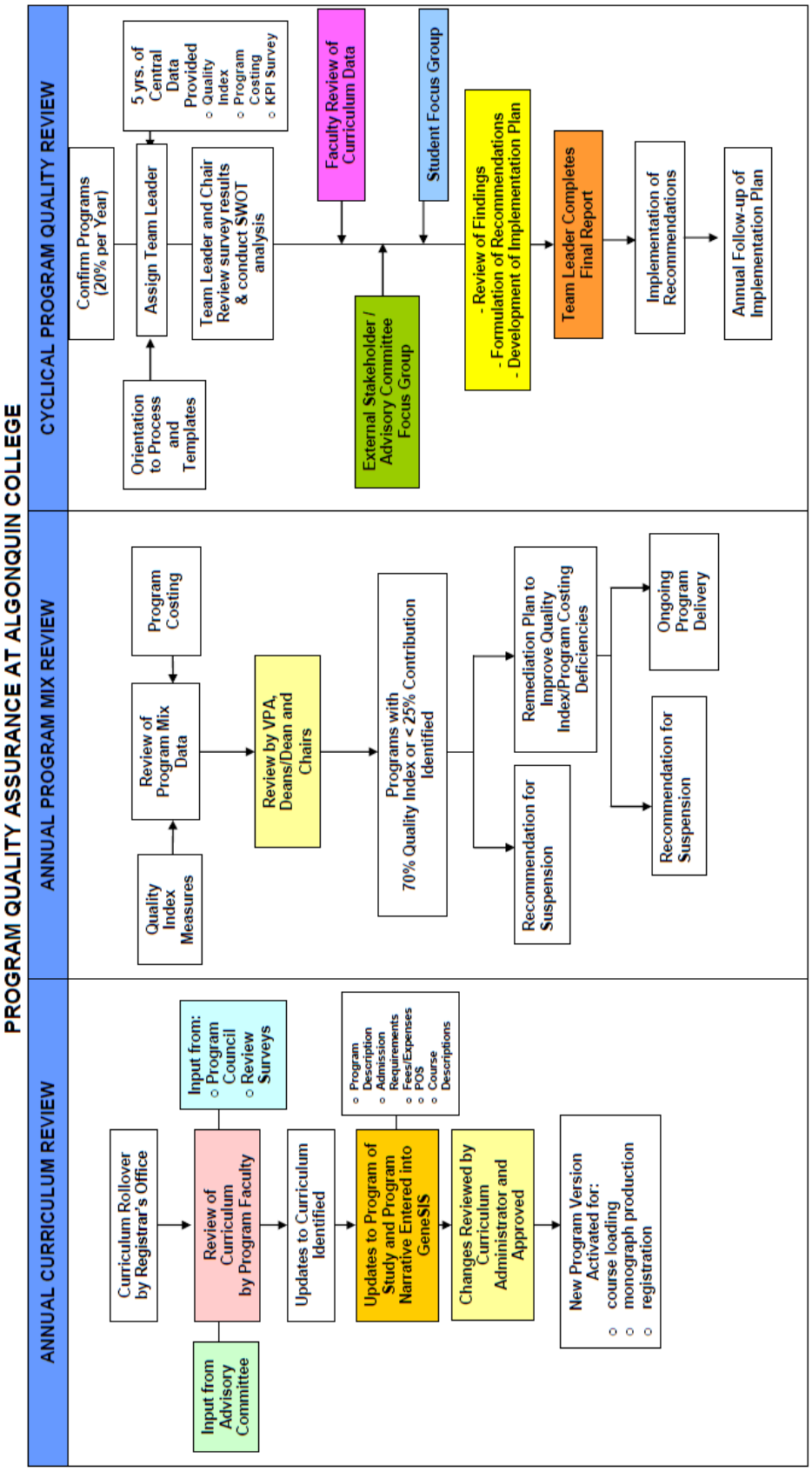
These items are being addressed in the ongoing self-study for the Degree Consent Renewal for BAB e-Business Supply Chain Management, and will be incorporated into the specific Team Leader PQR guide for Degrees in Applied Areas of Study.

Furthermore, for a degree program, a Program Evaluation Committee is established that adheres to the Board's requirements. The Program Evaluation Committee is expected to evaluate a program based on the self-study and a site visit during which members of the committee meet with faculty members, students, graduates, employers and administrators to gather information. A Program Evaluation Committee report is completed that provides an assessment of the program quality and leads to recommendations for change intended to strengthen the quality of the program and support ongoing continuous improvement. The report is addressed to senior administration and shared with the College's Academic Council, Board of Governors, faculty members and students in the program, and includes a plan of action to respond to the report's recommendations. The Program Quality Assurance Administrator works with the Program Chair in following up on the status of implementation of recommendations. A cyclical program review schedule is established that conforms to Board requirements in that the first PQR will occur prior to a request for ministerial consent renewal. For example a review that is currently in process is depicted below:

Program	**Academic Year for PQR**	**Self-Study**	**Review and Report by Program Evaluation Committee**	**Action Plan** *(Response to Program Evaluation Committee Report)*	**Consent Renewal Application Deadline**	**Consent Expiry**
BAB (e-Business Supply Chain Management)	2010/2011	Fall 2010	Spring 2011	Fall 2011	Dec.31, 2011	Dec. 31, 2012

The electronic policies file (Section 16: Policies), includes policies and procedures pertaining to program evaluation and quality assurance within the following:

Policy E25: Program Quality Assurance


PROGRAM QUALITY ASSURANCE AT ALGONQUIN COLLEGE
ANNUAL CURRICULUM REVIEW
ANNUAL PROGRAM MIX REVIEW
CYCLICAL PROGRAM QUALITY REVIEW
Curriculum Rollover by Registrar's Office
Review of Curriculum by Program Faculty
Input from: Program Council Review Surveys
Input from Advisory Committee
Updates to Curriculum Identified
Updates to Program of Study and Program Narrative Entered into GeneSIS
Program Description Admission Requirements Fees/Expenses POS Course Descriptions
Changes Reviewed by Curriculum Administrator and Approved
New Program Version Activated for: course loading monograph production registration
Quality Index Measures
Review of Program Mix Data
Program Costing
Review by VPA, Deans/Dean and Chairs
Programs with 70% Quality Index or < 25% Contribution Identified
Recommendation for Suspension
Remediation Plan to Improve Quality Index/Program Costing Deficiencies
Recommendation for Suspension
Ongoing Program Delivery
Confirm Programs (20% per Year)
Orientation to Process and Templates
Assign Team Leader
5 yrs. of Central Data Provided Quality Index Program Costing KPI Survey
Team Leader and Chair Review survey results & conduct SWOT analysis
Faculty Review of Curriculum Data
External Stakeholder / Advisory Committee Focus Group
Student Focus Group
- Review of Findings - Formulation of Recommendations - Development of Implementation Plan
Team Leader Completes Final Report
Implementation of Recommendations
Annual Follow-up of Implementation Plan

Section 11: Academic Freedom and Integrity

Algonquin College policies detail procedures relative to academic freedom, ownership of intellectual products of its employees and students, compliance with copyright law, academic honesty/integrity, and research involving humans and/or animals, as well as the management of research funds.

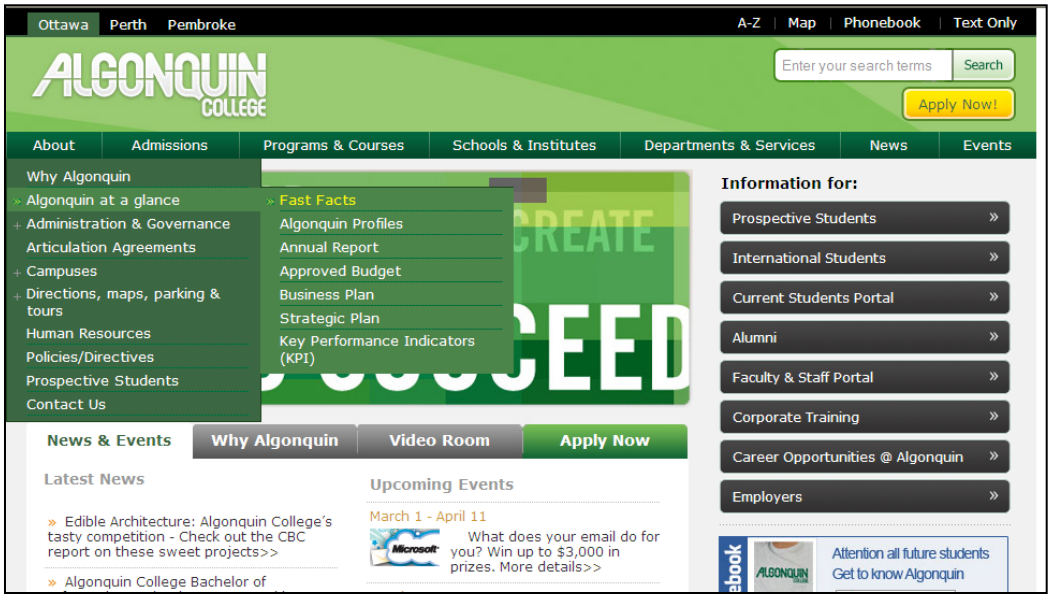
The electronic policies file (Section 16: Policies), includes policies and procedures pertaining to academic freedom and integrity within the following:

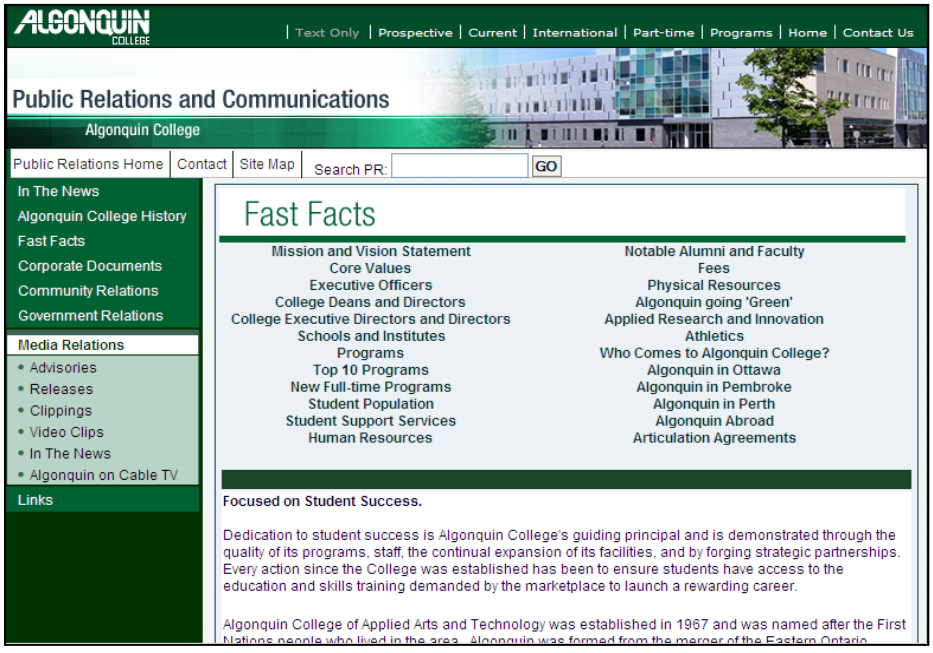
Policy A3: Copyright Legal Deposit and Plagiarism
Policy A25: College Information Security
Policy AA18: Academic Dishonesty and Discipline
Policy E19: Confidentiality of Student Records
Policy E43: Plagiarism
Policy E46: Protection of and Access to Student Information and Online Course Materials
Policy H1: Research Administration
Policy H2: Integrity in Research and Scholarship
Policy H3: Research Involving Humans
Policy H5: Intellectual Property
Policy RE04: Use of Animals in Research, Teaching and Other Activities
Policy RE06: Use of Biohazardous and Radioactive Materials in Research and Education

Section 12: Student Protection

In accordance with Algonquin's core values of caring, learning, integrity and respect, ensuring ethical business practices and the protection of students' interests are integral to the College's operation. Algonquin endeavors to ensure transparency, thoroughness, and clarity of its publications in terms of informing prospective and current students' as to their responsibilities and rights. Numerous policies and practices provide evidence of compliance with the Board's requirements for student protection.

The following screen captures of links from the College's Home and Fast Fact web pages depict the varied information provided about the College, its operation, and organizational structure.



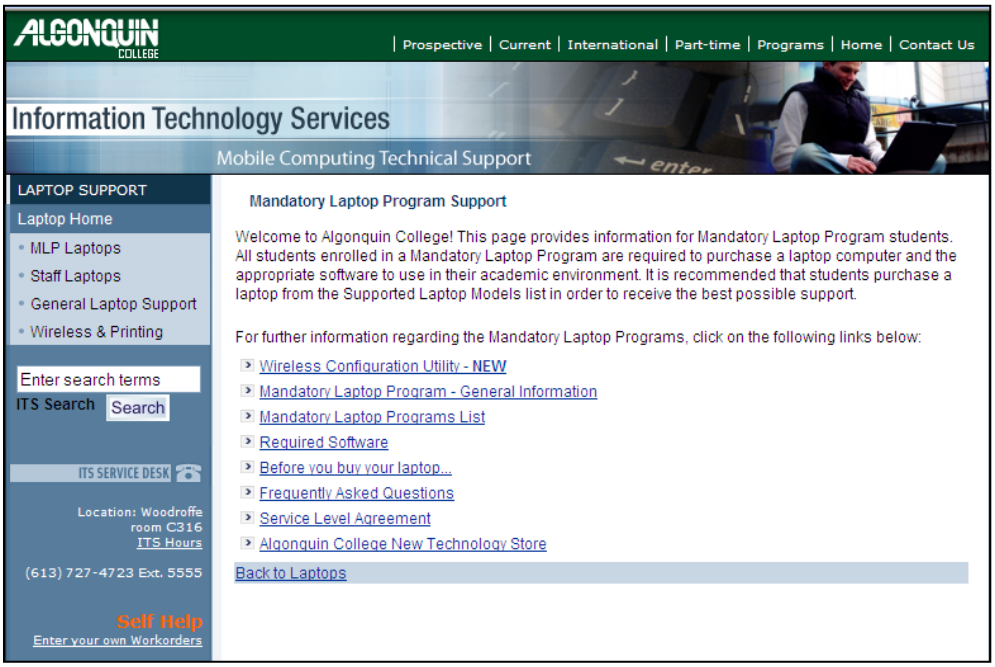


Applicant and student requirements and obligations are published in hard copy and/or web based formats as follows:

Program Monographs

- Full-time programs: http://algonquincollege.com/prospective/fulltime.html
- Part-time programs: http://algonquincollege.com/prospective/parttime.html

Monographs detail fees and expenses as well as information regarding the technological requirements and success factors required of a program. For example, for mandatory laptop programs' publications direct students to the Mobile Computing Technical Support website to obtain the technical specifications for programs and details of the Service Level Agreement associated with the Mandatory Laptop fee at:
http://algonquincollege.com/its/support/mobilecomputing/laptop/mlp/index.htm



Other primary College publications include the Viewbook and College Calendar.

Viewbook

- http://algonquincollege.com/prospective/publications/viewbook_2011_2012_embedded.htm

College Calendar

- http://www.algonquincollege.com/prospective/publications/documents/Calendar_2010_2011.pdf

The following 2010-2011 College Calendar Table of Contents Excerpt displays the information provided within the Calendar:

President's Welcome
Board of Governors' Message
Chart of Programs and Page Index
Overview of the College
- Organizational Structure
- Recruitment Office
- Academic Calendar 2009-2010

Program Information by School
- School of Advanced Technology
- School of Business

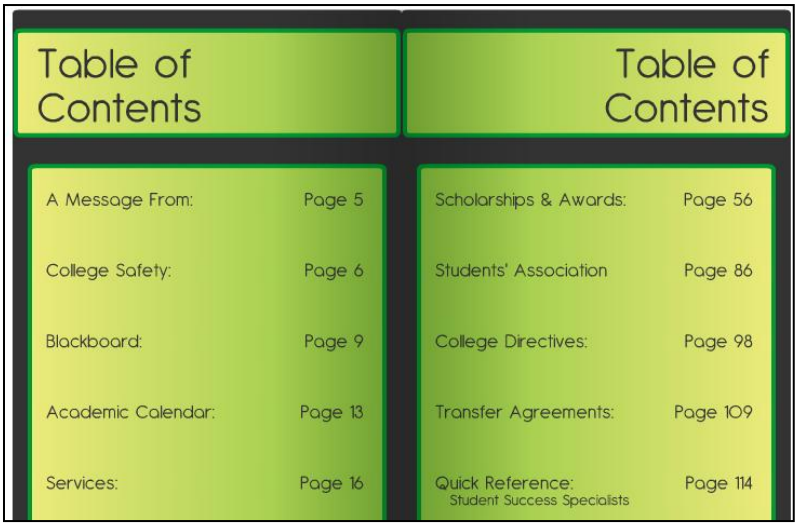
- School of Health and Community Studies
- School of Hospitality and Tourism
- School of Media and Design
- School of Transportation and Building Trades
- Police and Public Safety Institute
- Career and Academic Access Centre
- General Arts and Science
- Algonquin College Heritage Institute
- Algonquin College in the Ottawa Valley
- Part-time Studies
- Algonquin College Language Institute

Apprenticeship Programs
Administrative Policies
- Policies Related to Admission
- International Student Information
- Fees
- Policies Related to Registration

Services to Students
- Student Support Services
- Financial Assistance for Students
- Students' Association
- Other Services

Glossary of Terms
Degrees of Opportunity
- Bachelor Degrees in Applied Studies
- Collaborative Degrees
- Articulation Agreements
- Course Descriptions See enclosed CD

Prospective and current students can view all College policies since they are readily available online http://www2.algonquincollege.com/directives/. Excerpts of these policies are published in the Student Handbook available from the Student Affairs and Orientation website http://www.algonquincollege.com/studentservices/sao/index.htm. The following screen capture depicts the Student Handbook's Table of Contents:



The electronic policies file (Section 16: Policies), includes policies and procedures pertaining to student protection within the following:

Policy A21: Rights, Freedoms, Responsibilities and Code of Conduct for the Algonquin College Community
Policy AA10: Transfer of Academic Credit (External)
Policy AA18: Academic Dishonesty and Discipline
Policy AA19: Academic Appeal
Policy AA37:Review of Final Grades
Policy AD02: Compliance with Ontario's Freedom of Information and Protection of Privacy Act
Policy AD04: Fees
Policy AD05: Fee Deferral Policy (For Students Not Applying for Financial Aid)
Policy E9: Transfer of Academic Credit (Internal)
Policy E12: Registration
Policy E18: Scholarships, Prizes, Awards
Policy E20: Ombudsperson
Policy E23: Student Complaints
Policy E27: Student Conduct
Policy E28: Bursaries
Policy E29: Program Progression & Graduation Requirements
Policy E37: Admission of International Students
Policy HR22: Harassment/Discrimination

Section 13: Economic Need

The benchmark for economic need is demonstrated through the evidence contained within this section that includes:

- Market Analysis conducted by the Hanover Research Council in March 2010
- Applicant Demand Survey and Data
- Current Employment Opportunities Listing

This information provided is indicative of the need for this program in addressing a gap in labour force skills.

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Market Analysis

HANOVER RESEARCH COUNCIL
1101 Pennsylvania Ave. NW, Suite 600 Washington, DC 20004
P 202.756.2971 F 866.808.6585 www.hanoverresearch.com

Market Analysis for a Bachelor of Applied Technology (Building Science)

Prepared for Algonquin College

In this report, The Hanover Research Council conducts a market analysis for a Bachelor of Applied Technology degree program in Building Science. The report begins with a general discussion of the current construction market as this is the best indicator of demand in the field. The second main section covers current and projected employment growth rates, current retirement rates, and occupational outlook profiles for four different occupations related to building sciences. Finally, we present our results of a scan of current building sciences program offerings throughout Canada.

Executive Summary

In this report, The Hanover Research Council explores the demand for graduates with degrees in building science. Below is a summary of our key findings which indicate that there is relatively strong demand for workers with a building science background.

Key Findings:

- The demand for building science in Canada is most closely tied to the construction industry. Currently, in response to the global and national recession, the construction industry has struggled across Canada. However, the industry appears to remain strong within the province of Ontario.

- As compared with previous projections, employment growth rate projections for occupations related to building science for the 2006-2015 are somewhat more modest. In comparison to the national average, however, the employment growth rates for the majority of occupations in building science outpace the rates for all occupations.

- Of the four occupational classifications which we cover in this report, three have retirement age gaps which are at or below the national average. A lower age gap indicates that there are likely to be more openings due to retirement each year.

- The current and near future outlook for the construction manager occupation is rated as "good" in Canada. Likewise, an outlook rating of "good" was also given to the province of Quebec while the prospects for construction managers are expected to be "average" in Ontario.

- Engineering technicians currently have an occupational outlook rating of "fair" in Canada. Civil engineering technicians, the branch that is most relevant to building sciences, has a rating of "average" in Ontario and "good" in Quebec.

- In 2009, the job prospects for technical occupations in architecture, drafting, etc. were rated as "limited" for Canada. However, within Ontario, the market for architectural technologists and technicians was rated as "good" for the near term future. In Quebec, the occupation of architectural technologists and technicians received a "fair" rating.

- The current occupational outlook for other technical inspectors and regulatory officers in Canada is rated as "good." In Quebec, the occupation of construction inspector is also rated as "good" and is projected to maintain this positive outlook. Information for this occupation is not available for Ontario.

- There appears to be a dearth of bachelor degree programs in building science in Canada. While building sciences is a common component of engineering and architecture programs, an entire curriculum dedicated to the study of building science appears to be rare in the country. This may provide an opportunity for Algonquin to fill an educational gap in a field which is projected to be in demand in the coming years.

Overview of Current Trends in the Market

What is Building Science?

In broad terms, building science is defined as the application of scientific principles in the planning, design, and construction of structures. Within this wide definition, there are a multitude of principles and practices that building science entails. In fact, because the scope of what is covered under the term "building science" is relatively vast, there is no widely agreed-upon specific definition. One version, as summarized in the *Journal of Building Physics* states that building science:[27]

- Is an applied science;
- Includes the study of the hygrothermal, acoustical, and light-related performances of materials, building elements, and buildings;
- Is conducted based on human comfort, health, and serviceability of buildings (health, costs, sustainability, etc.);
- Is strongly rooted in math, physics, and materials science;
- Is closely tied to construction and services engineering, and is less concerned with structural mechanics; and
- Is a foundational component of a Building Engineering education.

These principles of building science have many applications in the professional realm. A few examples of particular areas of expertise include:

- Knowledge of materials characteristics and an ability to combine materials which are compatible and complement each other.
- Understanding of the effect of weather on a structure, including temperature, solar, wind, rain, snow loads, and many others.
- Comprehension of subterranean activity. An understanding of how shifts underground may affect a structure and how to best design and construct it to handle these shifts.
- Expertise in energy consumption, particularly in recent years with a heavy emphasis on conservation and sustainability.

As can be seen from this somewhat expansive definition of building science, there are a lot of sub-categories as well as occupations which fit underneath the umbrella of building sciences. This makes it difficult to accurately discuss and current trends in the market as they specifically apply to building science. **However, nearly all professional applications and occupational paths which correspond to**

27 Bomberg, Mike. "Letter from the Editor". *Journal of Building Physics*. 2005; 29; 5. Pg. 7. <http://jen.sagepub.com/cgi/reprint/29/1/5.pdf>

training in building science have one common feature; they largely depend on the construction market. As such, we believe that the Canadian construction outlook is the closest indicator of the market for individuals with a building sciences background.

As suggested in the following pages, there is somewhat of a mixed outlook for the construction market in Canada as a whole. While there is an indication that the construction market across Canada has struggled in recent years, there are signs that the market will rebound and regain its strength in the longer term outlook. Yet, **within the province of Ontario, more specifically, the construction industry is expected to continue growth trends throughout the foreseeable future.**

Canadian Construction Outlook

In 2009, new starts in industrial, commercial, and institutional construction fell dramatically. This marked the greatest drop percentage-wise in history for industrial starts, falling almost 66 percent. By the numbers, the total ICI (industrial, commercial, and institutional) starts for 2008 were at 75.5 million square feet. In contrast, this same figure in 2009 only reached 48.5 million.[28]

In the short term future, projections for construction growth across Canada continue to be mixed. As Lodging Econometrics suggested in a February 2010 article, the number of construction projects across the country has experienced significant decline since 2008 and is predicted to continue to decline until approximately 2015.[29] The organization cites this decline in construction starts due to "falling lodging demand and the tightening of lending."[30]

On the private side, confidence levels are rising and there are signs including low interest rates, the improving economy, and higher stock market levels, that construction may be close to turning a corner, possibly by the end of the year. On the public side, all levels of government will continue to struggle with reduced tax revenue and the resulting budget shortfalls. Total building forecasts for non-residential building starts are projected to be around 57.5 million square feet for 2010, a modest increase from 2009. In 2011 and 2012, the market is expected to continue to improve with starts reaching 70.0 and 84.0 million square feet, respectively.[31]

As the *Daily Commercial News and Construction Record* article notes, there are many signs that there is reason for optimism in the long term for the Canadian construction market. First, the population in Canada is growing and is expected to continue growing at a rate which is above that of most other well off countries. Currently at 34 million, the population is projected to increase by 1.1% annually. This influx of additional citizens will require new jobs, new housing, medical care, and a variety of other services, all requiring structures. On a basic level, the addition of more people to the population means that more money will be spent in the Country.[32]

Finally, Canada is viewed as a strong option for investors looking to make property investments in safe environments. There are a variety of economic factors which have led to this view including the strength

28 Carrick, Alex. "2010 to be Another Difficult Year for Construction". *Daily Commercial News and Construction Record*. Feb 9, 2010. <http://www.dailycommercialnews.ca/article/id37280>

29 "Construction Slows for Canadian hotels." Lodging Econometrics. February 4, 2010. <http://www.execdigital.ca/Construction-slows-for-Canadian-hotels_41561.aspx>

30 Ibid.

31 Carrick, Op. Cit.

32 Ibid.

of the currency, the stability of the government, and the low risk of the commercial building investments because of the substantial ownership positions of government-backed pension funds.[33]

Indeed, recent indicators hint that construction starts for 2010 may already be showing signs of improvement. According to a March 2010 article in the *Journal of Commerce*, CanaData reports that construction starts statistics for buildings for January and February of 2010 are up 51 percent from the same time last year.[34] In particular, much of this growth is concentrated in the province of Ontario; major projects in the region include the development of a correctional facility, the University of Toronto, and two additional health care facilities.[35] Given the importance of the Ontario construction industry to the Canadian economy, in the next sub-section we provide a more in-depth glance at the construction industry within the province.

Ontario

In recent years, the expansion of Ontario's construction industry has contributed to Canadian job growth as a whole. As a 2008 article in the *Daily Commercial News and Construction Report* suggests, the province's "strong market conditions have resulted in construction employment rising by 150 percent" over the 1998 to 2008 period.[36] In fact, as the article indicates, the expansion of the construction industry in Ontario has translated into broader employment growth across Canada. For example, as Statistics Canada notes, between 2007 and 2008 the construction labor force increased by roughly 21,000 workers in Ontario; in Canada, the construction workforce increased by nearly 94,000 individuals.[37]

According to a 2008 article published by the Construction Sector Council, Ontario's construction industry is expected to sustain the hiring of approximately 74,000 workers over the 2008-2016 period, including both jobs due to industry growth and jobs due to the retirement of baby boomers.[38] As Ron Martin, Executive Director of the Sudbury Construction Association aptly notes, "**While there is some risk of an economic slowdown affecting Ontario, the level of growth for construction over the next eight years remains very positive…Major projects underway and proposed will add significant construction related employment in the province**."[39]

Indeed, construction forecast data completed in February 2010 suggest that Resident Construction Housing investments will nearly double across Ontario between 2010 and 2018.[40] As Table 1 suggests, growth appears to be particularly pronounced in the region of Central Ontario.

33 Ibid.

34 "CanaData's February Year-to-Date Construction Starts a Mix of Pluses and Minuses." *Journal of Commerce.* March 16, 2010.
< http://www.journalofcommerce.com/article/id37998>

35 Ibid.

36 "Ontario Construction Industry Drives Canadian Job Growth." Daily Commercial News and Construction Record. March 14, 2008.
<http://www.dailycommercialnews.com/article/id26832>

37 Ibid.

38 "Employment Opportunities in Ontario's Construction Industry." Construction Sector Council. July 11, 2008. <http://www.csc-ca.org/english/whatsnew_4.html>

39 Ibid.

40 "Construction Forecast Data." Construction Sector Council. February 2010.
< http://www.constructionforecasts.ca/oft/table?preset=236&locale=en>

Table 1. Resident Construction Housing Investment in Ontario, 2010-18

Region	2010	2011	2012	2013	2014	2015	2016	2017	2018
Ontario	**9,946**	**12,381**	**12,308**	**12,604**	**13,430**	**14,597**	**15,969**	**17,119**	**17,632**
Central Ontario	1,804	1,852	2,039	2,259	2,600	3,248	3,927	4,539	5,023
Eastern Ontario	1,320	1,137	1,332	1,444	1,468	1,475	1,512	1,558	1,610
Northern Ontario	319	277	315	385	488	578	648	651	57
Southwest Ontario	725	805	993	1,511	2,033	2,295	2,436	2,527	2,242

Source: Construction Sector Council

While the Construction Sector Council forecasts suggest that Engineering Construction investments will decrease throughout the province of Ontario in the immediate future, investments are predicted to steadily grow after 2012.[41] The following table presents an overview representation of expected increase in engineering investment over the 2010-2018 period. As Table 2 suggests, Eastern Ontario appears to have a relatively higher concentration of engineering investment relative to other regions of the province.

Table 2. Engineering Construction Investment in Ontario, 2010-18

Region	2010	2011	2012	2013	2014	2015	2016	2017	2018
Ontario	**16,207**	**14,645**	**14,525**	**15,225**	**15,086**	**15,348**	**15,626**	**16,912**	**18,520**
Central Ontario	2,751	2,415	2,365	2,478	2,528	2,547	2,594	2,648	2,697
Eastern Ontario	3,443	3,215	3,120	3,141	3,190	3,214	3,252	3,309	3,364
Northern Ontario	1,774	1,694	1,689	1,760	1,770	1,785	1,788	1,805	1,822
Southwest Ontario	2,934	2,566	2,602	2,800	2,316	2,335	2,416	2,471	2,510

Source: Construction Sector Council

Employment Projections

HRSDC Employment Projections

Human Resources and Skills Development Canada (HRSDC) has developed a series of employment projections through 2015 for the Canadian labor market. Projections are made at the three-digit National Occupational Classification (NOC) level, so it is possible to determine which occupational categories will experience growth on a general level. This is unfortunate given that some of the occupations which graduates of a building sciences program would pursue are highly specific to the point where the general classifications may not provide a completely accurate account of the job prospects of these positions.

41 "Construction Forecast Data." Construction Sector Council. February 2010.
<http://www.constructionforecasts.ca/oft/table?preset=216&locale=en>

However, we believe that in general most occupations within the three-digit classifications will follow similar trends given that most are tied to the same overall construction market.

The following table presents the HRSDC's projections through 2015 for employment growth in occupations classified under four different NOC codes: 071, 223, 225, and 226.

Table 3. Employment by Three-Digit Occupations, 1987-2015

Occupations by NOC Code	Non-student employment			Past Average Annual Growth 1988-2005	Future Average Annual Growth 2006-2015
	1987 (000's)	2005 (000's)	2015 (000's)		
071 - Managers in construction and transportation	80.9	142.4	167.3	3.20%	1.60%
223 - Civil, mechanical and industrial engineering technicians	28.2	63.9	78.7	4.70%	2.10%
225 - Technical occupations in architecture, drafting, etc.	56.4	49.8	52.7	-0.70%	0.60%
226 - Other technical inspectors and regulatory officers	22.6	43.9	51.8	3.70%	1.70%
Total - All Occupations	11,242.9	14,566.0	16,263.7	1.40%	1.10%

Source: Human Resources and Skills Development Canada[42]

Of the four occupations which we have matched to the building science major, all but one is projected to exceed the rate of growth for the average of all occupations for the 2006-15 period. The growth rate for all occupations is estimated to be around 1.1 percent from 2006 to 2015. In comparison, civil, mechanical, and industrial engineer technicians is projected to grow by 2.1 percent, other technical inspectors and regulatory officers is expected to grow by 1.7 percent, and managers in construction and transportation by 1.6 percent during the same period. Only technical occupations in architecture, drafting, etc. is expected to grow at a rate below the average (0.6 percent annually).
In total, the four occupations related to building science are expected to account for 2.2 percent of all occupations by 2015. This proportion is nearly identical to the 2005 levels where the four occupations comprised 2.1 percent of the total employment for the country.

While the growth outlooks in these fields is promising, it is important to note that historically, all but technical occupations in architecture, drafting, etc. had significantly higher rates of growth from 1988-2005. In most cases, the occupations were growing nearly twice as fast previous to 2005 than they are expected to grow through 2015.

HRSDC Retirement Projections

As part of the HRSDC's labor studies, the organization also makes projections for future retirement rates for all three-digit NOC-classified occupations. Studying retirement rates and future projections provides insight into the number of job opportunities that are expected to become available to younger workers as

42 "Employment by Three-Digit Occupations, 1987-2015." Human Resources and Skills Development Canada.
www.hrsdc.gc.ca/eng/publications_resources/research/categories/labour_market_e/sp_615_10_06/page08.shtml#three

older employees retire from the field. In the table below, we present the retirement data for the same four occupations which we covered in the previous section.

Table 4 includes projected retirement numbers, the projected retirement rate, the median retirement age, the average employment age, and the age gap for each occupation. The "age gap" in the final column of the above table is an indicator of retirement pressures. The number represents the difference between the average employment age and the average retirement age, so the greater the age gap in a given occupation, the fewer job openings there are for newcomers to the field.

Table 4. Retirements by Three-Digit Occupations, 2006-2015

Occupations by NOC Code	Total Retirements 2006-2015 (000's)	Retirement Rate 2006-2015	Median Retirement Age	Average Employment Age	Age Gap
071 - Managers in construction and transportation	39	2.4%	63	45	18
223 - Civil, mechanical and industrial engineering technicians	14	1.9%	61	39	22
225 - Technical occupations in architecture, drafting, etc.	10	1.9%	61	37	24
226 - Other technical inspectors and regulatory officers	14	2.8%	61	44	17
Total – All Occupations	3,801	2.4%	61	39	22

Source: Human Resources and Skills Development Canada[43]

From 2006-2015, the retirement rate for all occupations in Canada is projected to be 2.4 percent. In comparison, the retirement rate for each of the four selected occupations with the exception of other technical inspectors and regulatory officers (2.8 percent), is expected to have a rate equal to or lower than the national average. Managers in construction and transportation are expected to have the same retirement rate as all occupations at 2.4 percent, while both civil, mechanical, and industrial engineering technicians and technical occupations in architecture, drafting, etc. are projected to have retirement rates of 1.9 percent.

Overall, for the four occupations related to building sciences, the age gap figures are favorable indicators for newcomers to the field when compared to the national average. The age gap for all occupations is 22 years. Other technical inspectors and regulatory officers (17 years) and managers in construction and transportation (18 years), each have age gaps which fall below the national average. Civil, mechanical and industrial engineering technicians have the same age gap as all occupations at 22 years, while technical occupations in architecture, drafting, etc. (24 years) is the only occupation with a greater age gap than the total for all occupations.

Overall Outlook

Based on the projected occupational growth rates and retirement rates for the four covered occupations, all except technical occupations in architecture, drafting, etc. exhibit positive indicators for future employment prospects when compared to the national average for all occupations for the 2006-15 period. Each of the other three have projected growth rates which are higher than the average for all occupations and age gaps which are equal to or smaller than the total average.

43 "Retirement Projections: Methodology and Results." Human Resources and Skills Development Canada. www.hrsdc.gc.ca/eng/publications_resources/research/categories/labour_market_e/sp_615_10_06/page07.shtml#projections

Beyond the employment and retirement projections, Service Canada provides occupational outlooks for each occupation by NOC code. Information on salary levels, education and training, work prospects, and top occupational areas is included. For each of the occupations which we have determined are relevant to building sciences, we provide a summary of the Service Canada outlook. In addition, because each occupation relates to building sciences in different ways, we include a listing of some of the job titles and descriptions within the occupational code for which a building sciences degree would be beneficial.

Managers in construction and transportation

For the managers in construction and transportation occupational classification, we present the overall occupational outlook. At the Ontario and Quebec levels, we discuss specifically the construction managers sub-classification as we believe it is the most relevant to the building sciences degree. The most recent Service Canada occupational outlook for managers in construction and transportation was provided in 2009. For this year, work prospects were rated as "good." The key determinants for the rating included:[44]

- Employment in the occupation grew at a rate consistent with the national average.
- The hourly wage for construction and transportation managers was higher ($28.94) than the average for all occupations ($18.07).
- The unemployment rate for the occupational code was 2 percent, which falls well below the national average in 2004 of 7 percent.

For the near future, job prospects are expected to continue to be good. Employment growth is likely to be close to the average, retiring workers should contribute to job openings, and the number of job openings is projected to exceed the number of job seekers.

Outlook for Ontario

Ontario Job Futures provides another outlook for occupational categories specific to Ontario. In contrast to Service Canada's outlook, employment prospects for construction managers during the next five years in Ontario are rated as "average." Job openings will be created by retirement in the industry, yet the overall construction market tends to move up and down with the cycles of economic activity. Because of the advances in building materials, the development of new "smart" and "green" buildings, and the changes in building standards, the occupation is becoming more complex. Ontario Job Futures cites that because of increasing complexity, those with a degree in construction science will have an advantage in the job market going forward.[45]

The vast majority of construction managers in Ontario will be employed in the construction industry (81%). Other industries of note include "all other industries" (9%) and professional business services (4%).[46]

44 "Managers in Construction and Transportation". Service Canada Job Futures.
<http://www.jobfutures.ca/noc/071p3.shtml>

45 "0711 Construction Managers". Ontario Job Futures. <http://www.tcu.gov.on.ca/eng/ojf/pdf/0711_e.pdf>

46 Ibid.

Outlook for Quebec

We also cover the construction manager job prospects for Quebec. In 2008, the overall outlook in the province was rated as "good." In recent years, the total number of construction managers in Quebec has grown significantly and this trend is expected to continue going forward. In addition to the boost from new job creation, those looking to break into the field of construction management will benefit from the number of current managers who are either retiring or being promoted to higher positions.[47]

The industry in Quebec that employs the most construction managers is construction with 71 percent of the total. Other industries of note include architectural, engineering and related services (7%) and manufacturing (4%).[48]

The following table presents other pertinent data for construction managers in Quebec:[49]

Table 5. Outlook for Construction Managers: Quebec

Main Labor Market Indicators	Construction Managers
Employment, Average 2005-2007	10,150
EI Claimants in 2007	150
Average Annual Growth Rate 2008- 2012	1.1%
Annual Employment Variation 2008- 2012	100
Annual Attrition 2008- 2012	350
Total Annual Needs 2008- 2012	450

Source: Job Futures Quebec

Job Details and Titles

Construction managers are tasked with a variety of tasks within their occupation. Mostly, people in these positions "plan, organize, direct, control and evaluate the activities of a construction company or a construction department within a company, under the direction of a general manager or other senior manager."[50]

There are a variety of company and organization types that often hire construction managers and within these entities there are a variety of job titles. Ontario Job Futures cites the following as potential employers: general construction companies; commercial building construction firms; industrial construction firms; construction maintenance firms; highway and heavy construction firms; and architectural, engineering and other scientific companies.[51]

According to Ontario Job Futures, examples of job titles which are relevant to the building sciences degree include: Construction Manager, Construction Superintendent, General Contractor, and Project Manager.[52]

Ontario Job Futures also includes a sampling of duties which are often expected of those who hold construction manager positions:[53]

47 "Construction Managers". Service Canada, Job Futures Quebec. <http://www.servicecanada.gc.ca/eng/qc/job_futures/statistics/0711.shtml>

48 Ibid.

49 Ibid.

50 "0711 Construction Managers". Ontario Job Futures.

51 Ibid.

52 Ibid.

- Prepare and submit construction contract bids and project estimates;
- Manage construction projects from start to finish according to schedule, contract specifications and budgets;
- Direct the purchase of building materials and land acquisitions;
- Hire and supervise the activities of subcontractors and subordinate staff;
- Prepare contracts and negotiate revisions, changes and additions to contractual agreements with architects, consultants, clients, suppliers and subcontractors;
- Plan and prepare construction schedules and milestones and monitor progress against established schedules;
- Develop and implement quality control programs;
- Represent company on matters such as business services and union contract negotiation;
- Prepare progress reports and issue progress schedules to clients and mortgage lenders.

Civil, mechanical and industrial engineering technicians

Within the civil, mechanical, and industrial engineering technicians occupational grouping, there are NOC sub-codes for each branch. Since civil engineering is the focus of engineering which is most closely tied to building and construction, we center in on the civil engineering technician occupation in this section.

In 2009, Service Canada rated the civil engineering technician occupational outlook as "fair," based on the following indicators:

- Employment for civil engineering technicians grew at a rate which is higher than the average for all occupations.
- Hourly wages were only slightly higher ($21.81) than the average ($18.07).
- The employment rate was somewhat lower (3%) than the all-occupation average from 2004 (7%).

Looking forward, the outlook is projected to remain fair in the coming years. The strength of the housing market and other related industries will help the occupation to continue growing at a rate which is higher than the average. Retiring workers will also contribute to job openings for new employees to the industry. Finally, the number of job seekers should roughly match the number of new openings.

Outlook for Ontario

Ontario Job Futures rates the occupational outlook for civil engineering technicians as "average." Employment for this occupation typically moves in unison with the construction market, which shifts with labor market conditions. For those looking to break into the civil engineering technician job market, those with co-op experience, computer expertise, and managerial aptitude are likely to have an advantage.[54]

The industry with the greatest proportion of civil engineering technicians is professional business services (42%). Other industries with significant concentrations are public administration (22%), all other industries (19%), and construction (12%).[55]

53 Duties are taken directly from the Job Futures Ontario website.

54 "2231 Civil Engineering Technologists and Technicians". Ontario Job Futures. <http://www.tcu.gov.on.ca/eng/ojf/pdf/2231_e.pdf>

55 Ibid.

Outlook for Quebec

Of the three outlooks which we cover in this report, the occupational outlook for civil engineering technicians is strongest in Quebec where the most recent rating was "good" in 2008. However, the outlook mentions that many jobs in this field are seasonal. Job opportunities are at their peak from June to November of each year.[56]

Since the early 1990s, the market for civil engineering technicians has remained fairly stable. Then, in recent years, there has been a sharp increase in the number of technologist and technician positions in Quebec. It is thought that this phenomenon will continue and the number of opportunities will continue to grow in the coming years.[57]

Table 6 presents other meaningful occupational data for civil engineering technologists and technicians in Quebec:[58]

Table 6. Outlook for Civil Engineering Technologists and Technicians: Quebec

Main Labor Market Indicators	Civil Engineering Technologists and Technicians
Employment, Average 2005-2007	6,350
EI Claimants in 2007	400
Average Annual Growth Rate 2008- 2012	2.8%
Annual Employment Variation 2008- 2012	200
Annual Attrition 2008- 2012	150
Total Annual Needs 2008- 2012	350

Source: Job Futures Quebec

Job Details and Titles

The civil engineering technician position often entails working in an engineering team. Duties of the technician vary, but often include analysis, design, and supervisory roles. Job Futures Ontario has outlined several of the common critical duties of employees in the field, many of which would fit with a building sciences degree:[59]

- Develop or assist in preparing engineering designs and drawings from preliminary concepts and sketches;
- Prepare construction specifications, cost and material estimates, project schedules and reports;
- Supervise or conduct field surveys, inspections or technical investigations of topography, soils, drainage and water supply systems, road and highway systems, buildings and structures to provide data for engineering projects;
- Inspection and testing of construction materials;
- May supervise, monitor and inspect construction projects.

Job Futures Ontario has also highlighted some of the common employers of civil engineering technicians as well as some of the more prominent job titles for those in the field.

56 "Civil Engineering Technologists and Technicians". Job Futures Quebec. <http://www.servicecanada.gc.ca/eng/qc/job_futures/statistics/2231.shtml>

57 Ibid.

58 Ibid.

59 Duties are taken directly from the Job Futures Ontario website. <http://www.tcu.gov.on.ca/eng/ojf/pdf/2231_e.pdf>

Possible employers include highway and heavy construction firms; electric power companies; provincial and municipal governments; architectural, engineering consulting and other scientific companies; building construction firms; and electrical, mechanical and trade contractors.[60]

Sampling of job titles that may be relevant to building sciences: building materials technician, construction technologist, foundation technologist, municipal engineering assistant, specifications writer (construction), structural design technologist, and structural investigator.[61]

Technical occupations in architecture, drafting, etc.

Job Futures Canada by Services Canada only provides the occupational outlook for the three digit NOC code which entails all technical occupations in architecture, drafting, etc. At the provincial level for both Ontario and Quebec, several sub-sections of the occupational category are available. Of these, we believe that the architectural technologists and technicians occupation is most relevant to building sciences. As a result, in this section we present the overall outlook for Canada, followed by the architectural technologist and technician outlooks for the provinces of interest.

In 2009, the job prospects for technical occupations in architecture, drafting, etc. were rated as "limited" by Services Canada. The following reasons were cited for the rating:[62]

- The employment opportunities during the year grew at a rate which is below the average for all occupations.
- Hourly wages for technical occupations in architecture, drafting, etc. ($20.56) were similar to the average ($18.07), however wage growth is occurring at a faster rate than for all occupations.
- The unemployment rate for the occupation group (4%) is determined to be similar to that which it was in 2004 (7%).

In the coming years, the outlook for this occupational group is expected to remain limited. First off, the job growth rates are expected to remain consistent with the average. The number of retirees should also be aligned with all occupations and this will contribute to modest openings in the field. Finally, the largest negative for the occupation is that the number of people seeking jobs in the occupation is expected to outpace the number of openings.[63]

Outlook for Ontario

Within Ontario, the market for architectural technologists and technicians was rated as "good" for the five year period from 2008-2013 by Job Futures Ontario. As with most other occupations detailed in this report, the demand for architectural technologists and technicians is tied closely to the construction industry. One recent trend in the field which is noted by Job Futures is the proliferation of computer-aided design which is changing the landscape of the field. The trend essentially blurs the necessity for specific training in architectural design. Now people with a wider variety of degrees in the construction design realm are able to hold positions that were previously filled exclusively with architectural technologists and technicians. This may actually place a greater strain on the number of available

60 "2231 Civil Engineering Technologists and Technicians". Ontario Job Futures.

61 Ibid.

62 "Technical Occupations in Architecture, Drafting, Surveying and Mapping". Service Canada Job Futures. <http://www.jobfutures.ca/noc/225p3.shtml>

63 Ibid.

positions. Those wishing to be successful in the field should become proficient with new technologies and should expect to complete intermittent re-training.[64]

People working as architectural technologists and technicians are most commonly employed in the business services industry (74%). Other industries of note include construction (11%) and "all other industries" (10%).[65]

Outlook for Quebec

After a limited outlook for all of Canada in the general occupational grouping and a good outlook for Ontario, Job Futures Quebec has given a "fair" rating to architectural technologists and technicians. The job report for Quebec also cites the slow growth of architectural technologists and technicians during the nineties and into the current decade followed by the rapid job growth in recent years. Based on the projected growth of the construction industry in the province and the demand for architectural services, the rapid job growth for this occupation is anticipated to continue going forward.[66]

The most common industry for employing architectural technologists and technicians in Quebec is the architectural, engineering and related services firms sector (63%). Other industries which commonly hire the occupation include the construction industry (9%), public administration (9%), and the manufacturing sector (5%).[67]

The following table presents other relevant occupation data for architectural technologists and technicians in Quebec:[68]

Table 7. Outlook for Architectural Technologists and Technicians: Quebec

Main Labor Market Indicators	Architectural Technologists and Technicians
Employment, Average 2005-2007	1,600
EI Claimants in 2007	45
Average Annual Growth Rate 2008- 2012	1.8%
Annual Employment Variation 2008- 2012	30
Annual Attrition 2008- 2012	20
Total Annual Needs 2008- 2012	50

Source: Job Futures Quebec

Job Details and Titles

Architectural technologists and technicians may be presented with the opportunities to work independently or with professional architects and civil engineers. Job Futures Ontario defined several common responsibilities of those hired in this occupational field.[69]

64 "Architectural Technologists and Technicians". Ontario Job Futures. <http://www.tcu.gov.on.ca/eng/ojf/pdf/2251_e.pdf>

65 Ibid.

66 "Architectural Technologists and Technicians". Job Futures Quebec. <http://www.servicecanada.gc.ca/eng/qc/job_futures/statistics/2251.shtml>

67 Ibid.

68 Ibid.

69 Duties are taken directly from the Job Futures Ontario website. <http://www.tcu.gov.on.ca/eng/ojf/pdf/2251_e.pdf>

- Assist in the development of architectural designs;
- Analyze building codes, by-laws, space requirements, site requirements and other technical documents and reports;
- Prepare drawings, specifications, cost estimates and listings of quantities of material from conceptual drawings and instructions;
- Construct architectural and display models;
- Prepare contract and bidding documents;
- Supervise drafters, technicians and technologists on the architectural team;
- Supervise construction projects and co-ordinate, monitor and inspect work done by others.

Additionally, Job Futures has identified the types of companies and organizations which commonly hire architectural technologists and technicians as well as individual job titles commonly found within the field. Those trained for this occupation can expect to be hired by: federal and provincial governments; architectural, engineering and other scientific companies; and building developers and construction firms.[70]

In terms of job titles, the following are common: Architectural Design Technician, Architectural Design Technologist, Building Technologist.[71]

Other technical inspectors and regulatory officers

As with the previous occupational profile, Job Futures Canada by Services Canada only provides the occupational outlook for the three digit NOC code which entails all other technical inspectors and regulatory officers. At the provincial level for Quebec, several sub-sections of the occupational category are available. Of these, the most relevant to building sciences is the construction inspector occupation. Because of this scenario, in this section we present the overall outlook for Canada, followed by the construction inspector outlooks for Quebec. Unfortunately the only related NOC code available from Ontario Job Futures is inspectors in public and environmental health and occupational health and safety, which is not related to building sciences.

The current occupational outlook for other technical inspectors and regulatory officers in Canada is rated as "good." Service Canada cites the following reasons for the rating:[72]

- Employment for other technical inspectors and regulatory officers grew at a below average rate when compared to all occupations.
- While the employment growth rate was low, the retirement rate is above average, leading to increased job openings.
- In 2009, hourly wages ($25.82) were significantly above the average ($18.07) and the salary growth rates also exceeded the average of all other occupations.
- The unemployment rate (3%) was somewhat lower than the national average in 2004 (7%).

In the coming years, the outlook is expected to maintain a "good" rating. The employment growth rate is projected to align with the national average moving forward. Additionally, the retirement rate is expected to continue to be above the average for all occupations. Finally, the number of people seeking jobs in the occupation will likely match the number of openings.[73]

70 "Architectural Technologists and Technicians". Ontario Job Futures.

71 Ibid.

72 "Other Technical Inspectors and Regulatory Officers". Service Canada Job Futures. <http://www.jobfutures.ca/noc/226p3.shtml>

73 Ibid.

Outlook for Quebec

The job outlook for construction inspectors for the five years spanning 2008-2013 is rated as "good." The Quebec level outlook report is somewhat limited. The report does not include justification for the rating.[74]

The profile does in fact include the general employment outlook data which we included in the other occupational profiles. The table below presents this information for construction inspectors.[75]

Table 8. Outlook for Construction Inspectors: Quebec

Main Labor Market Indicators	Construction Inspectors
Employment, Average 2005-2007	2,550
EI Claimants in 2007	60
Average Annual Growth Rate 2008- 2012	1.4%
Annual Employment Variation 2008- 2012	35
Annual Attrition 2008- 2012	100
Total Annual Needs 2008- 2012	135

Source: Job Future Quebec

Job Details and Titles

In their day to day jobs, construction inspectors inspect construction and maintenance efforts on new and existing buildings, bridges, highways and industrial construction. Service Canada has outlined some of the primary duties of a construction inspector. These duties include:[76]

- Examine plans, drawings, and site layouts for new buildings, building renovations and other proposed structures
- Inspect construction of buildings, bridges, dams, highways and other types of building and engineering construction for conformance to drawings, specifications, building codes or other applicable ordinances
- Inspect and test electrical or plumbing installations in buildings to ensure compliance with municipal, provincial and federal regulations
- Inspect steel framework, concrete forms, reinforcing steel mesh and rods, concrete or pre-stressed concrete to ensure quality standards and to verify conformance to specifications and building codes
- Inspect construction of sewer systems and pipelines
- Inspect construction sites to ensure that safe working conditions are maintained
- Inspect existing buildings to identify and report on structural defects, fire hazards and other threats to safety
- Inspect new or resale homes on behalf of clients and assess and provide reports on the physical condition of property.

In addition to job responsibilities, the HRSDC provides a variety of possible job titles in the occupational category. The titles relevant to building sciences include: building construction inspector, construction inspector, home inspector, housing construction inspector, plumbing inspector, and safety officer (construction).

74 "Construction Inspectors". Job Futures Quebec. <http://www.servicecanada.gc.ca/eng/qc/job_futures/statistics/2264.shtml>

75 Ibid.

76 Duties are taken directly from the HRSDC website. <http://www5.hrsdc.gc.ca/NOC/English/NOC/2006/QuickSearch.aspx?val65=2264>

Peer/Competitor Institution Offerings

In order to identify programs in Canada which are similar in purpose to the proposed Bachelor of Applied Technology (Building Science) at Algonquin College, we utilized a multi-pronged approach. First, a search engine investigation was used to locate related programs as well as relevant professional organizations and other industry groups. The other main tool which we utilized was the Association of Canadian Community Colleges programs database. Through our efforts, we identified six programs which would share similar characteristics to a proposed Building Science program at Algonquin. As mentioned previously, there do not seem to be any programs in Canada which are an exact match with what Algonquin is planning. As a result, we profile programs with a variety of levels ranging from certificates to four- year degree programs in a variety of specialties which share the same professional realm as building sciences.

For each profiled school, we provide brief descriptions of the program as well as required courses.

George Brown College[77]

Name of Program: Bachelor of Applied Technology Degree - Construction Science and Management
Duration: 8 Semesters

Description:

According to the program website of George College University, the construction industry employs almost three times as many Ontario workers as the automobile industry - about 400,000 people or about six percent of Ontario's total workforce.[78]

George Brown College boasts the only degree program in construction science and management in Ontario. As the name indicates, there is a shared focus in the program. A primary emphasis of the program is on the building and environmental sciences aspect of construction. The other focus of the curriculum is on project management. George Brown created the program in response to the progress that has been made in the construction industry in terms of specialization and complexity. The school believes that in the current construction landscape, there is strong demand for project managers with a strong foundation in construction science who also possess practical business and managerial skills, such as negotiation, organization, and interpersonal.

The program consists of eight semesters in total. In addition, each student is provided the opportunity to participate in a co-op summer semester following their sixth semester. The co-op provides the student with valuable hands-on work experience in a field relevant to their desired career.

77 "Bachelor of Applied Technology Degree - Construction Science and Management". George Brown College Website.
<http://www.georgebrown.ca/degrees/construction_science_main.aspx>

78 Ibid.

Required Courses:

The following selected courses represent a sampling of core courses, based on perceived pertinence to building sciences:[79]

- Science of Architecture
- Construction Technology I – Housing and Small Buildings
- Building Code Act and Regulations
- Construction Technology II – Materials and Geophysical Science
- Building Science I – Fundamentals
- Mechanics – Strength of Materials
- Zoning and Site Engineering
- Construction Science – Foundations and Structures
- Building Science II – Components and Separators
- Sustainable Development and the Environment
- Quantity Surveying and Estimating
- Construction Estimating – Pricing
- Mechanical and Electrical Services and Systems
- Construction Technology III – Industrial, Commercial, Institutional, Civil
- Plan Examination and Inspection
- Structural Systems Analysis (Engineering Reinforced Concrete)
- Construction Cost Control
- Environmental Science
- Integrated Data Management
- Environmental Protection Legislation
- Enforcement and Compliance
- Building and Site Assessment
- Innovation and Constructability
- Environmental Assessment and Planning

University of Toronto[80]

Name of Program: Certificate in Building Science
Duration: Six courses

Description:
The University of Toronto offers a certificate program in building science which consists of six individual courses. The program is designed to provide students with an understanding of how the different elements and components of a building come together as a whole entity, specific to its unique environment. This certificate is the only of its kind which is accredited by the Ontario Building Envelope Council (OBEC). Further, this certificate is a requirement for those seeking a Building Science Specialist of Ontario (BSSO) designation.

79 "Course Calendar." Bachelor of Applied Technology Degree – Construction Science and Management..
<http://www.georgebrown.ca/degrees/construction_science_study.aspx>

80" Certificate in Building Sciences." University of Toronto School of Continuing Studies Website.
<http://learn.utoronto.ca/bps/bs.htm>

Students cannot complete the certificate all at once. As a first step, they must take Building Science I. They are then eligible to take Building Science II, which is a prerequisite for the remaining three courses. The complete list is included below.[81]

Required Courses:

- Building Science I
  - This foundational course deals with the indoor and outdoor climates and the thermal envelope that separates them. Upon completion of Building Science I, the participant will be able to predict the transfer of heat and moisture through thermal envelopes and the interaction of these flows within the envelope materials. Emphasis in the course is on the understanding of the physics associated with relevant processes. Through the use of practical examples, this knowledge will be applied to both new construction as well as to modification of existing designs. The material presented will underscore the importance of improving building performance as we face the challenges of climate change and the decline in use of fossil-fuel energy.

- Building Science II
  - This course is a continuation of Building Science I and covers the management and movement of moisture in and around buildings, including rain management, moist air movement in buildings and the interaction of solar heating. Principles of life cycle costing will also be presented along with a capstone module which will highlight the principles of building science for both cold and hot climates. Building on the importance of efficient energy use introduced in Building Science I, participants will be presented with examples of responsible buildings practices so that they can design and build tomorrow's buildings today.

- Building Envelope Materials
  - This course examines the use of various materials used to construct and repair the building envelope. Beginning with the thermal insulation materials, this course looks at a variety of fibrous and rigid insulation products, their properties and their uses. Next, various air barrier materials and air sealing materials will be examined for both new and retrofit construction. Finally, materials and methods used to maintain and repair concrete slab structures such as balconies and parking garages will be examined. Illustrative case studies will be used throughout the course.

- Wall and Window Systems
  - Recognizing that the building envelope must function as a system, this course examines a range of window and wall systems and the interaction between these systems. The performance of assemblies including: solid masonry walls, cavity walls, EIFS, wood and precast concrete walls and curtain wall systems will be covered. Case studies will be used illustrate issues such as thermal and moisture performance, air leakage resistance, durability, maintenance, life cycle cost, fire safety, environmental impacts and the real life challenges of dealing with these systems as well as best practices currently used in industry. To facilitate the design of low energy buildings, passive solar strategies will also be outlined.

81 Ibid. Cited verbatim from website.

- HVAC Systems and the Building Envelope
  - This course deals with the interrelationship of the building envelope and environmental control with an emphasis on sustainable building practices. The course will examine thermal comfort and indoor air quality, heating, cooling and moisture regulation, air distribution and pressure regimes, energy usage, solar and internal gains, natural and hybrid ventilation. More "responsible" building practices will be identified and illustrated throughout.

- Roof Systems
  - This course deals with the design, application and maintenance of flat roofing systems. Special emphasis will be given to investigation of roofing failures, focusing on diagnostic techniques to aid in defining the necessary scope of repairs, and in predicting the probable performance and service life of the roofing system. Specific topics will include alternative roofing systems including green roofs, material selection, design and application considerations, historical perspectives, drainage and penetrations.

New Brunswick Community College – 2 Programs

Name of Program: Civil Engineering Technology: Building Systems[82]
Duration: 4 Semesters

The Building Systems of Civil Engineering Technology program at New Brunswick is designed to prepare students for employment as an engineering technologist. In the position students can expect to take part in the design, management, and field supervision of both electrical and mechanical projects for buildings. A curriculum covering electrical systems involving power, lighting, and data communication as well as mechanical systems which include thermal, air conditioning, water services and fire prevention, provides students with the tools to succeed in the field.

The program is separated into two segments, a first year and second year, each with specific curriculum. The first year is focused on the fundamentals of building engineering technology. In the second year, students take courses which develop their skills and knowledge base related to building systems. Students are presented with the opportunity to complete a work attachment allowing them to gain hands-on field training on building projects. Upon completion of the program, graduates are expected to have the ability to:

- Assist in the design of mechanical systems for residential and commercial buildings;
- Assist in the design of electrical systems for residential and commercial buildings;
- Produce professional quality drawings in the electrical and mechanical fields;
- Produce professional quality drawings in the architectural, structural, and industrial plant design fields.

82 "Civil Engineering Technology: Building Systems". New Brunswick Community College. <http://www.nbcc.nb.ca/programs/?view=program&id=2661>

Selected Areas of Study:

- Computer-Aided Design and Drafting
- Thermodynamics and HVAC Systems
- Plumbing, Piping, and Fire Control
- Building Electrical Systems
- Supervision/Safety
- Contract and Project Management
- Computers

Name of Program: Mechanical Engineering Technology: Buildings – Energy and Environment[83]
Duration: 4 Semesters

The Mechanical Engineering Technology: Energy and Environment diploma program prepares students for careers as mechanical engineering technologists. More specifically, technologists which specialize in energy and environment. Graduates of the program are trained to:

- Provide technical support and services in mechanical engineering fields.
- Design HVAC systems and controls.
- Maintain HVAC systems and controls; and
- Test HVAC systems and controls.

As with the other relevant program at New Brunswick, the first year curriculum provides students with a foundation in engineering technology. In this program, the second year is spent specializing in building energy and environment. The energy and environment program also offers co-op positions in the industry when available, which can last up to 12 months.

Selected Areas of Study:

- Thermodynamics (Energy Transfer and Refrigeration)
- HVAC Systems and Measurements
- Fluid Handling Systems - Hydraulics and Pneumatics
- Energy Management
- HVAC Controls
- Management
- Sciences
- Safety

Humber College Institute of Technology & Advanced Learning[84]

Name of Program: Sustainable Energy and Building Technology
Duration: 6 Semesters

Humber College offers a three-year program with a multidisciplinary approach. After completing the program, successful graduates have the tools to develop integrated solutions within the sustainable

83 "Mechanical Engineering Technology: Buildings - Energy and Environment ". New Brunswick Community College. <http://www.nbcc.nb.ca/programs/?view=program&id=2602>

84 "Sustainable Energy and Building Technologies". Humber College Website. <http://www.humber.ca/program/31551>

technologies sector. Within this sector, the program pays particular attention to energy efficiency and renewable energy.

Examples of specific skills taught through the curriculum include:

- Assessment of site characteristics and client needs;
- Ability to provide advice on renewable energy;
- Knowledge of building design and heating/cooling system alternatives;
- Ability to prove energy efficiency through energy audits and energy performance simulation;
- Understanding costs of energy systems; and
- Ability to select appropriate suppliers and contractors.

Selected Course requirements:

- The Energy Commons
- Architectural and Electrical Drawing
- Energy Metrics, Surveying and Analysis
- Electric Circuits
- AC Circuits
- Building Science and Thermodynamics
- Renewable Electricity Technologies
- Building Energy Loads
- Re and Green Building Policies and Programs
- Computer-Aided Design
- Sustainable Building Design
- Low Energy Building Systems
- Energy Auditing
- Energy Performance Simulation Software
- Energy Systems Integration and Programming
- Sustainable Resource Management
- Land Development Policies

British Columbia Institute of Technology[85]

Name of Program: Bachelor of Technology in Architectural Science
Duration: 8 Semesters

BCIT created a program in architectural science which bridges the gap between design theory and construction execution. It is a full four-year program delivering a broad foundation in the theoretical and applied facets of architectural science with a focus on being technically current. Upon completion, students will be trained to work as architectural technologists.

Selected course requirements:

- Architectural Foundation Studio
- Materials in Building
- Environmental Separators
- Tectonics Architecture and Design/Build
- Technical Language of Architecture

85 "Architectural Science: Bachelor of Technology". British Columbia Institute of Technology. <http://www.bcit.ca/study/programs/8050btech>

- Sustainable Design
- Building Envelope Performance
- Building Envelope Lab
- Systems Integration Studio
- Building Preservation Values

Project Evaluation Form

The Hanover Research Council is committed to providing a work product that meets or exceeds member expectations. In keeping with that goal, we would like to hear your opinions regarding our reports. Feedback is critically important and serves as the strongest mechanism by which we tailor our research to your organization. When you have had a chance to evaluate this report, please take a moment to fill out the following questionnaire.

http://www.hanoverresearch.com/evaluation/index.php

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Applicant Demand

As the Labour Market Analysis indicates a Bachelor of Building Science program does not have many comparable programs in the Province of Ontario that can be used to gauge applicant demand.

Review of Data for Comparable Programs

A degree program offered at George Brown, Bachelor of Applied Technology (Construction Science and Management), has some affinity with this program. Data collected from the Ontario College Application Service (OCAS) shows healthy registration and enrolment numbers from 2007 to 2009 with an increase of eleven student enrolments from 2008 to 2009 (See Figure 1: Summary of OCAS Data for George Brown's Bachelor of Applied Technology (Construction Science and Management)).

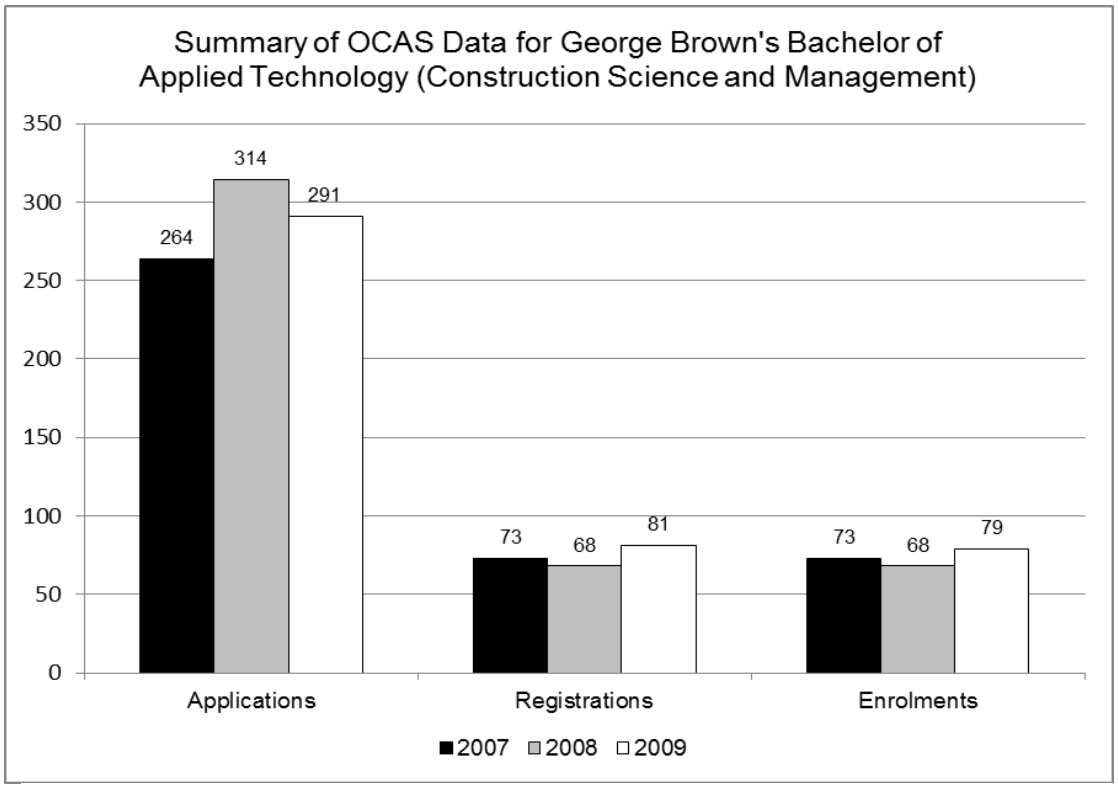

Figure 1: Summary of OCAS Data for George Brown's Bachelor of Applied Technology (Construction Science and Management)

Results of Feeder Surveys

In order to acquire more applicable data on applicant demand, feeder surveys were conducted with the five diploma-level programs at Algonquin that would be eligible for the degree completion arrangements.

In early fall of 2010, surveys were administered to students in core program courses in the following programs and levels:

- Architectural Technician, level 03,
- Architectural Technology, level 05,
- Construction Engineering Technician, level 03,
- Civil Engineering Technology, level 05,
- Mechanical Engineering Technology, level 03, and
- Mechanical Engineering Technology, level 05.

Based on the completed and returned surveys, the sample size was 207 students across the four programs. Consolidated results for four of the survey questions are captured below.

INTEREST IN CONTINUED POST-SECONDARY STUDIES

Respondents showed significant interest in continuing their post-secondary studies upon completion of their current program. (See Figure 2: Continuing Post-Secondary Studies in the Future – Question 4)

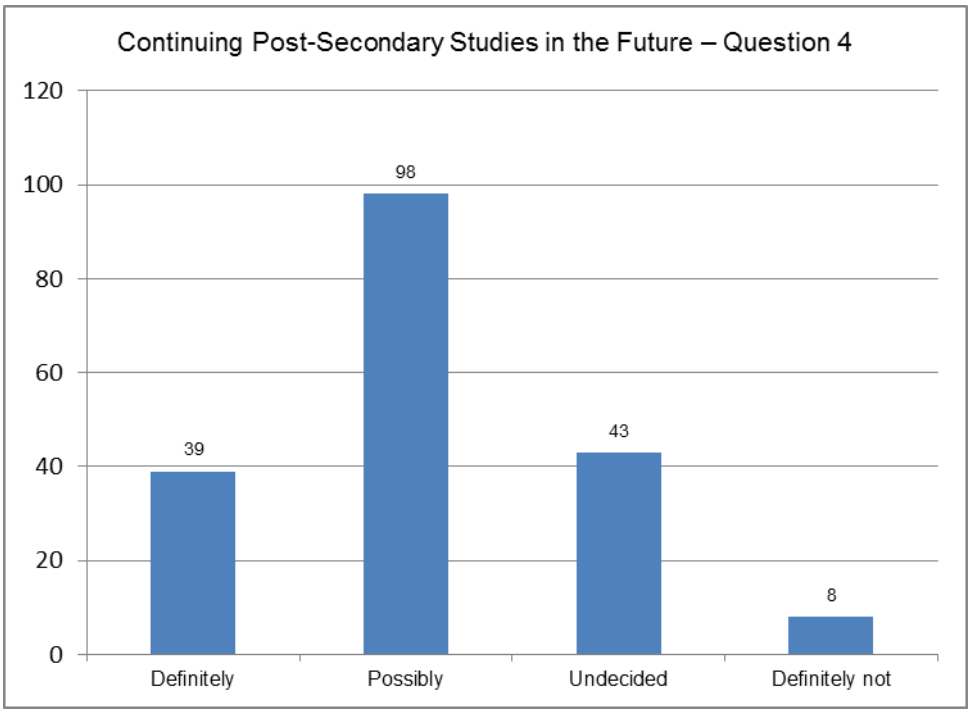

Figure 2: Continuing Post-Secondary Studies in the Future – Question 4

INTEREST IN THE BACHELOR OF BUILDING SCIENCE

Approximately 70% of the respondents expressed some level of interest in taking the Bachelor of Building Science program. (See Figure 3: Interest in Bachelor Building Science – Question 5)

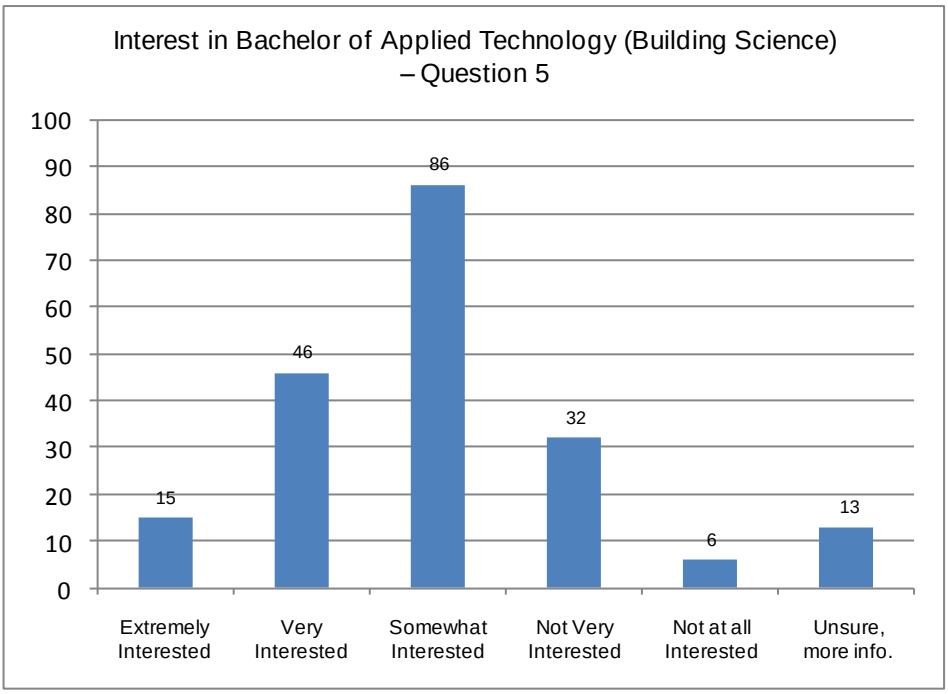

Figure 3: Interest in Bachelor of Building Science – Question 5

Consistent with the program title and description, the lowest level of interest in the program was from respondents in the Mechanical Engineering Technology. Within that group, only about 55% of the respondents had some level of interest in the program.

LAG TIME FOR POTENTIAL ENROLMENT IN BACHELOR OF BUILDING SCIENCE

In terms of program development and launch timelines, over 65% of respondents indicated that they would be willing to enrol in the program within the next three years. Moreover, at least a quarter of the respondents would be willing to enrol in the program "as soon as it is available." (See Figure 4: Lag Time for Potential Enrolment in Bachelor of Building Science – Question 6)

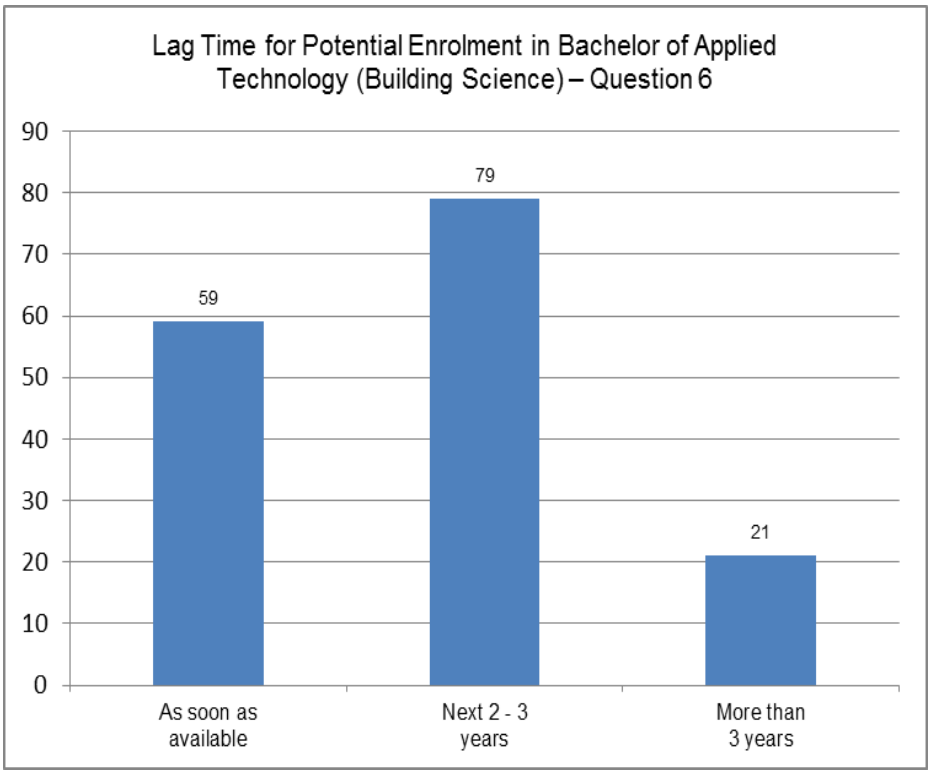

Figure 4: Lag Time for Potential Enrolment in Bachelor of Building Science – Question 6

PREFERENCE FOR BACHELOR OF BUILDING SCIENCE OVER EXISTING PROGRAM

Respondents were also asked if they would have chosen the Bachelor of Building Science over their current, if it had been available at the time they registered. Only a third of the respondents were emphatic about the fact that they would have chosen their current program. (See Figure 5: Preference for Bachelor of Building Science over Existing Program – Question 7)

The thirty-four respondents who would have chosen the Bachelor of Building Science translates into an almost full section for the program.

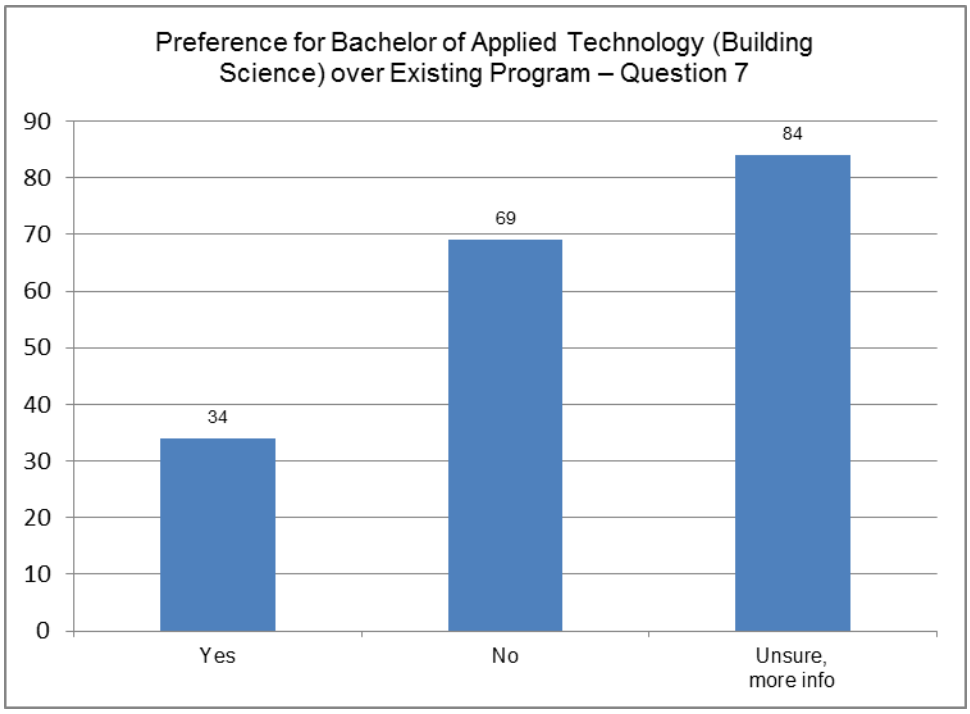

Figure 5: Preference for Bachelor of Building Science over Existing Program – Question 7

As a final note, the uncertainty among respondents related to the interest in the program (13 respondents) and preference for the program over their existing program (84 respondents) represents further applicants who could be attracted to the program once marketing initiatives begin.

Conclusion

The analysis of the applicant demand indicates that there is significant interest in the program among potential applicants, and that the interest is likely to translate into registrations that would allow the program to meet enrolment targets.

Employment Opportunities

The following job advertisings provide additional evidence of the economic need for this program. Employers (locally, provincially, nationally, and internationally) are seeking candidates for Building Science related positions. The table was developed between the 2nd and the 5th of March 2011 for current positions still open within that period.

These particular postings were selected because of the relevance of the proposed degree learning outcomes to the position. Some are very specific to the field (Building Science), but others reflect career mobility between specializations that apply to Building Science.

The following table summarizes a sample of job postings found on websites of companies offering building science services and on popular job search websites such as
http://www.workopolis.com/EN/Common/HomePage.aspx
http://jobs-emplois.gc.ca/
http://jobsearch.monster.ca/?WT.srch=1&WT.mc_n=olmsrchskca
http://regionalhelpwanted.com/ottawa-jobs
http://canadajobs.com/
http://www.jobbank.gc.ca/
http://www.jobshark.ca/caeng/index.cfm

Position and Organization	**Location**	**Job Descriptions** *(Summary)*	**Education Requirements**
Local Job Postings (Ottawa Ontario and surrounding area)			
New Graduate - Project Associate, Building Science, *Halsall Engineers, Consultants*	Ottawa, ON	Deliver building science and restoration services to clients. Perform construction and site reviews, monitoring quality control. Apply sustainable thinking to each project being delivered to clients.	Bachelor's degree in Civil/Structural Engineering, Building Science, Architectural Science or an Applied Science. LEED AP is an asset. 1-2 years of related work experience gained through summer work, co-op or internships.
Intermediate Engineer or Project Manager, Building Science, *Halsall Engineers, Consultants*	Ottawa, ON	Team responsible for the delivery of building design, restoration engineering and audit services. Investigation of building envelope failures and consultation on new construction	A Bachelor's degree in Civil/Structural Engineering or a Diploma in Architectural Tech.
Project Manager, *Halsall Engineers, Consultants*	Ottawa, ON	The incumbent will be responsible for managing restoration engineering and construction projects covering a range of building types. Conduct building investigations and field reviews to determine design and repair options	Post-secondary education in civil engineering, architecture or a construction-related discipline

Position and Organization	Location	Job Descriptions *(Summary)*	Education Requirements
Sustainability Specialist, *Morrison Harshfield*	Ottawa, ON	Prepare green building-related reports and presentations. Mentor and oversee staff coordinating the LEED certification process. Conduct LEED presentations & meetings, assist in workshop facilitation, and deliver other communication activities such as industry events and seminars. Develop technical tools and deliver internal training relating to green buildings and sustainability.	Bachelor's in Engineering, Architecture, Building Sciences or related studies LEED Accredited Professional
Project Manager *Flynn Canada Ltd*	Ottawa, ON	Confer with employees, inspectors and suppliers of tools and materials to resolve construction problems and improve construction methods Consult with project personnel to provide technical advice and to resolve issues.Engage in planning and executing work procedures; schedule, manage and maintain projects and budgets, interpret specifications, coordinate various phases of construction.	Education in a civil engineering / building science program or a related educational field Knowledge of Commercial Building Envelope
Commissioning Manager, *SNC-Lavin*	Ottawa, ON	Prepare commissioning budgets for project work. Define Commissioning requirements for projects and monitor contracted consultants to ensure compliance Review of specification documents and drawings including development of commissioning specifications and testing requirements. Verify site installations are in conformance with specifications and drawings. Coordinate start-up of equipment/systems. Review of O&M Manual and as-built drawings. Coordination of training for operational staff	Completion of High School with a specialised technical or business course/program Knowledge of HVAC, Control System Design, Mechanical & Electrical systems
Facility Manager, *SNC-Lavalin*	Ottawa, ON	Forecasting, planning, and identifying capital projects to maintain building assets and ensure ongoing reliability. Overseeing operation and maintenance of all electrical, mechanical, switchgear and Direct Digital Control (DDC) systems. Overseeing all operations of mechanical plants including HVAC systems, cooling towers, chillers, plumbing systems, package a/c units and pumps. Overseeing all preventative maintenance routines (PMRs). Identify energy reduction strategies and implement as permitted by client.	Possesses a University degree or College degree

Position and Organization	Location	Job Descriptions *(Summary)*	Education Requirements
Leader – Buildings, *NRCan*	Ottawa, ON	Experience in leading the proposing, development and implementation of complex technology development projects. Experience in the development or commercialization of energy projects related to commercial or multi-residential buildings. Experience in initiating and facilitating partnerships for advancing innovation in commercial or multi-residential buildings.	Graduation with a degree from a recognized university in an engineering specialty relevant to the duties of the position.
Project Manager, Roofing and Waterproofing *Dessau*	Ottawa, ON	Be responsible for all roofing and waterproofing jobs.	College diploma in civil engineering or equivalent;
Project Manager - Building Science, *Adecco*	Ottawa, ON	Conduct building investigations and field reviews to determine design and repair options. Prepare client proposals, building investigation reports and construction documents. Provide technical advice to clients and direct project teams (consultants and contractors).Manage the contract administration and quality of restoration projects at the construction.	Post-secondary education in civil engineering, architecture or a construction-related discipline
Building Systems coordinator, *PCL*	Ottawa, ON	Provides mechanical and electrical coordination for a project under supervision. They also assist other project team members in matters concerning building systems from a technical and administrative perspective. Experience in supporting superintendents, project managers and estimators in the areas of: site co-ordination, schedules, meetings and budgeting. Experience in commissioning between the mechanical, electrical and other building trade divisions. Familiarity with various building codes Knowledge of mechanical/electrical trades for adherence to drawings, specifications, quality, schedule, progress claims.	Must have post-secondary education in the field of engineering
Project Coordinator, *PCL*	Ottawa, ON	Responsible for assisting with overall project performance, including the management of costs, schedule, qualities and overall project status. Ability to reads blue prints. Estimating and quantity surveying experience. Ability to schedule and planning. Understanding of project forecasting. Shop drawing review Knowledge of construction contracts	Must have post-secondary education in the field of engineering.

Position and Organization	Location	Job Descriptions *(Summary)*	Education Requirements
Project Manager – Energy Solutions (Ottawa), *wwwork!com*	Ottawa, ON	Support the site investigation activity and provide cost estimates for initial cost/savings analysis of all potential energy conservation measures (ECMs) being considered. Draft a Project Plan in support of the validated / proposed ECM program. Create a detailed Critical Path Method (CPM) schedule and Gantt chart for the proposal, identifying all tasks and milestones from customer award through project implementation and final acceptance. Manage the project team by obtaining input, assigning tasks and tracking action items to ensure quality control and effectively constructing, commissioning and closing out projects on time while considering service phase responsibilities for long term operation and maintenance and energy savings measurement and verification.	Bachelor Degree in Mechanical Engineering, Electrical Engineer or Construction Management
Provincial Job Postings (Ontario, Canada)			
Junior Drafter/Technologist | Building Science & Restoration *Rjc Read Jones Christoffersen Consulting Engineers*	Toronto, ON	Drafting Duties: Including Co-ordinate RJC's drawings with those of other disciplines on projects. Engineer/Technologist Duties: Assist Project Engineers and Project Managers on the implementation of both building envelop and structural restoration projects during both the assessment and construction stages of the project. Building envelope projects, including evaluation and rehabilitation of cladding and roofing system.	Certificate in civil/structural/architectural drafting / technology from University, Technical college or institute
Junior Building Sciences Engineer / Technologist *The Engineering Search firm*	Toronto, ON	Preparation of performance audits and Warranty Tracking. Assess building envelopes such as exterior walls, windows and roofs. Preparation of plans and engineering specifications and supervision of repair work. Contract administration and project management services.	Post-secondary education in civil engineering, architecture or construction related discipline
Project Manager-Building Science-Mississauga-Restoration, *Randstad Engineering*	Toronto, ON	Project Management, Building Condition Assessment, Technical Audits Concrete Restoration Building Envelope . Business Development	

Position and Organization	Location	Job Descriptions *(Summary)*	Education Requirements
Junior Sustainability Specialist, *Morrison Hershfield*	Ontario	Project delivery tasks associated with LEED and green building projects. Performing LEED assessments. Tracking LEED credits. Communicating LEED requirements and obligations to other team members. Tracking LEED submittals.	Bachelor's in Engineering or Architecture, or Buidling / Construction related diploma, or related studies LEED Accredited Professional is mandatory
Energy Specialist, *SNC-Lavalin*	Toronto, ON	Identifying buildings requiring energy audits; Recommend energy measures (budget) for further analysis and/or implementation. Identify usage or cost anomalies of building energy profiles and areas for investigation. Tracking updates on available energy incentives and provide the SCUs assistance in making incentive applications. Tracking and reporting on innovative energy technologies as well as provide analysis on energy savings through use of tools such as CUSUM and other linear regression analysis. Use Enerprise One and related software for the production of POs. Acts as a general resource to management and field staff in regards to all aspects of energy management.	University or College degree in engineering discipline or equivalent education
Facility Assessment Engineers/Architect Technologists - Junior/Intermediate, *Stantec*	Ottawa, Mississauga, Markham and Kitchener, Ontario	The successful candidate(s) will be part of a project team, and under the direction of a project manager, will provide property condition assessments, report writing and capital planning services. The individual(s) must be capable of working independently to provide general evaluations of primary building system components, within a multi-discipline evaluation team.	Ideal candidates will have a related academic background that includes a university degree or college certificate in Mechanical, Electrical, Civil or Structural Engineering or Architecture Technology.
3-D Architectural CAD Technologist, *RWDI*	Guelph, Ontario	Creating electronic engineering test models from architectural drawings. Builds physical or electronic models and prototypes. Collaborates with the engineering team to problem solve modeling issues.	A high school diploma and/or college diploma in architectural or engineering technology. A high proficiency in computer applications, ideally with experience in SolidWorks, Rhino Software and/or 3D Studio, Revit and AutoCAD.
Project Manager, *Halsall Engineers, Consultants*	Toronto, Ontario	The incumbent will be responsible for managing building audit and capital planning projects covering a range of building types.	Post-secondary education in civil engineering, mechanical engineering, architecture or a construction-related discipline.

Position and Organization	Location	Job Descriptions *(Summary)*	Education Requirements
Administrator, Energy Tracking & Analysis *SNC-Lavin*	Etobicoke, Ontario	Responsible for entering into Helios (or new energy system EnergyCAP), energy and cost information pertaining to all energy commodities (i.e., electricity, natural gas, steam, oil, diesel, chilled water & water) at a significant level of detail. Responsible for utility bill verification and follow up resolution with vendors of discovered invoice errors. Responsible for preparing regular and adhoc energy consumption and cost analysis reports and submission to client. Periodic quality auditing of inputted energy data. Filing of utility invoices.	College diploma or equivalent experience.
Project Manager, *SNC-Lavalin*	London, ON	Develop project work plans and schedules, discuss project priorities with client, plan assigned program. Prepare cost estimates and budgets. Ensure the governance standards and project methodology are adhered to throughout the project life cycle.	Post secondary certification in Engineering, Architecture, or Project Management. Technical knowledge of construction methods, building systems and terminology.
Project Procurement Manager *SNC-Lavalin*	Toronto, ON	Manage procurement functions on large domestic and international projects (billion +) encompassing purchasing, contracts and materials controls activities. Administer project procurement budgets.	Post secondary degree
Virtual Design and Construction Manager *EllisDon*	Mississauga, ON	Reports directly to the Director of BIM services and is responsible to manage the tendering and/or in-house production of Building. Information Models, developing proposal material.	
CADD Technician Infrastructure *Aecon Buildings Ottawa*	London, ON	The incumbent will be responsible for all facets of design drafting for our existing and perspective Utility clients. Completion of design drawings, quantity calculations and as-built drawings for various types of utility projects. Assisting in field surveys using total station or GPS. Previous survey experience shall be considered an asset. Complete detailed piping system design using a 3D drafting package. Assist in the preparation of schedules, estimates and construction packages.	Post secondary education in Civil or Mechanical Engineering (or equivalent)
Engineer In. Training Infrastructure Toronto, Ontario, *Aecon Buildings*	Toronto, ON	Responsible for all facets of design for our existing and perspective Utility clients.	Bachelor's Degree in Civil or Mechanical Engineering (or equivalent).

Position and Organization	Location	Job Descriptions *(Summary)*	Education Requirements
Senior Building Science Engineer/ Architect, *GRG Building Consultants*	Ontario	Conduct review of repair work on existing buildings and assist in administration of contracts for repair. Have demonstrated team management capability	P.Eng. OAA, BSSO
Junior - Intermediate Technologist / Field Engineer *GRG Building Consultants*	Ontario	Conduct review of repair work on existing buildings and assist in administration of contracts for repair. Are able to work with a minimum of supervision	Have C.E.T., B.Arch. Sci., EIT
Senior Building Science Engineer, *Express employment professionals*	Burlington, Hamilton, Niagara, Oakville, ON	Providing the full envelope of consulting within the Building Science Engineering discipline. This includes but is not limited to; sealant performance, roofing, balconies and walls. Preparing and presenting technical reports. Experience with federal and provincial codes and accepted practices.	Bachelor's Degree in Engineering
Building Science / Property Condition Assessment, Junior / Intermediate Position *Golder Associates' GTA*	Whitby, ON	Perform field assessments Reports address structural, mechanical, electrical, envelope, roofs, conveyance, fire/life/safety, architectural aspects of all types of commercial real estate projects. Recognize building system defects, signs of deterioration mechanisms and evaluate upcoming capital expenditure items, provide replacement reserve schedules for building systems and cosmetic components of properties including foundations, structural elements, walls, roofing, interior finishes, mechanical and electrical equipment, fire-life safety systems, elevators, pavement and drainage. Review/repair improvement costs incurred by tenants/ownership along with the following documents (if available): maintenance reports and logs, elevator safety inspection reports, building and fire department inspection reports, current certificates for elevators, and fire, life safety systems and warranty information.	Degree or Diploma in Architecture, Engineering, Building Science or related field preferred.
Building Science Engineering Graduate, *Morrison Hershfield*	Ontario	Building envelope design and condition assessments for clients with both high-rise and low-rise buildings. Testing procedures and long term monitoring and development of remedial measures to correct building performance problems including a string emphasis on the interaction of the building and mechanical systems. Assists to interpret results using relevant software applications. Analysis and interpretation of heat, air and moisture flow through building envelope systems.	Civil or Mechanical Engineering Degree.

Position and Organization	Location	Job Descriptions *(Summary)*	Education Requirements
Building Science Specialist - Project Manager *Conestoga Personnel*	Toronto, ON	Accountable for the completion and delivery of building science projects, audits and studies. Provide technical building science expertise to engineering teams throughout completion of projects. Prepare project proposals, investigative reports, engineering specifications and technical information.	Post secondary education in civil engineering, architecture, construction or associated discipline
Building Science Engineer *Adecco*	Toronto, ON	Performing building evaluation and reserve funds studies. Providing strategic and technical input on capital planning projects. Performing property condition assessments. Conducting building investigations and field reviews to determine design and repair options. Preparing project proposals, investigation reports, and engineering specifications.	Degree in Civil/Structural Engineering or a Diploma in Architectural Technology
National Job Postings (Canada)			
New Graduate - Project Associate, Building Science, *Halsall Engineers, Consultants*	Calgary, AB	Deliver building science and restoration services to clients. Perform construction and site reviews, monitoring quality control. Apply sustainable thinking to each project being delivered to clients	Bachelor's degree in Civil/Structural Engineering, Building Science , Architectural Science or an Applied Science. LEED AP is an asset. 1-2 years of related work experience gained through summer work, co-op or internships
Project Associate - Restoration Engineering, *Halsall Engineers, Consultants*	Calgary, AB	Successful hires will perform building investigations, develop engineering solutions and supervise construction related activities. Deliver building science and restoration services to clients. Participate in building investigations and contribute to technical reports. Perform construction and site review, monitoring quality control	Bachelor's degree in Civil/Structural Engineering,, Building Science , Architectural Science or an Applied Science 1-2 years of related work experience gained through summer work, co-op or internships
Project Manager, *Kolostat mechanical contractor*	Montreal, QC	Experience in piping, plumbing and the hvac field, the ability to design hvac systems.	Mechanical engineering degree in building systems or Cegep graduate with degree in building systems
Building Science Technologist *Morrison Hershfield*	Vancouver, BC	Assist the engineering staff in the preparation and review of designs, design drawings, contract documents, and engineering specifications for engineering work. Perform engineering calculations (e.g., quantities, initiating or checking design elements).Assist engineering staff in carrying out field investigation work and the diagnosis of building problems required to design building envelope/ structural repairs.	A graduate of BCIT' Architectural and Building Technology program within the Building Science option. Knowledge in areas related to building science such thermodynamics, heat transfer, pyschrometrics

Position and Organization	Location	Job Descriptions *(Summary)*	Education Requirements
Maintenance Manager, *SNC-Lavalin*	Halifax, NS	Overseeing a portion of the energy management plan for the Portfolio related to the buildings managed. Preparing Building Performance Reviews and update annually as required including the LSSCT forms and firefighter cop reports Conducting annual property inspections to ensure proper operations and reliability of equipment and building components and participating in inspections conducted by various authorities (Fire Dept, Labour Canada, PWGSC audits etc) Budgeting, forecasting and reporting of all project relating to the portfolio as well as operating expenses, including expense participation and annual tenant reconciliation.	Post secondary diploma or degree in a related field and a trades certificate in HVAC, mechanical or electrical
Operations Manager, *SNC-Lavalin*	Halifax, NS	Overseeing all preventative maintenance routines, work orders and the CMMS program via Shared Services. Overseeing a portion of the energy management plan for the Portfolio. Managing all aspects of risk management and environmental compliance as per contractual obligations. Participate and oversight for Quality Management Program (ISO). Ensures inspections are conducted by various authorities (Fire Department, Labour Canada, PWGSC audits, Safety, Risk Management, Environmental, etc).	Hold a related professional designation (CPM, RPA, CFM, FMA) or post secondary school diploma or degree
Quality Control Inspector, *SNC-Lavalin*	Fredericton, NB	Work in collaboration with the laboratory. Interpret test results for acceptance of work. Liaise with construction crews, subcontractors and customer representatives on-site and obtain the necessary permits and certificates. Ensure proper calibration of measuring and testing equipment used for quality control.	Civil engineering technician or junior civil engineer or Civil Engineering Intern
Concepteurs en mécanique du bâtiment, (Building Systems Designers) *SNC-Lavalin*	Montreal, QC	Sector of Activity: Infrastructure & Buildings Job Family: Design, Engineering, Technical Engineering. Discipline: Building Services/HVAC. Design systems such as: Breakdown complex humidification and dehumidification. Perform and / or coordinate calculations related to the discipline. Estimate the costs associated with the cycle of life, including those of maintenance and operation. Provide technical assistance during construction.	Bachelor or DEC specializes in building mechanics. Knowledge of REVIT is an asset

Position and Organization	Location	Job Descriptions *(Summary)*	Education Requirements
Energy Advisor, *SNC-Lavalin*	Montreal, QC	Applicant will help market the program and manage energy efficiency projects within a context of sustainable development. The program targets the commercial and institutional sectors. Provide support for the modelling of financial calculation rules associated with the program	Bachelor's degree or college diploma (DEC) in mechanical or electrical engineering with a building related specialization Knowledge of DOE2.1, eQuest or EE4 software programs
Building Technician IV, *SNC-Lavalin*	Montreal, QC	Ensuring that electrical, mechanical and environmental systems, which include, but are not limited to, heating, ventilation and air-conditioning systems, plumbing, large cooling equipment, electricity and lighting distribution systems as well as water processing systems, operate effectively	College graduation or professional diploma in instrumentation and controls, building engineering and/or physical technology.
Facility Manager *SNC-Lavalin*	Edmonton, AB	Management of environmental and energy initiatives. Mid and long-term asset management planning. Management of key performance indicator (KPI) expectations. Management of life safety requirements and management of quality requirements, as well as creation of and management of the O&M budget.	A Post-Secondary diploma or degree in Facility Management, Building Sciences or a BPMA and/or IFMA designation preferred
Energy Manager, *SNC-Lavalin*	Montréal, QC	Implementation and upkeep of a portfolio-wide Energy Management Plan (EMP). Utility information management, analysis, budgeting and report generation as well as performance tracking of energy reduction measures. Identify buildings requiring energy audits.Recommend to Facility Managers which energy measures should be included in their budget for further analysis and/or implementation.	University or College degree in engineering discipline or equivalent education
Commissioning Manager II, *SNC-Lavalin*	Montréal, QC	Review project load and assignment of Commissioning Managers. Prepare commissioning budgets for project work. Define Commissioning requirements for projects and monitor contracted consultants to ensure compliance. Review of specification documents and drawings including development of commissioning specifications and testing requirements. Verify site installations are in conformance with specifications and drawings. Coordinate start-up of equipments/systems. Review of O&M Manual and as-builds' drawings.	Community college diploma or equivalent training is an asset. University graduation or professional certification (e.g. CET, P.Eng. or equivalent of technical years of experience) is an asset.

Position and Organization	Location	Job Descriptions *(Summary)*	Education Requirements
Jr. Spooler/Draftsperson (New Grad), *Aecon Buildings*	Alberta	Responsible for production of shop fabrication drawings are as per client specifications, codes and Aecon Lockerbie shop fabrication standards using software such as Spoolgen, AutoCAD and Acorn	
Project Manager *Ian Martin Limited/The 500 Staffing Inc.*	Winnipeg	Responsible for all phases of green building design, construction and certification to the LEED Canada Green Building Rating System Lead integrated design workshops and develop innovative solutions to reduce the environmental impact of new and existing buildings Minimize utility costs for building owners and operators through detailed building energy simulations.	Degree in Mechanical Engineering
Building Envelope Engineer – EIT, *Levelton*	BC	Field conformance reviews of buildings under construction. Gather field data to assess existing building envelope conditions. Document field data in corporate format. Prepare field review reports	Undergraduate degree in Civil Engineering or Mechanical Engineering with courses in building envelope design
Building Science Professional / Project Manager, *MountainCrest Personnel Inc.*	BC	Theoretical design and field experience of the building envelope, encompasses window wall, curtain wall, commercial panelized systems, stucco, cementicious and wood siding, as well as roofing for all types of buildings including wood, steel, and concrete-framed structures. Hygrothermal modeling, air barrier testing, water penetration testing of windows, field review reports building condition assessments, due diligence reports, and reserve fund studies. Ensuring projects meet production requirements/deliverables. Focus lies on: project and contract management, business development, preparing proposals, opinion of probable costs (OPC); creating and administering consulting and construction contracts, litigation support/expert advice, design review and development.	Engineering or architectural degree from an accredited Canadian university.
International Job Postings			
Directeur(trice) Activités Commissioning (Commissioning Activities Director) *SNC-Lavalin*	Lyon, Fr	Sector of Activity : Infrastructure & Buildings Construction Engineering Operations and Maintenance. Be responsible technically and financially Commissioning Activities: Organizing and Development Activities; Supervise the tasks related to activities; Make and maintain a Business Plan.	Trained Engineer
Projeteur Bâtiment (Building designer) *SNC-Lavalin*	Illkirch, France	Sector of Activity : Infrastructure & Buildings Construction Design and drafting. Reporting to the Project Manager, you support the installation of building permits and bids. Realize different plans and design-related written materials,participate in monitoring progress of projects.	Hold a BA + 2 (BTS / DUT) Civil Engineering

Position and Organization	Location	Job Descriptions *(Summary)*	Education Requirements
Construction Manager, *SNC-Lavalin*	Jakarta, Indonesia	Planning and supervising the design, procurement and construction of the temporary site installations and services required for the proper execution of the work and the management of a safe site; Preparing the manpower planning and budget of hours for the construction management team.	Relevant tertiary qualifications
Commissioning Engineer, *Peter Kiewit sons*	Colorado, USA	Develop project commissioning plans, coordinate pre-functional and function performance testing of HVACR and other primary building systems, and collects building system information for turnover documentation to the client. KBG Cx Engineers also provide Energy Auditing, Facility Assessments, and Existing Building Commissioning services directly to customers	Bachelor's Degree in Mechanical, Electrical or Construction Engineering related curriculum
Project Manager/ Designer *Peter Kiewit sons*	Davenport, USA	Detailing of shop drawings, field engineering, operation planning, project scheduling, quantity tracking, material procurement, contract administration, estimating and supervision of field activities	Undergraduate degree in engineering, construction management or related degree, or equivalent experience in a construction related position.
Building Envelope Field Technician *ECS*	Maryland, USA	Conduct field observations of building envelope components including: roofing, masonry/flashings, EIFS, waterproofing and window assemblies for medium-to-large scale commercial projects in the greater Washington.	High School/GED diploma or college degree desired
Building Envelope Engineer/Project Manager, *ECS*	Virginia, USA	Perform condition assessments and field observations, analysis and retrofit designs of building envelope components including: roofing, masonry/flashings, EIFS, waterproofing, and curtain wall and window assemblies for medium-to-large scale commercial projects in the greater Washington.	BS Civil Engineering or Architecture required.
Building Envelope Consultant, *Integrity Technical Services*	Illinois, USA	Experience with building envelope design, consulting, specification preparation and construction administration.	Bachelor of Science degree in engineering, construction, architecture or similar.

Position and Organization	Location	Job Descriptions *(Summary)*	Education Requirements
Group Director, Energy Management, *Esquel Group*	Hong Kong	Lead the energy management function by developing and reviewing projects including energy auditing, energy modeling, renewable energy and energy efficiency. Perform a variety of work involving development of technical guidance, design/planning of projects and programs eliminating obstacles which could impede success of energy management initiatives. Use creativity and objectivity to perform studies and technical activities to assist operating units to develop cost effective and reliable technical solutions related to energy management. Outreach to educate and engage operating units in energy efficiency and sustainable development. Support procurement and construction phases of projects related to energy management.	Graduate degree preferred in engineering, building services, energy management or environmental sciences.

Section 14: Duplication

The material presented in this section addresses the Board's standards and benchmarks for Duplication. The proposed Bachelor of Building Science program, with its focus on applied knowledge, has been developed as a parallel educational path to programs offered at Ontario Universities, not as a duplication of existing educational opportunities. In addition, the structure of the program enables students who have studied at an Ontario college to pursue further educational prospects through the degree completion arrangements that are proposed.

This proposed Bachelor of Building Science program

1. surpasses the standards of related diploma programs,
2. is related to, but sufficiently different from, existing degree programs offered at Ontario universities, and
3. meets a need, by virtue of the preceding two facts, that is not adequately addressed by other post secondary programs in Ontario.

Section 14.1: Analysis of Similar College Programs

Based on research conducted during the initial stages of program development, nine programs offered at Ontario colleges are considered similar to this proposed Bachelor of Building Science program. Where Provincial Program Standards, published by the Ministry of Training, Colleges, and Universities, exist, these are used as the basis for comparison. As such, the analysis in the table below (see Table 14.1: Comparison of Bachelor of Building Science program to Similar College Programs) looks at both common programs offered at a number of Ontario colleges, and at related programs that are unique to specific colleges.

Table 14.1: Comparison of Bachelor of Building Science Program to Similar College Programs

College Program (Credential)	Similarities	Differences	Analysis
Architectural Technician ***Various Colleges in Ontario*** (Ontario College Diploma)	• Participation in building design phase • Review of legal requirements and building code • Integration of technology for the completion of work	• Intense focus on working drawings and Computer-Aided Design (CAD) • Minimal focus on assessment of building systems and building lifecycle • Depth of technical competence in the specific content takes precedence over the development of autonomy or professional leadership skills.	This program provides a level of foundational knowledge, skills and attitudes that are related to the proposed Bachelor of Building Science program. The relationship between the two credentials is recognized in the proposed degree completion arrangements (See Section 4.10 Gap Analysis). Graduates of Architectural Technician are able to achieve a greater depth and breadth of knowledge should they choose to enroll in the proposed Bachelor of Building Science program.

College Program (Credential)	Similarities	Differences	Analysis
Architectural Technology ***Various Colleges in Ontario*** (Ontario College Advanced Diploma)	• Work with sustainable design and building practices. • Some attention to the principles of building science. • Review of legal requirements and building code • Introduction to project management for construction.	• More depth on building design phase for a variety of applications and purposes. • Heavier focus on Computer-Aided Design (CAD) tools and working drawings. • Focus and approach to scholarship and professional autonomy does not match degree-level learning.	This program provides a level of foundational knowledge, skills and attitudes that are related to the proposed Bachelor of Building Science. The relationship between the two credentials is recognized in the proposed degree completion arrangements (See Section 4.10 Gap Analysis). Graduates of Architectural Technology are able to achieve a greater depth and breadth of knowledge should they choose to enroll in the proposed Bachelor of Building Science program.
Construction Engineering Technician ***Various Colleges in Ontario*** (Ontario College Diploma)	• Consideration of building materials and components. • Review of legal requirements and building code. • Integration of technology for the completion of work	• Intense focus on construction site activities and requirements. • Little or no consideration of the design phase. • Depth of technical competence in the specific content takes precedence over the development of autonomy or professional leadership skills.	This program provides a level of foundational knowledge, skills and attitudes that are related to the proposed Bachelor of Building Science program. The relationship between the two credentials is recognized in the proposed degree completion arrangements (See Section 4.10 Gap Analysis). Graduates of Construction Engineering Technician are able to achieve a greater depth and breadth of knowledge should they choose to enroll in the proposed Bachelor of Building Science program.

College Program (Credential)	Similarities	Differences	Analysis
Civil Engineering Technology ***Various Colleges in Ontario*** (Ontario College Advanced Diploma)	• Collection and analysis of data related to construction materials and methods • Review of legal requirements and building code • Introduction to project management for construction	• Broader consideration of construction work, including transportation and infrastructure applications. • More depth on construction site supervision and management. • Focus and approach to scholarship and professional autonomy does not match degree-level learning.	This program provides a level of foundational knowledge, skills and attitudes that are related to the proposed Bachelor of Building Science program. The relationship between the two credentials is recognized in the proposed degree completion arrangements (See Section 4.10 Gap Analysis). Graduates of Civil Engineering Technology are able to achieve a greater depth and breadth of knowledge should they choose to enroll in the proposed Bachelor of Building Science program.
Mechanical Engineering Technology ***Various Colleges in Ontario*** (Ontario College Advanced Diploma)	• Application of scientific and engineering principles for assessing and solving problems • Awareness of the role of specifications and standards in design-build situations • Introduction to engineering project management	• Little or no content related to building construction • Stronger focus on mechanical systems and manufacturing • Focus and approach to scholarship and professional autonomy does not match degree-level learning.	This program provides a level of foundational knowledge, skills and attitudes that are related to the proposed Bachelor of Building Science program. The relationship between the two credentials is recognized in the proposed degree completion arrangements (See Section 4.10 Gap Analysis). Graduates of Mechanical Engineering Technology are able to achieve a greater depth and breadth of knowledge should they choose to enroll in the proposed Bachelor of Building Science program.

College Program (Credential)	Similarities	Differences	Analysis
Building Systems Engineering Technician ***Seneca College*** (Ontario College Diploma)	• Consideration of energy efficiency and renewable energy • Use of software tools • Co-op option is available	• Intense, almost exclusive focus on building systems • No discrete content related to building construction • Depth of technical competence in the specific content takes precedence over the development of autonomy or professional leadership skills	The focus of this program is on energy and energy systems as a controllable variable in strategic business planning. The proposed Bachelor of Building Science program incorporates this concept and expands beyond it to include the entire building as a contributor in strategic management decisions.
Energy Management and Sustainable Building Technology ***Durham College*** (Ontario College Advanced Diploma)	• Consideration of energy and energy management • Examination of sustainable and clean energy technologies • Integration of IT and software tools for analysis of performance	• Less focus on building construction • Greater emphasis on energy systems manufacturing • Focus and approach to scholarship and professional autonomy does not match degree-level learning.	This program prepares graduates for energy management work in a variety of settings that typically involve existing buildings. As a result, it is conceivable that graduates of this program will have a role in part of the building project, but graduates of the proposed Bachelor of Building Science program will be involved in the project from start to finish.
Mechanical Engineering Technology – Building Sciences ***Seneca College*** (Ontario College Advanced Diploma)	• Consideration of energy sources and energy use • Examination of sustainable principles and practices • Co-op option is available	• Less focus on building design and construction • Stronger focus on the operation and maintenance of existing buildings • Focus and approach to scholarship and professional autonomy does not match degree-level learning.	The differences between this program and the proposed Bachelor of Building Science program are substantial as evidenced by the fact that graduates from the proposed degree hand the completed building and its documentation over to graduates of this program for ongoing operation and maintenance.

College Program (Credential)	Similarities	Differences	Analysis
Sustainable Energy and Building Technology ***Humber College*** (Ontario College Advanced Diploma)	• Common focus on energy and sustainability • Co-op option is available • Related to building construction	• Less focus on the whole building and its construction • Stronger focus on energy policy issues • Focus and approach to scholarship and professional autonomy does not match degree-level learning.	Entry level positions for graduates of this program are unlikely to overlap with employment opportunities for graduates of the proposed degree program. Graduates from the proposed Bachelor of Building Science program are likely to contract services or products from graduates of this program.
Bachelor of Applied Technology – Construction Science and Management ***George Brown College*** (Bachelor's Degree)	• Related to building construction • Offers degree-level learning • There is a mandatory co-op	• Stronger construction management focus • Little or no content related to energy and energy management • Less focus on the building and its components	The content focus and employment opportunities for graduates are distinct from those for the proposed Bachelor of Building Science program. Both programs address necessary, but different, specializations in the industry.

The proposed Bachelor of Building Science program fits within the array of programs offered at Ontario colleges. The nature of the construction-related programs allows for degree-completion arrangements for students who wish to develop themselves further in preparation for employment opportunities that are not available to graduates of diploma programs. Furthermore, the proposed degree is complementary to the existing degree offered at George Brown. As such, both students and employers benefit from the availability of programs that address the evolving requirements for employment in the construction industry.

Section 14.2: Analysis of Similar Ontario University Programs

Based on a review of the Ontario Universities' Application Center program listing for secondary school students and other undergraduate applicants, the five most similar or related programs have been identified. The following table (see Table 14.2: Comparison of Bachelor of Building Science Program to Similar University Programs) provides an analysis of the similarities and differences that exist between the proposed program and the indentified related programs.

Table 14.2: Comparison of Bachelor of Building Science Program to Similar University Programs

University Program	Similarities	Differences	Analysis
Architectural Science ***Ryerson University***	• Includes an examination of sustainability along with construction materials • Focus on the building as an entity with component systems that interact for comfort and performance • Integration of tools and technology through hands-on learning • Includes capstone project	• Common core courses place more emphasis on architectural design • Less focus on energy and energy efficiency • Three streams for specialization	While there are a number of similarities between this program and the proposed Bachelor of Building Science program, the additional content related to energy, energy efficiency and building construction provides graduates of the proposed degree with a greater breadth of employment opportunities. Graduates will have the knowledge and skills to address issues of constructability and building performance on a client's behalf during the design phase.
Engineering – Architectural Conservation and Sustainability ***Carleton University***	• Strong basis in scientific and engineering principles for construction applications • Consideration of sustainability and green building design • Structural stream examines construction applications • Has a co-op option • Includes capstone project	• Heavier focus on design and theoretical perspectives to construction and sustainability • Environmental stream focuses on broader infrastructure applications beyond their role in a specific building • Two streams for specialization	Students registered in this program choose one of two streams to complete their studies. As such they achieve depth of knowledge at the expense of breadth of knowledge. The proposed Bachelor of Building Science program uses an integrated, applied approach to balance the depth and breadth of knowledge, allowing graduates access to a wider array of employment opportunities.

University Program	Similarities	Differences	Analysis
Engineering – Sustainable and Renewable Energy ***Carleton University***	• Strong basis in scientific and engineering principles • Consideration of energy and related issues of sustainability • Offers co-op option • Includes capstone project	• Greater focus on broader energy issues as they affect the grid rather than a specific building • Little or no content related to building science and building construction • Two streams of study for specialization	The shared interest in sustainable and renewable energy suggests an affinity between this program and the proposed Bachelor of Building Science. Deeper review, however, reveals a necessary parallelism rather than an overlap. This program, Sustainable and Renewable Energy Engineering, with its two streams, addresses the development and improvement of energy production and distribution, whereas the proposed Bachelor of Building Science program examines the building as a closed system that can be designed, built, and operated to optimize available resources and energy consumption.

University Program	Similarities	Differences	Analysis
Civil Engineering and Computer Technology ***University of Ottawa***	• Considerable examination of scientific and engineering principles for construction applications • Integration of technology as a tool for modeling and simulation • Co-op option is available • Includes capstone project	• Very little focus on energy and energy efficiency • Core courses have a greater focus on environmental and infrastructure content • Very little content related to business principles or management • Opportunity for specialization	The knowledge base of the Civil Engineer reaches beyond the notion of the building as a system and considers the urban environment as an interconnected system with infrastructure and transportation requirements that need to mesh seamlessly. Graduates of the proposed Bachelor of Building Science program develop the depth and breadth of their knowledge through a focus on buildings and the intricate relationship between cost and performance, with a view to controlling and managing that relationship to the benefit of building owners.

University Program	Similarities	Differences	Analysis
Civil Engineering (Co-op Only) ***University of Waterloo***	• Strong basis in scientific and engineering principles for construction applications • Integration of IT and simulation tools • There is mandatory co-op • Includes capstone project	• More depth in mathematics and theoretical physics • Focus on infrastructure applications • Less focus on building systems and energy efficiency • Multiple options for specialization	The available options for specialization in this program demonstrate the diversity of opportunities within the discipline of Civil Engineering. Although one specialization considers construction applications, the approach is much more structural in its focus. Graduates of the proposed Bachelor of Building Science program spend more time on construction applications and develop a deeper sense of the various systems that are brought together to create a functional building that addresses the needs of the client/owner for use and performance under a variety of conditions.

Like the five Ontario university programs selected for comparison and analysis, the proposed Bachelor of Building Science program meets the needs of students and employers. It is, however, different from programs offered at Ontario universities. With its focus on the building as a system of parts that can be studied and improved, the proposed Bachelor of Building Science program distinguishes itself from Civil Engineering programs. Moreover, considerable content related to energy and energy efficiency provides an additional level of knowledge and skills that differentiates the proposed Bachelor of Building Science program from other potentially similar degrees with a heavier affinity for architectural design side of the construction industry.

Conclusion

Based on the review and analysis that has been completed, the proposed Bachelor of Building Science program satisfies the Board's requirement for non-duplication of programs. The development of the proposed degree has ensured that the program

1. surpasses the standards of related diploma programs,
2. is related to, but sufficiently different from, existing degree programs offered at Ontario universities, and
3. meets a need, by virtue of the preceding two facts, that is not adequately addressed by other postsecondary programs in Ontario.

Similarities between related programs offered in Ontario would enable student mobility through the opportunity for the recognition of prior learning, and, equally as important, the differences between the proposed Bachelor of Building Science program and the other related programs provide employers with graduates who possess the knowledge, skills, and attitudes to make meaningful and lasting contributions within the evolving construction industry. This includes contributions in the context of technological advancements within the industry. There is a growing demand for the use of information technology tools for building design and energy modeling. The proposed Bachelor of Building Science program differs, then, from other programs in that it looks to maintain an efficient harmony between building construction, management and design within a framework of energy utilization, efficient management, conservation and options for green generation. This whole project perspective requires a balanced engagement with the building envelope, the building systems, and sustainability.