Questionnaire for Evaluation of an Engineering Program

Submitted by:

Queen's University
Name of Higher Education Institution

Civil Engineering
Program name

26 October 2011
Date

Canadian Engineering Accreditation Board
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Questionnaire update: 26-Oct-11

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Preamble

Curriculum Content Tables

All curriculum content tables in this questionnaire response have been completed with reference to the 2010/2011 academic year.

Most tables in the questionnaire concerning curriculum content have been generated from a master CEAB database which contains the information about all courses offered in the program. Changes to the assigned AU content, “qualified” nature of content, instructor qualifications and so on made to the database can automatically be propagated through all the curriculum content tables.

The automated tables include Tables 5.5 a, b, c, d and e, Tables 3.3.3.1 and 3.3.3.2, Tables 3.3.4a and 3.3.4b, Table 3.3.5.1 and Tables 5.1a and 5.1b.

For courses in which special circumstances justify the inclusion of “qualified” ES or ED units a note accompanies the Table in this questionnaire and is also included in the master database.

Student Assessment

In May 2011 the university introduced a new student records system called SOLUS and, in the process, changed student assessment from being based upon a percentage grade and weighted average to being based upon a grade point (GP) and grade point average (GPA).

As a consequence of this university wide change, the regulations of the Faculty of Engineering and Applied Science were significantly revised and the revisions became effective on May 1, 2011. The new regulations are designed to retain the overall structure and pedagogical philosophy of the previous regulations but are based upon a GPA assessment rather than a % mark assessment.

The new regulations introduce a formal “probationary” status for students in all programs. Students with a cumulative GPA less than that required to graduate are required to follow a special program which forces them to increase their cumulative GPA or be required to withdraw from the program.

Students graduating in 2011 do so under the old faculty regulations and all responses within this questionnaire are based upon those regulations. Appendix A contains the new regulations, for reference.

1. General information regarding the higher education institution and the program

Name and postal address of the higher education institution

Queen's University, Kingston Ontario K7L 3N6

Name and title of the chief executive officer of the higher education institution

Dr. Daniel Woolf, Principal and Vice-Chancellor

Name, title and mailing address of the dean (or equivalent)

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Person responsible for organizing the visit

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Person responsible for the program

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Options in this program

1. No options
2.

Program objectives and plans

Program Objectives:

Our graduates should have strong analytical, technical, and professional skills. Additionally, they need to be able to apply their technical knowledge to practical problems, to recognize the limitations of their knowledge, and to know how to learn or access knowledge that they do not already have. Our students also need to have a recognition of the interaction between engineers and society as a whole, and the important responsibilities that flow from this relationship. They should recognize the need for lifelong learning and continuing education.

Fundamentals and first principles are very important, as are opportunities for technical training in mathematics and science. We must provide an intellectually stimulating program for our students, and better prepare them for both graduate and consulting work. Such a program will make our students more adaptable to future changes that technology may bring to civil engineering.

Plans:

The Department took the initiative to completely review the program in 2005. As a result, the Department implemented a new curriculum in stages starting in Fall 2007 with implementation complete in Winter 2010. Two major changes were the consolidation of two previous options (infrastructure and environmental) into one general program, and the implementation of Civil Weeks at the beginning of each year to emphasize professional skills and design. The Department's Curriculum Review Committee has the continuing task to monitor the progress of the new undergraduate curriculum. The Curriculum Committee meets regularly with undergraduate students to obtain their feedback on the program. For example, open "Town Hall" discussions were held with students in both 2010 and 2011, and an undergraduate student representative was added to the Curriculum Committee in 2010. Since the current program is very new, only minor changes to the curriculum such as integrating the curriculum with the current Faculty-wide "design-spine" initiative, bolstering hands-on experiences, and placing more emphasis on sustainability are envisaged over the next 5 years.

Resolution of previous issues

Deficiencies: NONE

Weaknesses: NONE

Concerns:

1. ***The character of the overall educational experience is being negatively influenced by the marginally sufficient faculty complement. (Criterion 2.3.2)***

Since 2005, the Civil Engineering faculty complement has increased by three full-time tenured or tenure-stream faculty members. Two faculty members (Kevin Hall and Luke Bisby) left the Department in 2008 for prestigious positions at other universities, but four new faculty members were hired in 2006 (Dr. Yves Filion), 2009 (Dr. Neil Hoult), 2010 (Dr. Kevin Mumford), and 2011 (Dr. Ryan Mulligan) while Dr. Kerry Rowe returned to the Department in 2010 after serving as Vice-Principal Research.

In addition to these tenure stream appointments, Dr. Duncan Cree has recently been hired on a three year non-renewable contract and will be teaching one undergraduate and one graduate course in the Department.

Furthermore, to address climbing enrollments in Civil Engineering, the Dean allocated an additional $150,000 of funding over the past three years to be used for adjunct instruction.

Finally, the Faculty is committed to another full-time tenure stream position in Civil Engineering as funds become available.

2. ***There is only a marginally sufficient amount of course content dealing with engineering economics (Criterion 2.2.4)***

In response to this concern, Civil Engineering now includes APSC221- Engineering Economics - as a compulsory course in its program. APSC221 is the core economics course taken by most engineering students at Queen's. An outline of the details of APSC221 is included in the course information sheet.

Self-appraisal

Vision Statement

Over the period 2011-2015, our objective is to provide a broadly-based education in civil engineering which is intrinsically supported by a world-class research emphasis in the areas of Structural, Geotechnical, Hydrotechnical, and Environmental Engineering.

Background

The Department presently has 17 tenured or tenure-track faculty members of which 14 are regular appointments and three are Canada Research Chair (CRC) appointments. We also have one additional professor on a three year contract appointment. Over the last 10 years we have, through continuing consultation amongst ourselves and our research and business partners, aligned our research in four areas of expertise: Structural Engineering, Geotechnical Engineering, Hydrotechnical Engineering, and Environmental Engineering. The purpose of the alignment was to assist in meeting our teaching obligations and to develop research initiatives that we felt would best meet the future needs of Civil Engineering in Canada.

At present, in addition to contributing to the common first year in Engineering and Applied Science, we teach almost 400 undergraduate students between 2nd and 4th year. Over the past four years we have undertaken a significant overhaul of our curriculum to improve learning outcomes and to balance the number of courses amongst disciplines. In the new curriculum we emphasize experiential learning and use field and laboratory study to the greatest extent possible.

Our research program is well-recognized across Canada and around the world. We host the Queen's-RMC Centre for GeoEngineering, arguably one of the leading research centres of its type in the world. We also have significant strength in water-related research, both in the area of fundamental physics and in the development of practical solutions to environmental problems. Our Structural Engineering group has developed a strong focus on rehabilitation of concrete structures that is attracting significant new funding interest from the business sector. The success of our research program can be largely attributed to the high-quality graduate students that we attract from all corners of Canada and the globe. In the following, we will outline how we see ourselves moving forward in research using our existing body of expertise

Departmental Vision

Based on considerable consultation with the public and private sectors, the Department envisions a need for broadly-educated civil engineers with strong foundations in a wide variety of sub-disciplines, and excellent development of professional skills. In order to provide the best education possible, we wish to develop more emphasis on hands-on learning with field-based experiences at the Department's Kennedy Field Station and elsewhere, and on lab-based experiences with large-scale testing in all disciplines. Although we presently enjoy strong relations with industrial partners, we see greater industrial involvement as means by which to enhance our experiential learning opportunities.

We also envision the nourishment of a naturally-developing thread in our research which is focused on the sustainability of both the natural and built environments (hence the new tag line in our name). This thread permeates each of our present areas of strength and we intend to pursue increasing research opportunities in areas such as structural rehabilitation including advanced materials, infrastructure replacement, sustainable water supply and management, and environmental engineering in general. In particular we envision strengthening the GeoEngineering Centre and the new Water Research Group, both hosted by our Department. Our specific objective in this research program will be to cement our place as a premier Civil Engineering Department in Canada and to bolster our standing internationally.

In order to most effectively deliver our program, the Department envisions a stable complement of 18 faculty members with approximately 80-90 undergraduate students per year, and approximately 100-120 graduate students split 60% PhD and 40% MASc. International students are expected to remain a vital part of our graduate training.

General Description of Revised Curriculum

The Department implemented a new curriculum in stages starting in Fall 2007 with implementation complete in Winter 2010. Four key changes have been introduced with the new curriculum. The first change is that the infrastructure and environmental options have now been merged into a solid general program that concentrates on the core technical skills that all civil engineering graduates should possess. Students obtain their desired specialization through five electives in fourth year, a thesis course (CIVL 500), and the capstone design course.

Second, professional skills short courses focusing on communication, problem-solving, and teamwork skills have now been concentrated into three Civil Weeks offered at the beginning of the fall term in each of second, third, and fourth year. During this first week of term, no other civil engineering lectures are delivered so that students can concentrate on Civil Week activities. In these week long courses, students are given instruction in technical writing, oral presentation skills, problem-solving strategies, and teamwork skills. The students are then challenged to work in teams to solve an engineering problem. For example, in 2007, students had to design and construct a water balloon launcher in teams of 8 to 10 students, and compete against each other for accuracy and distance. Students then made oral presentations and wrote a technical report on their design.

The third key element of the new curriculum is the introduction of applied sustainability and public health engineering into the program. This innovation recognizes the importance of civil engineering in ensuring sustainability and public health and gives our graduates the background to succeed in the multi-disciplinary nature of 21st century civil engineering.

The fourth change is the introduction of common chemistry and materials courses in 2nd year and the elimination of surveying as a core course. These new common courses were added to provide all civil engineering students with strong fundamentals. Surveying was dropped because it was not deemed an essential skill for civil engineering students, and resources were not available to properly sustain the course. The Department felt that limited resources were better spent on the other innovations in the program rather than on surveying. Our survey of industry partners supported this view.

Civil Engineering Curriculum Implementation

The new curriculum was approved in 2006 and the first offering was to students starting 2nd year Civil Engineering in September 2007. The new curriculum was implemented in three stages to accommodate both current students in our system (students in 2nd, 3rd and 4th year as of September 2006 stayed with the old curriculum) and students starting their programs in Civil Engineering (2nd year) in September 2007 and later followed the new curriculum. The new curriculum is now fully implemented and two classes (2010 and 2011) have graduated under the new curriculum.

Resource issues

One of the objectives of the new curriculum was to reduce the teaching loads of faculty members by reducing the overall course numbers. Although more involvement of faculty members in the Civil Week courses will increase other teaching responsibilities somewhat, the new curriculum will still result in reduced teaching loads for faculty members. Thus, the new curriculum has resulted in an average teaching load reduction of approximately 0.5 courses per faculty member. To support the applied sustainability initiative, two new faculty members, Yves Filion and Kevin Mumford, were hired in September 2006 and January 2010, respectively. In terms of staff, no significant resource changes are expected as a result of the new curriculum although slightly more technical staff involvement is required in the Civil Weeks. From an equipment perspective, the main additional resource was chemical equipment to support the 2nd year chemistry course. This was purchased with $50,000 of equipment funds from the Faculty of Engineering and Applied Science in 2007-08. In the last 3 years, an additional $250,000 was spent on undergraduate equipment.

Summary:

In summary, the Civil Engineering Department has just completed a process of significant program revision. This is in response to a desire to improve the overall body of knowledge acquired by our students during their civil engineering education at Queen’s, while at the same time addressing workload and resource issues for our faculty. We are very excited about these changes, and we look forward to providing an intellectually stimulating foundation for our students that will better prepare them for the wide range of options enabled by a civil engineering degree.

For faculty, the plan is to have a stable complement of 18 full-time faculty members. The general plan is to hire faculty into existing strengths, and to hire only candidates of the highest calibre. Another position is required to bring the faculty complement to 18. This next position should be in the area of structural, materials, or geotechnical engineering, or a candidate who could bridge these sub-disciplines. Ideally this candidate would also contribute to our sustainability theme. If any faculty members leave the department, the plan is to replace them with another faculty member with similar expertise. For potential growth, the Department will explore opportunities for research and endowed chairs.

As we have experienced significant growth in our enrolment over the last few years and substantially changed our curriculum, our needs for technical and administrative support have grown significantly. Thus, in order to run the department efficiently, we hired one additional technical staff member and one additional administrative staff member in early 2011.

2. Purpose of accreditation

3. Accreditation criteria

3.0 Continual improvement

Summarize the continual improvement process:

The Faculty of Engineering and Applied Science has been committed to continual program improvement. This has been particularly focused on professional skill development, reflecting a general consensus that this was the most significant need within the program.

In the mid 90's the faculty began an initiative, labelled Integrated Learning, to promote integration of theory and practice, and concepts from academia and industry. The faculty saw a need to enhance development of professional skills and an understanding of the engineering profession in the first year program. Informed by data from pilot projects and an awareness of outcomes-based assessment being introduced in the USA via EC2000, a committee of faculty, administration, and industry advisors designed new facilities and curriculum to developing competence in areas now covered by the CEAB graduate attributes. This led to the introduction of two new team and project-based first year courses focusing on problem analysis, design, investigation, engineering tools, teamwork, communications, professionalism, ethics and equity, and lifelong learning.[1]

Over the past 10 years these courses have seen regular re-development based on student feedback and assessment.[2] Previously existing courses have also been going through a development process; a course on earth systems has been developing a stronger emphasis on the impact of engineering on society and the environment, and courses on engineering graphical communications and computer programming include open-ended design projects.

With the introduction of the graduate attribute assessment requirements the faculty has begun formalizing an approach to program development informed by measurable and meaningful data.

In the 2009-2010 academic year the Faculty piloted a process for attribute assessment within some first year courses. At the end of the year the processes were reviewed and expanded to cover graduating year courses for the 2010-2011 academic year.

The process used is shown in Figure 1 and follows other accepted processes for outcomes assessment).[3]

In 2009 the Faculty created seven working groups to establish measurable and meaningful indicators (e.g. "Students will be able to...") appropriate to first year, middle years, and at

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[1] See J. McCowan, C. Knapper, An Integrated and Comprehensive Approach to Engineering Curricula, (Three parts), Int. J. Eng. Ed, Vol. 18, No. 6, 2002.

[2] See A. Topper, L. Clapham, From Experiments to Experimentation; A New Philosophy for First Year Laboratories, C2E2 2001, Victoria; B. Frank, J. Mason, Impact of Peer-Managed Project-Based Learning in First Year Engineering, ASEE 2008 General Conference, Pittsburgh, PA

[3] P. Wolf, New Directions for Teaching and Learning, Volume 2007, Issue 112, pp. 15-20

graduation. Although current accreditation regulations require assessment only at graduation, the faculty is assessing attribute development in earlier years for several reasons:

1. The ability to apply the results of graduate attribute assessment to the further development of the program is improved when data is available for earlier years.
2. Creating expectations by years greatly improves the efficiency and quality of curriculum design
3. The first year of the engineering program is common to all engineering students and is administered by the faculty office. It is efficient to benchmark all incoming students.
4. Most of the professional skill attributes are specifically targeted in the first two years of the current program and not in upper years. The curriculum is being developed to ensure these attributes continue to be developed in upper years.

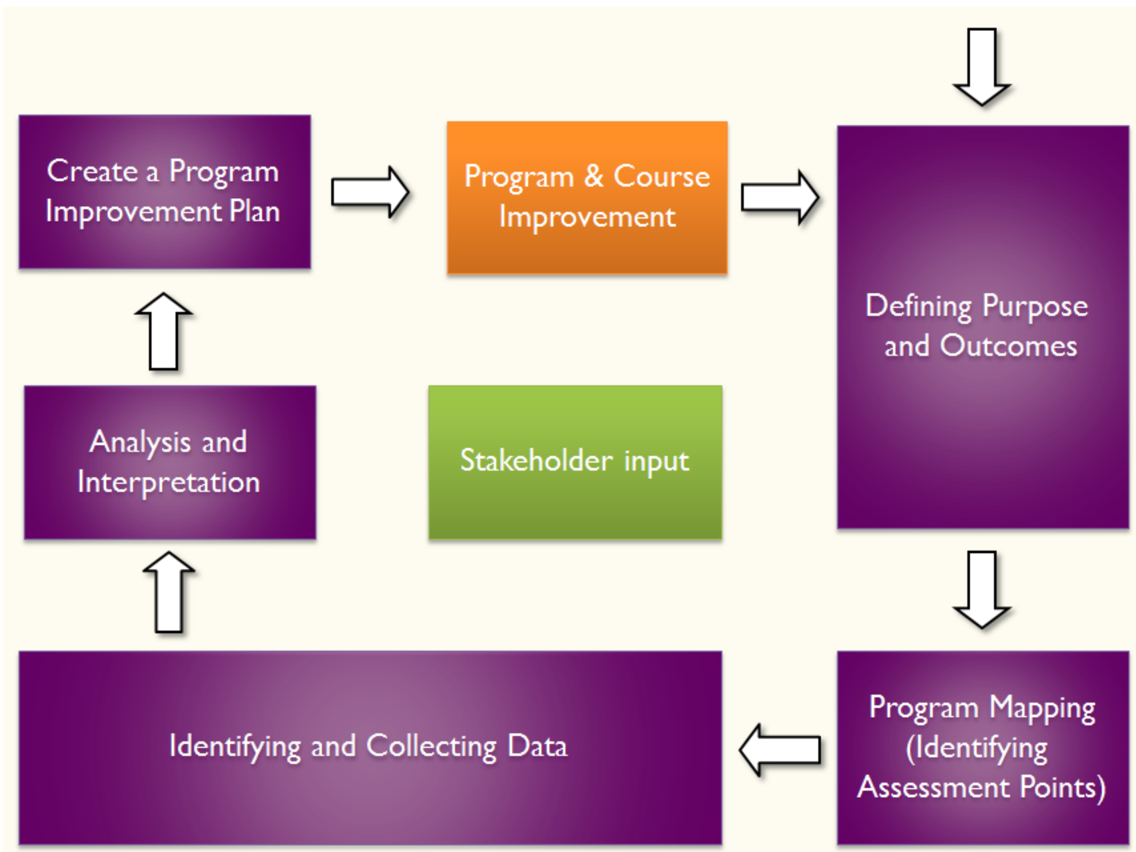

Figure 1 - Current graduate attribute assessment process

Working groups were composed of representatives from departments across the faculty, subject experts in areas required by the graduate attributes (library science, economics, communications, etc.) and students. An educational developer was consulted throughout the process. The groups used several resources including the CDIO syllabus and resources from other engineering accreditation bodies. The requirements from the Ontario Council of

Academic Vice Presidents Guidelines for University Undergraduate Degree Learning Expectations (UDLEs) were also used.[4]

1. Depth and Breadth of Knowledge
2. Knowledge of Methodologies
3. Application of Knowledge
4. Communication Skills
5. Awareness of Limits of Knowledge
6. Autonomy and Professional Capacity

Appendix A to the Section 3.1 response shows the indicators created by these groups in a single table.

At the beginning of the 2010-2011 academic year, a set of indicators from Appendix A was selected for assessment in the 2010-2011 academic year based on the current state of the curriculum and ability to assess in a timely manner. The indicators were mapped to some faculty-wide courses, including the common first year, and faculty-wide middle year courses in economics and communication, and to program specific courses. Appropriate assessment tools were determined by individual course instructors. Finally, grading resources like rubrics were created for each of the course assignments that were used to assess the indicators.

In a parallel process, a survey of instructors in the faculty was conducted to look at the alignment between the curriculum and the attributes.

After the data was gathered and collated, statistical analysis was performed and provided to the faculty and programs to interpret and create an improvement plan.

Recent Curriculum Revision in Civil Engineering

The Department has been very proactive in improving the curriculum. A major curriculum revision was made since the last accreditation. The previous program essentially consisted of two options: Infrastructure and Environmental. The first two years of the program were common with the options starting in third year. In addition to regular courses in the program, several short courses were offered each year to focus on professional skills such as communication, teamwork, and problem-solving. Three electives were offered in fourth year.

Curriculum Revision Process

A curriculum review committee was established consisting of three Department of Civil Engineering faculty members, representing our three of our main teaching and research foci (geotechnical, hydrotechnical and structural), two undergraduate students, two graduate

[4] See, e.g. http://www.cou.on.ca/related-sites/the-ontario-universities-council-on-quality-assura/policies/pdfs/quality-assurance-framework---guide-may-2011.aspx

students, the undergraduate administrative assistant, and Integrated Learning Centre (ILC) Chair in Engineering Education, Dr. Caroline Baillie.

The committee sought feedback from current undergraduates, past graduates, industry, and the Professional Engineers Ontario. Generally, feedback was provided by one-on-one meetings, group discussions, and both mail-out and Web-based questionnaires.

Based on this information, the committee developed objectives for the program, opportunities for excellence, and desired program outcomes as detailed on pages 11 and 12. The committee then developed a framework for the new curriculum. This framework was brought forward to the department as a whole and through a series of meetings was refined to its final form. All members of faculty in the department were consulted.

Careful attention was paid to the requirements of the CEAB. The new curriculum surpasses the minimum unit requirement in all required categories and as a collective program.

The Department's Curriculum Review Committee has the continuing task to monitor the progress of the new undergraduate curriculum. The Curriculum Committee meets regularly with undergraduate students to obtain their feedback on the program. For example, open "Town Hall" discussions were held with students in both 2010 and 2011, and an undergraduate student representative was added to the Curriculum Committee in 2010. Since the current program is very new, only minor changes to the curriculum such as integrating the curriculum with the current Faculty-wide "design-spine" initiative, bolstering hands-on experiences, and placing more emphasis on sustainability are envisaged over the next 5 years.

Overview of Objectives

Our graduates should have strong analytical, technical, and professional skills. Additionally, they need to be able to apply their technical knowledge to practical problems, to recognize the limitations of their knowledge, and to know how to learn or access knowledge that they do not already have. Our students also need to have a recognition of the interaction between engineers and society as a whole, and the important responsibilities that flow from this relationship. They should recognize the need for lifelong learning and continuing education.

Fundamentals and first principles are very important, as are opportunities for technical training in mathematics and science. We must provide an intellectually stimulating program for our students, and better prepare them for both graduate and consulting work. Such a program will make our students more adaptable to future changes that technology may bring to civil engineering.

Opportunities for Excellence

The new curriculum introduces more choice for technical specialization within the program while at the same time reducing teaching loads for faculty. This is accomplished by establishing a common core program with more technical electives. The new curriculum also provides an opportunity for selected outstanding students to complete a 4th-year thesis course if desired.

Desired Program Outcomes

Based on recent publications by the American Society of Civil Engineers (ASCE) and others, and on discussions within the curriculum committee, a list of 15 program objectives was identified. These outcomes describe, in broad terms, the "Body of Knowledge (BOK)" that civil engineering students need to be successful in the coming century based on current societal and industrial trends. These outcomes form the foundation of the current curriculum review.

1. Fundamental knowledge in mathematics, science, and engineering
2. Ability to select and use basic engineering tools such as methods of analysis, application-specific software, and equipment
3. Ability to identify and solve practical problems
4. Ability to design a system, component, or process to meet desired needs within practical constraints
5. Ability to plan and conduct research, as well as to analyze and interpret results
6. Ability to apply knowledge in a specialized area of civil engineering
7. Ability to communicate verbally
8. Ability to communicate in writing
9. Ability to effectively work as part of a team
10. Understanding of the role of a leader and development of leadership skills
11. Understanding of professional and ethical responsibilities
12. Ability to think creatively and to innovate
13. Understanding of business and administration
14. Awareness of impact of engineering solutions in a global, economic, environmental, and societal context
15. Recognition of the need for, and an ability to engage in, ongoing learning

While all of the program objectives are of high importance, it was desired to better understand the relative importance of the various objectives, as well as the quality of delivery of these objectives for students completing our current undergraduate program.

3.1 Graduate attributes

The higher education institution must demonstrate that the graduates of a program possess the attributes under the following headings. The attributes will be interpreted in the context of candidates at the time of graduation. It is recognized that graduates will continue to build on the foundations that their engineering education has provided.

Engineering programs are expected to continually improve. There must be processes in place that demonstrate that program outcomes are being assessed in the context of these attributes, and that the results are applied to the further development of the program.

Response to criterion 3.1:

In 2009 the Faculty of Engineering and Applied Science began developing a process for graduate attribute assessment by forming working groups to establish measurable and meaningful indicators of graduate attributes appropriate to first year, middle years, and at graduation. In the 2009-2010 academic year the Faculty piloted a process for attribute assessment within some faculty-wide first year courses. In the summer of 2010 the processes were reviewed and expanded, and in the 2010-2011 academic year the process of attribute assessment was broadened to involve include faculty wide first and second year courses, and CIVL 460 Civil Engineering Design 2.

For this cycle attribute assessment was a separate process from the remainder of accreditation preparation. As a result the detailed response to Criterion 3.0 and 3.1 are contained in a separate document in Appendix 3.1, which details the processes followed faculty wide and within the program in the 2010-2011 academic year. It lists the indicators measured, where they were measured, a description of how the curriculum contributes to the development of the attributes, a description of the student activities used to measure the attributes, data collected from student work and surveys, an evaluation of the data, and proposals for program improvement. Based on evaluation of the data from student work and surveys, revisions are planned as follows:

- The existence and importance of attributes for engineering practice will be communicated and used more extensively, and linked to learning objectives in courses. Some of the attributes appear to be poorly understood by students, and this will be addressed

- At the first year level, the program is being revised in the areas including making effective arguments, evaluating complex problem solutions against objectives, written communications, and evaluating information. Grader calibration is being enhanced to reduce variation between graders, and some indicators will be revised to reflect student ability.

- At the second year level, changes are being made to the faculty-wide communications and economics courses. More emphasis will be placed on summarizing important information clearly and concisely, effectively participating in informal small group discussions, and on risk assessment and project planning.

- A 4-year sequence of courses in engineering design and practice is partway through implementation, which will support development of professional skill attributes, and provide a venue for developing and assessing all attributes in broad integrative experiences, like team projects, that emulate professional practice.

- Assessment of graduate attributes was piloted this year in CIVL 460 Civil Engineering Design II on two significant milestones, the first progress report and the first presentation. The attributes assessed were focused on the student's communication abilities and their ability to apply engineering knowledge. Criteria for the assessment were established in concert with other departments and applied using the Moodle software package. In general the results show that the assessments were easy to undertake using an appropriate list of criteria, and the students were very successful in meeting the selected criteria.

Because the process of attribute assessment started in faculty wide courses, the faculty-wide data and analysis is more detailed and should be viewed as representing an example of process that will be introduced into graduating year assessment in the coming years. The faculty plans to continue assessing student attributes throughout the four-year program for the purpose of program improvement. As curriculum changes occur over the next two years, the program evaluation and improvement process will be expanded to include all attributes at the first and graduating years of the program.

3.1.1 A knowledge base for engineering

Response to criterion 3.1.1:

Please see Appendix 3.1 for more details.

3.1.2 Problem analysis

Response to criterion 3.1.2:

Please see Appendix 3.1 for more details.

3.1.3 Investigation

Response to criterion 3.1.3:

Please see Appendix 3.1 for more details.

3.1.4 Design

Response to criterion 3.1.4:

Please see Appendix 3.1 for more details.

3.1.5 Use of engineering tools

Response to criterion 3.1.5:

Please see Appendix 3.1 for more details.

3.1.6 Individual and team work

Response to criterion 3.1.6:

Please see Appendix 3.1 for more details.

3.1.7 Communication skills

Response to criterion 3.1.7:

Please see Appendix 3.1 for more details.

3.1.8 Professionalism

Response to criterion 3.1.8:

Please see Appendix 3.1 for more details.

3.1.9 Impact of engineering on society and the environment

Response to criterion 3.1.9:

Please see Appendix 3.1 for more details.

3.1.10 Ethics and equity

Response to criterion 3.1.10:

Please see Appendix 3.1 for more details.

3.1.11 Economics and project management

Response to criterion 3.1.11:

Please see Appendix 3.1 for more details.

3.1.12 Life-long learning

Response to criterion 3.1.12:

Please see Appendix 3.1 for more details.

3.2 Students

3.2.1 Admission

a) The major criterion for admission to first year in the Faculty of Applied Science is the average achieved in the final year of secondary school, which is considered in conjunction with the grades of the previous two years of secondary school. The published minimum overall average for admission is 80%, using only Physics, Chemistry, Mathematics, one other Grade 12 technical courses and English in the calculation of the average

b) The student is asked to provide a Personal Statement of Experience (PSE) on outside interests and activities, and the reasons for choosing engineering. This information helps to assess the applicant's motivation, and ability to communicate. We are also interested in the type of guidance the student has received prior to choosing Queen's.

c) Although all students are admitted to a common first year, applicants are asked to indicate the branch of engineering in which they are interested since this information is helpful in allocating resources a year hence to meet anticipated demand.

d) Ability to communicate in English must be proven for foreign applicants whose native tongue is not English.

e) Applications from students in institutes of technology, community colleges and junior colleges are dealt with individually on their merits. In general, consideration is given only to applicants who have completed at least two years of a postsecondary program, and who have taken appropriate courses in Mathematics, Physics and Chemistry. In the Department of Civil Engineering, students who have completed the three year civil engineering technologist program at St Lawrence College may be admitted to civil engineering with advanced standing including upper year credits. The admission criteria and credits have been developed over the past 10 years with significant consultation with St Lawrence College. A copy of the list of course credits is provided in Exhibit 2.

Applicants from other faculties at Queen's or from other postsecondary institutions are considered for admission to the year for which they qualify. Academic performance is the criterion for admission. Credit is given for completed courses that correspond in content to courses of the program to which the applicant is admitted. Advanced credit is usually given only for first year courses. Admission is often limited by capacity of the department offering the program.

Official transcripts from the institution attended, as well as secondary school, and calendar descriptions of completed postsecondary courses are required to determine course exemptions. The applicant's preparation is reviewed by the department offering the desired program, and a recommendation is made to the Operations Committee of the Faculty, proposing course exemptions for work already completed and course deficiencies to be made up.

Students with adequate academic preparation may register as Special Students, on a non-degree program. A Special Student is permitted to register in the regular courses offered by the Faculty, provided space is available and the student has the necessary prerequisites and background preparation. If such students are admitted as regular students on a degree program at a later date they will, in general, receive credit for courses taken earlier providing the courses are a part of the program in which they are now registered. Credit for work completed while on a formal university exchange is dealt with in the same way as students seeking admission for advanced standing with the exception that students are advised prior to commencement of the exchange, of credits which will be allowed for courses successfully completed.

3.2.2 Promotion and graduation

NOTE: The Faculty of Engineering and Applied Science is in the process of changing the method of student assessment from one based upon a percentage grade to one based upon GPA. This change will take place in September 2011and necessitates significant changes to the wording of the Faculty regulations. However, the structure of the regulations and the philosophy behind them has not changed.

The responses given below are based upon the regulations under which students will graduate in 2010/2011. The new regulations, based upon GPA, are available in Appendix B for reference.

Summarize the engineering unit’s policy on promoting students through the program.

The policy on promoting students through the program is outlined in the Regulations of the Faculty (Appendix D). Promotion of individual students is evaluated at the end of the winter term each year, and is based on academic performance in the previous fall+winter session. The pass mark for an individual course is 50% and an overall weighted average of 50% is needed to pass an individual year (Regulation 10). At the end of a student's program they must have a cumulative average of 55% in order to graduate. Students having a cumulative average less than 55% at the end of the winter term in any year are placed on academic probation the following year (Regulation 2h).

Summarize the practices (including formal committee responsibilities) involved in monitoring the academic progress of students; include the practices related to determining probationary status and required withdrawal from programs. Briefly describe any appeal procedures available to students.

The academic progress of students is monitored primarily within the department by the Chair of Undergraduate Studies. The Chair verifies that each student's program of study, progress through the program, attainment of competency and satisfaction of graduation requirements, are in accordance with the Faculty's regulations and CEAB requirements.

Practices concerning probationary status and withdrawal from programs are reflected in Regulation 2(h) and Regulations 10, 11 and 12, respectively. (See Appendix D)

Appeals or requests for exemptions from the regulations are considered by the Operations Committee of the Faculty Board. The terms of reference of this committee are attached as Appendix E. The one exception to this process is a request for a waiver of a Requirement to Withdraw which is considered directly by the Associate Dean (Academic)

Each department conducts, through participation from all faculty members, a marks meeting in which the final results of all students are reviewed. Eligibility for graduation is verified first within the department and then by the Faculty Board and University Senate.

Procedures for Academic Dishonesty are given in (Appendix F). Every effort is made to resolve appeals at the level of the instructor and department head.

Summarize any institutional and faculty policies and practices concerning the students with disabilities. Provide details of the manner in which accommodation is made in areas such as exams, laboratories, course requirements, work-experience programs, etc.

The University has a legal requirement to accommodate students with disabilities without compromising the academic integrity of its programs. Students requiring accommodation are normally assessed with the assistance of the Disabilities Services Office. http://library.queensu.ca/websrs/faculty_guideIndex.html. A plan is then prepared to accommodate the students and it is communicated to faculty members and other members of the University community as required. There are many different strategies for making accommodations and these depend upon individual circumstances. Some students, for example, require more time to complete an examination. The following statement is intended to guide this process.

"The question of fairness often arises in providing some students with alternate means of performing academic tasks. Accommodations for a disability are never intended to give an advantage, but to provide an equal opportunity for students who need to do certain tasks in a different fashion. Students must still meet the essential requirements of the curriculum. They must (i) gain the required knowledge, (ii) demonstrate that knowledge to the satisfaction of the instructor and (iii) apply that knowledge appropriately."

3.2.3 Counselling and guidance

Summarize the process involved in advising and counselling students.

The Department of Civil Engineering provides several opportunities for students to obtain advice on selecting appropriate courses. Students will typically initially consult with the undergraduate program assistant (Mrs. Cathy Wagar) who is knowledgeable about degree requirements and required courses. For more detailed academic advice, students may contact and/or meet with their year advisor (2nd year – Dr. Amir Fam; 3rd year – Dr. Ana da Silva; 4th year – Dr. Mark Green). Dr. Fam is also undergraduate chair while Dr. Green is associate head. The curriculum currently requires 5 electives in fourth year. Four of these electives are technical electives while the fifth is a free elective. The free elective may be essentially any course offered at Queen's, but this elective still needs to be approved by the Undergraduate Chair to ensure that the selected course is acceptable (i.e., the course must be 100 level or greater and the course cannot substantially duplicate material already taken in other parts of the student's program).

At least three electives must be technical electives from List 1 shown below. Choose one other technical elective from Electives List 1 or from Electives List 2 shown below (electives offered by other engineering departments):

Electives List 1
APSC 381 Fundamentals of Design Engineering
CIVL 431 STR TE I: Infrastructure Rehabilitation
CIVL 436 STR TE II: Prestressed Concrete
CIVL 443 GEO TE I: Geoenvironmental Design
CIVL 451 HYD TE I: Lake, Reservoirs and Coastal Eng
CIVL 455 HYD TE II: River Engineering
CIVL 471 ENV TE I: Subsurface Contamination
CIVL 472 ENV TE II: Waste Management
CIVL 500 Civil Engineering Thesis

Electives List 2
APSC 480 Multi-disciplinary Design Project
MECH 333 Gender, Engineering and Technology
MECH 371 Fracture Mechanics and Dislocation Theory
MECH 441 Fluid Mechanics III
MECH 444 Computational Fluid Dynamics
MINE 462 Occupational Health and Safety in Mining Practices
CHEE 484 Bioremediation
CHEE 481 Air Quality Management

CHEE 342 Environmental Biotechnology
SURP 853 Environmental Services
SURP 856 Environmental Assessment
In exceptional cases, a free elective may be substituted for this other technical elective (List 2) if special approval is obtained from the Undergraduate Chair.

List 1 electives were developed to provide the students with access to a broad range of courses in civil engineering and to allow them to specialize in the area of their interest. Students are required to take at least 3 courses from List 1 to ensure that they have a strong background in civil engineering. Substitutions for these List 1 electives are rarely granted. Such substitutions are only granted if the student takes an alternative advanced course that is centrally related to civil engineering and that satisfies CEAB requirements. List 2 courses were selected to provide students with the opportunity to experience courses in other disciplines that relate to civil engineering. Substitutions for a List 2 elective are granted more often than substitutions for a List 1 elective. For a course to be deemed equivalent to a List 2 elective, the course needs to be related to engineering and the student needs to demonstrate the relevance of the proposed course to his/her career objectives.

IMPORTANT NOTE: All CEAB criteria (other than total load units) are satisfied by our core curriculum. (See Tables 3.3.3.1, 3.3.3.2, 3.3.4, and 3.3.5). Thus, from a CEAB perspective, technical electives are only needed to provide sufficient units for our program and are not needed to satisfy any technical requirements of CEAB.

3.2.4 Degree auditing

Summarize the higher education institution’s process for degree auditing.

Degree auditing is done on a continuous basis for each student by the Chair of Undergraduate Studies.

The transcripts of all students who apply for graduation in a given year are reviewed manually for compliance with the Faculty regulations by members of the Operations Committee and the Undergraduate Chair of the program. Any anomalies detected in the transcript are noted and referred to the Undergraduate Chair for clarification. Once all issues are resolved the student is deemed eligible for a degree. The final degree list is reviewed and approved by Faculty Board.

3.3 Curriculum content

3.3.1: Approach and methodologies for quantifying curriculum content

3.3.1.1 **Accreditation Units (AU)**

Queen's has two academic terms (Fall and Winter) each comprised of 12 weeks of instruction. Each term contains one statutory holiday. The total length of an academic session is 12 weeks times 5 days times two terms minus two holidays = 118 days.

Each 50 minute lecture is assigned 1 AU
Each 50 minute tutorial is assigned 0.5 AU
A two hour and 50 minute laboratory session (typical length) is assigned 1.5 AU

3.3.1.4 The Accreditation Board can give consideration to departures from these approaches and methodologies in any case in which it receives convincing documentation that well-considered innovation in engineering education is in progress.

No departures to report.

3.3.2 Minimum curriculum components

3.3.3 Mathematics and natural sciences

3.3.3.1 **Mathematics**

Table 3.3.3.1: Mathematics content summary

Program Civil Engineering
Option: All

Course number	Course title	Math AU	Course contact(s)	Specify relevant content
APSC 100	Engineering Practice	6.0	Frank, B.	
APSC 171	Calculus I	42.0	Jonker, L.	Differential calculus
APSC 172	Calculus II	42.0	Taylor, P.	Integral calculus
APSC 174	Introduction to Linear Algebra	42.0	Mansouri, A.-R.	Linear Algebra
MATH 224	Applied Mathematics for Civil Engineers	54.0	Maciejewski, W.	Differential equations
CIVL 222	Numerical Methods for Civil Engineers	45.0	Moore, I.D.	Numerical analysis
CIVL 380	Applied Sustainability and Public Health in Civil Engineering	12.0	Filion, Y.	Probability
CIVL 450	Hydraulics 3	12.0	Filion, Y.	Differential equations
	Total	**255.0**		
	Accreditation Board minimum	**195**		

3.3.3.2 **Natural sciences**

Table 3.3.3.2: Natural science content summary

Course number	Course title	NS AU	Course contact(s)	Specify relevant content
APSC 100	Engineering Practice	16.0	Frank, B.	Physics
APSC 111	Mechanics	42.0	Boulay, M.G.	Physics
APSC 112	Electricity and Magnetism	31.0	Noble, A.	Physics
APSC 131	Chemistry and Materials	31.0	Newstead, W.	Chemistry
APSC 132	Chemistry and the Environment	31.0	Newstead, W.	Chemistry
APSC 151	Earth Systems and Engineering	24.0	Hanes, J.A.	Earth Science
CIVL 210	Chemistry for Civil Engineers	15.0	Safari, E.	Chemistry
CIVL 215	Materials for Civil Engineers	12.0	Cree, D.	Chemistry
CIVL 250	Hydraulics I	4.0	da Silva, A.M.	Physics
CIVL 470	Municipal Water Engineering	12.0	Anderson, B.C.	Chemistry
	Total	**218.0**		
	Accreditation Board minimum	**195**		

3.3.4 Engineering science and engineering design

Table 3.3.4: Licensure status of instructors delivering engineering science and engineering design AU

Course number and name	Course contact(s)	Instructor(s)	Licensure status of instructor(s): Lic. in Canada (P.Eng., ing.)	Applied	Not licensed/ not applied	ES	ED	ES+ED	"Qualified" ED	"Qualified" ES+ED
APSC 100 Engineering		Frank, B.	X			40.0	30.0	70.0	30.0	70.0
Practice		Clapham, L.	X							
APSC 112 Electricity		Noble, A.			X	11.0	0.0	11.0	0.0	0.0
and Magnetism		Narayanan, S.			X					
		Lake, K.			X					
APSC 131 Chemistry		Newstead, W.			X	11.0	0.0	11.0	0.0	0.0
and Materials		Carran, J.			X					
		Cunningham, M.F.	X							
APSC 132 Chemistry and the Environment		Newstead, W.			X	11.0	0.0	11.0	0.0	0.0
APSC 142[1]		Carran, J.			X					
Intro to Computer Programming for		Rudie, K.	X			24.0	12.0	36.0	12.0	36.0
Engineers		Dean, T.			X					
APSC 151 Earth Systems and Engineering		Hanes, J.A.			X	12.0	0.0	12.0	0.0	0.0
APSC 161[2] Basic		Zak, G.	X			31.0	11.0	42.0	11.0	42.0
Engineering Graphics		Yao, Z.			X					
		Dumas, G.A.	X							
CIVL 200 Civil Week 1 - Professional Skills		Beddoe, R.A.			X	7.0	7.0	14.0	0.0	0.0
CIVL 210 Chemistry for Civil Engineers		Safari, E.			X	30.0	15.0	45.0	0.0	0.0
CIVL 230 Solid Mechanics I		Pilkey, K.	X			54.0	0.0	54.0	0.0	54.0
CIVL 260 Civil Engineering Design 1		Nelson, M.			X	12.0	24.0	36.0	0.0	0.0
		Sadeghian, P.			X					
CIVL 215 Materials		Cree, D.	X			32.0	10.0	42.0	10.0	42.0
CIVL 222 Numerical Methods		Moore, I.D.	X			15.0	0.0	15.0	0.0	15.0
CIVL 231 Solid Mechanics II		Hoult, N.	X			54.0	0.0	54.0	0.0	54.0
CIVL 250 Hydraulics I		da Silva, A.M.	X			22.0	22.0	44.0	22.0	44.0
CIVL 300 Civil Week - Professional Skills		Beddoe, R.A.			X	7.0	7.0	14.0	0.0	0.0
CIVL 330 Structural Analysis		MacDougall, C.	X			48.0	0.0	48.0	0.0	48.0
CIVL 340 Geotechnical Engineering 1		Brachman, R.W.I.	X			36.0	12.0	48.0	12.0	48.0
CIVL 350 Hydraulics 2		Boegman, L.		X		15.0	33.0	48.0	0.0	0.0

Course number and name	Course contact(s)	Instructor(s)	Licensure status of instructor(s): Lic. in Canada (P.Eng., ing.)	Applied	Not licensed/ not applied	ES	ED	ES+ED	"Qualified" ED	"Qualified" ES+ED
CIVL 370 Environmental Engineering 1		Anderson, B.C.			X	32.0	16.0	48.0	0.0	0.0
CIVL 331 Structural Design 1		MacDougall, C.	X			12.0	36.0	48.0	36.0	48.0
CIVL 341 Geotechnical Engineering 2		Beddoe, R.A.			X	12.0	36.0	48.0	0.0	0.0
CIVL 371 Groundwater Engineering		Mumford, K.	X			32.0	16.0	48.0	16.0	48.0
CIVL 380 Applied Sustainability and Public Health in Civil Engineering		Filion, Y.	X			24.0	12.0	36.0	12.0	36.0
CIVL 400 Civil Week - Professional Skills		Beddoe, R.A.			X	7.0	7.0	14.0	0.0	0.0
CIVL 430 Structural Design 2		Green, M.F.	X			12.0	36.0	48.0	36.0	48.0
CIVL 450 Hydraulics 3		Filion, Y.	X			24.0	12.0	36.0	12.0	36.0
CIVL 460[3] Civil Engineering Design 2		Novakowski, K.S.	X			31.0	31.0	62.0	31.0	62.0
		Nelson, M.			X					
		Sadeghian, P.			X					
CIVL 470 Municipal Water Engineering		Anderson, B.C.			X	18.0	18.0	36.0	0.0	0.0
		Total				**676.0**	**403.0**	**1079.0**	**240.0**	**731.0**
		Accreditation Board minimum				**225**	**225**	**900**	**225**	**600**

Notes:

[1] The ED units primarily come from the software design project in which students are required to program a robot to complete some task. The task is proposed by them and approved by course personnel. The project provides an opportunity for students to create their own design objectives on an open-ended project, determine what sensors and algorithms would be needed, and design a program to meet the design objectives. The project was created by Stan Simmons, P.Eng., including the expectations and grading scheme. The course coordinator, Karen Rudie, P.Eng., is responsible for modifications to the grading scheme, approving changes in objectives of the project, and overseeing the project. Each section will have a presentation on software design process before the project begins, given either by Karen Rudie or another P.Eng. guest speaker.

[2] The ED units primarily come from the project, in which students design a casing for a consumer product provided to them, based on some components that must fit inside. The project will be overseen by Genevieve Dumas, a PEng, including setting up the expectations, training TA's, and overseeing TA's who mark it. This is worth 15% of the course grade. There will be one question on the final exam, worth about a quarter of the exam, or slightly over 10% of the overall course mark to be marked by Zak (P. Eng.) or Dumas that is fairly comprehensive and would assess graphical design.

[3] Novakowski (LEL) is the main instructor for the course. He teaches all ES and ED and supervises every project.

3.3.4.1 **Engineering science**

A minimum of 225 AU in engineering science is required. Engineering science subjects involve the application of mathematics and natural science to practical problems. They may involve the development of mathematical or numerical techniques, modeling, simulation and experimental procedures. Such subjects include, among others, the applied aspects of strength of materials, fluid mechanics, thermodynamics, electrical and electronic circuits, soil mechanics, automatic control, aerodynamics, transport phenomena, and elements of materials science, geoscience, computer science, and environmental science.

3.3.4.2 **Other engineering science content**

Most engineering science content relevant to other disciplines is provided in first year through the common first year as shown in Table 3.3.4b. For example, students are exposed to electrical engineering in APSC 112 (Electricity and Magnetism), chemical engineering in APSC 131 (Chemistry and Materials) and APSC 132 (Chemistry and the Environment), and geological engineering in APSC 151 (Earth Systems and Engineering). Civil engineering students are given an appreciation of mechanical engineering in APSC 161 (Basic Engineering Graphics), and CIVL 230 (Solid Mechanics I) which is offered with common lectures to mechanical engineering students as CIVL 220.

3.3.4.3 **Engineering design**

A minimum of 225 AU in engineering design is required. Engineering design integrates mathematics, natural sciences, engineering sciences and complementary studies in order to develop elements, systems and processes to meet specific needs. It is a creative, iterative and open-ended process, subject to constraints which may be governed by standards or legislation to varying degrees depending upon the discipline. These constraints may also relate to economic, health, safety, environmental, societal or other interdisciplinary factors.

3.3.4.4 **Significant design experience**

In CIVL 400 (Civil Week – Professional Skills) and CIVL 460 (Civil Engineering Design 2), student teams undertake a comprehensive design project that involves the creative, interactive process of designing a structure or system to meet a specified need subject to economic, health, safety and environmental constraints. **CIVL 460 is conducted under the professional responsibility of Kent Novakowski, LEL.** Prof. Novakowski supervises the other two adjunct instructors and teaching assistants in the course, and meets with each team regularly. He also evaluates each of the final design projects. The teams consist of 4-5 members and groups are self formed as part of CIVL 400. The projects are obtained from industry and have an industry representative as a client liaison. The following are the steps taken in the process:

1. Groups bid on projects
2. Meet with group manager
3. Meet with client liaison
4. Begin design
5. Complete progress report
6. Complete design
7. Present a draft final report
8. Finalize the draft report
9. Present results to the client

Steps 1 and 3 are taken as part of CIVL 400, and step 2 should be arranged as soon as possible.

The intent of the course and the learning objectives are:

- To extend the department's outreach into industry by developing partnerships in the classroom between industry and graduating students.
- To integrate the knowledge and skills acquired through studies at Queen's into a significant design experience.
- To expose graduating students to aspects of real-life engineering projects including teamwork, management, scheduling, and costing.
- To provide industry with innovative solutions to their engineering problems.

3.3.4.5 **Modern engineering tools**

Applications of modern engineering tools are incorporated throughout the civil engineering curriculum. This starts in first year with computer programming in APSC 142 (Introduction to Computer Programming for Engineers) and computer drafting tools (SolidEdge in APSC 161 Basic Engineering Graphics). In CIVL 260 (Civil Engineering Design 1), students are introduced to a more standard civil engineering drafting package (AutoCad). AutoCad is applied by the students in many courses most notably the capstone design course CIVL 460 in fourth year. Also in second year, CIVL 222 (Numerical Methods for Civil Engineers) provides ample opportunities for students to apply the technical computing language MATLAB. Other examples of applying modern engineering tools include operating a total station or a survey-grade global positioning system (GPS) as part of CIVL 300 (Civil Week – Professional Skills); environmental sample collecting and chemical analysis as part of CIVL 300, CIVL 210 (Chemistry for Civil Engineers), and CIVL 370 (Environmental Engineering); and using the structural analysis package SAP as part of CIVL 330 (Structural Analysis).

3.3.5 Complementary studies

Table 3.3.5.1: Complementary studies content summary

Course number	Course title	Elective	CS AU	Course contact(s)	Area of study
APSC 100	Practical Engineering Modules		40	Frank, B. Clapham, L.	Health and Safety, Professional ethics, equity and Law
APSC 151	The Earth's Physical Environment		12	Hanes, J.A.	Sustainable development and environmental stewardship
CIVL 200	Civil Week 1 - Professional Skills		14	Beddoe, R.	Oral and written communications
APSC 221	Economics and Business Practices in Engineering		36	Martin, J.	Engineering Economics
CIVL 300	Civil Week - Professional Skills		14	Beddoe, R.	Oral and written communications
CIVL 400	Civil Week - Professional Skills		14	Beddoe, R.	Oral and written communications
CIVL 460	Civil Engineering Design 2		10	Novakowski, K	Oral and written communications
Linkage units (APSC 190 or upper year design spine courses)	APSC 190 Professional Engineering Skills or CIVL 260 Civil Engineering Design 1 or APSC 200 Engineering Design and Practice II		12	Frank, B.	Impact of technology on society
Management Elective	MGMT elective		36		Health and Safety, Professional ethics, equity and Law
Complementary Studies	2 Courses from List A (Humanities and Social Sciences) Courses		72		Humanities and social sciences
Complementary Studies	1 Course from List A (Humanities and Social Sciences), List B (Linkage and Professional Issues), List C (Performance Arts and Languages), or List D (Management) courses		36		Humanities and social sciences
		Total	296		
		Accreditation Board minimum	**225**		

3.3.6 The entire program must include a minimum of 1,950 Accreditation Units

Table 3.3.6: Summary of AU content for each program and/or option

Program and/or option	Total AU
All	2058
CEAB minimum requirement	**1950**

3.3.7 Laboratory experience

Table 3.3.7: Laboratory experience

Course number	Course title	Course contact(s)	Description of the experiments	Safety addressed	Safety examined
APSC 100	Engineering Practice	Frank, B Clapham, L.	Approximately 8 3-hour laboratory sessions on experimental design.	Yes	Yes
APSC 151	Earth Systems and Engineering	Hanes, J.	LAB. 1: Geology and Highway Design LABS. 2, 3, 4, and 5: Study of Earth Materials LAB. 6: Field-Trip Preparation and Geological Principles: LAB. 7: Analysis of Mass-Wasting, and a Slope-Stability Analysis LAB. 8: Structural Geology I:	Yes	No
APSC 142	Intro to Computer Programming for Engineers	Rudie, K.	Weekly labs to program Lego robots using RobotC. Involved programming to read information from sensors (e.g., infrared, sound) and make robot perform actions (e.g., movement in specified directions,displaying images on LCD, playing music).	No	No
APSC 161	Basic Engineering Graphics	Zak, G	Sketching and CAD-based problems are completed by students and then marked by the TAs; instructor and TAs provide assistance; homework and project tasks are marked.	No	No
CIVL 200	Civil Week I Professional Skills	Beddoe, R.	Hands-on problem solving/design scenarios (design, construction, and racing of cardboard canoes)	Yes	Yes
CIVL 210	Chemistry for Civil Engineers	Safari, E. Champagne, P.	Safety/ Corrosion/ Sorption/ Inorganic Chemistry - Acid Mine Drainage/	Yes	Yes

Course number	Course title	Course contact(s)	Description of the experiments	Safety addressed	Safety examined
			Bioremediation		
CIVL 215	Materials for Civil Engineers	Cree, D	Concrete mix design: hands-on approach to mixing and testing of concrete cylinders with different compositions.	Yes	No
CIVL 222	Numerical Methods for Civil Engineers	Moore, I.	Computer simulations	No	No
CIVL 230	Solid Mechanics I	Pilkey, K. Nelson, M	Axial Load Test; Flexure Test	Yes	No
CIVL 231	Solid Mechanics II	MacDougall, C	Using the "Learning Column" - labs involve loading an actual column in one of the engineering buildings and comparing the theoretical results that the students calculate with the experimentally acquired data	No	No
CIVL 250	Hydraulics I	da Silva, A.	Stream Flow Measurement; Uniform gradually varied and rapidly varied flows	Yes	No
CIVL 260	Civil Engineering Design I	Nelson, M Sadeghian, P	Fabrication of wood structures using the prototyping facility at Beamish Munro Hall. Use of computer lab for teaching and learning AutoCad	Yes	No
CIVL 300	Civil Week II - Professional Skills	Beddoe, R.	Bridge inspection and design evaluation in the field, environmental monitoring of water samples taken in the field, monitoring and evaluation of a landslide	Yes	No
CIVL 330	Structural Analysis	MacDougall, C	Computer simulations	No	No
CIVL 331	Structural Design I	MacDougall, C	Steel beam design lab	No	No
CIVL 340	Geotechnical Engineering I	Brachman, R.	Compaction, Consolidation, Shear Strength	Yes	No
CIVL 341	Geotechnical Engineering II	Beddoe, R.	Design, built and tested an earth dam. Modelled seepage and slope stability. Compared results with analytical prediction.	Yes	No
CIVL 350	Hydraulics II	Boegman, L.	Validation of analytical expressions against lab data/ Flow Visualization/ Understanding of measurement and	Yes	No

Course number	Course title	Course contact(s)	Description of the experiments	Safety addressed	Safety examined
			accuracy/Numerical modelling of river flows (HEC-RAS)		
CIVL 371	Groundwater Engineering	Mumford, K.	Aquifer investigation task (flownets, plume tracking in model aquifer)	No	No
CIVL 400	Civil Week III - Professional Skills	Beddoe, R.	Hands on problem solving/design scenarios	Yes	No
CIVL 430	Structural Design II	Green, M.	Study the behaviour of a simple reinforced concrete beam when tested to failure	Yes	No
CIVL 431	STR TE I: Infrastructure Rehabilitation	Hoult, N	Assessment of deteriorated reinforced concrete beams using non-destructive testing techniques	Yes	No
CIVL 436	STR TE II: Prestressed Concrete	Fam, A.	Comprehensive design project including bridge design & industrial crane supporting structures topics	No	No
CIVL 443	GEO TE I: Geoenvironmental Design	Brachman, R.	Waste management plan, geological model; landfill capacity & geometry; contaminant transport; barrier system design	Yes	No
CIVL 451	HYD TE I: Lake, Reservoirs and Coastal Eng	Boegman, L.	Laboratory wave measurement and analysis; numerical wave modelling in coastal environments; numerical lake and reservoir modelling; hydrodynamic and water quality	Yes	No
CIVL 455	HYD TE II: River Engineering	da Silva, A.	Sediment transport; formation of dunes and rivers in streams	Yes	No
CIVL 460	Civil Engineering Design II	Novakowski, K	Depends on design project, Approximately 15% of projects involve some laboratory testing	Yes	No
CIVL 470	Municipal Water Engineering	Anderson, B.	Four labs emphasize standard analytical procedures for characterization of waters and wastewaters and use of this information for implementation and design of treatment processes	Yes	Yes
CIVL 500	Civil Engineering Thesis	Novakowski, K	Depends on thesis. Approximately 80% of thesis projects involved some laboratory testing	Yes	No

Describe how safety is addressed in laboratory experience.

Safety is paramount when our laboratories are conducted. All students are required to take training on the Workplace Hazardous Materials Information System (WHMIS) in first year APSC 100. The Department has general safety rules that are posted on the departmental website and are distributed to students. Additional safety instructions are provided to students for specific laboratories. In general students are required to wear safety glasses in all laboratories. Full-face safety shields may be used in some laboratories (e.g., chemical or environmental labs). Safety shoes are required in some structural engineering laboratories. For off-campus field work, Queen's has an Off-Campus Activity Safety Policy (OCASP). For CIVL 200 and 300 (Civil Weeks), all students will need to review identified risks and measures to mitigate risks under the OCASP guidelines and are required to sign off on the form before participating in the field work components of these courses. This process both promotes safety and instructs the students in safety procedures. In CIVL 200, safety is examined because students must address safety issues in their oral presentations and written report. Safety is both addressed and examined in the labs of CIVL 470 (a safety quiz at the beginning and students must achieve 100% in order to be allowed into the lab). Each CIVL 470 lab starts with a safety briefing as well. Students in CIVL210 and CIVL470 are required to complete the WHMIS course or write the WHMIS refresher. Each of these courses has a lab session devoted to safety and the students are required to pass a quiz on biohazard safety; this is a biohazard lab permit requirement.

3.3.8 Evaluation of curriculum content

The requirements for curriculum content must be satisfied by all students, including those claiming advanced standing, credit for prior post-secondary-level studies, transfer credits, and/or credit for exchange studies.

Notes regarding criterion 3.3.8:

Conformance with this criterion will be evaluated based on a review of student transcripts. This review will be based on the Summary of Transcripts form.

3.3.8.1 **Prior education**

It is recognized that, for programs at some higher education institutions, some of the mathematics, natural sciences and complementary studies components of the curriculum may have been covered in prior university level (or post-secondary) education and this circumstance must be considered in the higher education institution's admission policy.

Please see section 3.2.1

3.4 Program environment

The Accreditation Board considers the overall environment in which an engineering program is delivered.

3.4.1 Quality of the educational experience

Major importance is attached to the quality of the educational experience as reflected by the following:

3.4.1.1 The quality, morale and commitment of the:

- students
- faculty
- support staff
- administration

Notes regarding criterion 3.4.1.1:

Conformance with this criterion will be evaluated based on information provided in the Academic Staff Information Sheets and interviews with students, faculty, support staff, and administrators. Additional comments may be provided in the following space.

Civil engineering students at Queen's are of very high quality (high admission standards, typically at least 85% high school average), are very active in department (e.g., Civil Club, Industry Open House), and are very engaged in the curriculum through Civil Weeks and feedback to the curriculum. Some interaction has declined with the increase in student numbers. Based on exit polls conducted by Queen's, the Department has the highest rating in the Faculty of Engineering and Applied Science. Across the whole Faculty, 89% of students rated their experience as excellent (2010 exit poll results).

The civil engineering faculty at Queen's are among the best in the country. For example, the Department ranks 2nd in the country in NSERC Discovery grants, 3rd in total research funding, and 4th in terms of numbers of graduate students (based on the 2010 CSCE survey of Chairs of Department). The teaching quality is excellent; faculty members have a strong sense of collegiality; and morale is high although strained by high student numbers.

The Department's support staff are extremely committed and competent. The support staff are managed by a Department Manager (Lloyd Rhymer) and consists of 4 administrative staff, and 7 technical staff positions. Cathy Wagar is the undergraduate program assistant whose main responsibility is for the undergraduate program. Morale is high although strained by high student numbers.

In terms of administration, the Department has a strong management structure. The management team consists of the Head (Novakowski), Associate Head (Green), Undergraduate Chair (Fam), Graduate Chair (Take), and the Department Manager

(Rhymer). The management team has regular meetings every 2 months. The Head, Associate Head, and Department Manager meet weekly to stay on top of issues. Additionally, monthly departmental meetings are held to keep department members informed; students and staff participate in these meetings.

3.4.1.2 The quality, suitability and accessibility of the:

- laboratories
- library
- computing facilities
- other supporting facilities

Notes regarding criterion 3.4.1.2:

Conformance with this criterion will be evaluated based on tours and interviews with support personnel in these facilities. Additional comments may be provided in the following space.

The Department presently uses many laboratory facilities to support a variety of undergraduate courses. Some courses require the laboratory space for the entire term the course is taught, while others have laboratory requirements of only short duration (a week or two). Several of our newer courses are very demanding on laboratory time.

The table presented below provides a summary of the current facilities used for undergraduate laboratories. The relevant courses for each facility are also listed in the table. For descriptions of the laboratories, please see Table 3.3.7. The current facilities in Beamish-Munro Hall (BMH) used for CIVL 210 include a preparatory dirty lab, a wet chemistry lab, and a lab with a fume hood for digestion having a total area of 130 m^2 (at 50% share). In addition, BMH has several group rooms, and working space for group projects. The Kennedy Field Station (north of Kingston) is used for CIVL 200 Civil Week.

Future Space Vision

At present we do not foresee expansion of our undergraduate labs beyond the current usage, with the exception that we wish to bring the labs used for CIVL 210 into Ellis Hall. This lab facility will be shared space with the Environmental Group and it is proposed that the facility be developed on the 1st floor in the area presently occupied by the cold rooms. The development of this facility is therefore dependent on the proposed move of the hydraulics lab in Ellis – 026 to West Campus and the relocation of the cold rooms into the space vacated by this move. The undergraduate labs currently operating in the hydraulics labs in Ellis Hall will be relocated to the larger space in the Coastal Lab. Estimated cost for a new environmental laboratory is approximately $500,000.

Undergraduate space

Room Number	Description and courses	Area m^2	Share %	Current m^2	Future m^2
Ellis-024	Structures Lab - High Bay Area CIVL 460, 500	270	5	14	14
Ellis-024	Structures Lab - Area outside strong floor, CIVL 430, 431, 500	80	50	40	40
Ellis-026	Hydraulics Lab, CIVL 250, 350, 371, 455	350	25	88	0
Ellis-043	Concrete Lab, CIVL 215, 430, 431	140	25	35	35
Ellis-038	Materials Lab, CIVL 215, 230, 500	70	10	7	7
Ellis-052	Undergraduate Lab, CIVL 340, 341, 470, 500	140	75	105	105
BMH	Existing CIVL 210 Lab	130	50		
Ellis-126	Proposed new lab CIVL 210, 470	0	0	0	65
Ellis-232	Computing Lab, CIVL 222, 460, 500	90	75	68	68
West Campus	Coastal Lab, CIVL 455	1870	5	94	181
	TOTAL LAB SPACE			**449**	**514**
Ellis-251	Study Area	120	100	120	120
Ellis-251D	Civil Club Office	15	100	15	15
	TOTAL OTHER SPACE			**135**	**135**
	TOTAL SPACE			**584**	**649**

Library

The Queen's University Library (QUL) consists of five main facilities. The Engineering and Science Library, located in the Douglas Library, provides resources and services for all engineering and science disciplines. An Advisory Committee on Library Collections and Services for Engineering and the Sciences composed of engineering and science faculty members, undergraduate and graduate students, and library staff members ensures continuing close consultation regarding the development of collections and delivery of services to the engineering and science community.

The Engineering and Science Library's homepage http://library.queensu.ca/webeng/ provides details of the Library's resources and services including a virtual tour of the facility. The Library, staffed by 5 librarians and 4.92 FTE library technicians, is open 95 hours per week for the majority of the year.

The Integrated Learning Librarian is primarily responsible for collaboration with the Faculty of Engineering and Applied Science as a whole, to identify, develop, promote, deliver, and assess services to applied science students and faculty. Some areas of collaboration include teaching support, curriculum design and development, and e-learning, especially with respect to working through the Engineering curriculum through librarian teaching. The Integrated Learning Librarian is also responsible for the continuing development of an integrated information literacy program for the Faculty, and is a member of the Faculty's Lifelong Learning Group, the Dean's Retreat Curriculum Review Committee (DRCRC), and the EGAD (Engineering Graduates Attribute Development) Project.

In addition to the liaison librarian model, QUL's recent reorganization has led to the creation of "Specialist" roles across the library system. These Specialists are responsible for maintaining a comprehensive spectrum of knowledge in specific strategic areas (e.g. E-Learning, Research, Assessment, Mobile Applications, Digital Initiatives, E-Books, Diversity, Teaching and Learning, Internationalization, Graduate Studies and Post-Doctoral Fellows), and for sharing that knowledge broadly. Two Engineering & Science librarians are specialists for Mobile Applications and E-Learning, respectively.

The Engineering and Science Library holds more than 330,000 volumes of print materials. In addition to print resources, Queen's University Library now provides access to more than 50,000 serial titles, primarily in the fields of science, technology, and medicine. QUL subscribes to over 600 electronic indexes and full text databases most of which are available both on and off campus.

In 2010/2011 with the approval of the members of the Advisory Committee on Library Collections and Services for Engineering and Science the Library ended the practice of allocating funds for print monographs and serials by department. The decision recognizes that as research and teaching become increasingly interdisciplinary, the division of resources by department becomes less and less meaningful. By the same token we no longer divide the acquisitions budget between pure and applied science departments. In 2010/2011 the total acquisitions budget for engineering and science was $2,731,500. Of this $2,449,000 was allocated to electronic resources including electronic books and serials, $100,000 to print monographs, $180,000 to print serials, and $2,500 to multimedia resources.

Computing Facilities

The computer facilities available to support the undergraduate program are provided through departmental resources, and through the university's Information Technology Services group. All students are provided with an account on the university system. The Department has a computing site (Ellis 232) consisting of 43 Windows-based workstations connected to an HP plotter and a laserjet printer. Two dedicated servers also support undergraduate activities. The software available on these workstations includes Microsoft Office, AutoCAD, MatLab, and SAP2000. Technical support is provided by the Department's computing technologist, Bill Boulton.

3.4.2 Faculty

The character of the educational experience is influenced strongly by the engineering competence, expertise, and outlook of the faculty. The faculty delivering the program must have the following characteristics:

3.4.2.1 Faculty qualifications and experience

There must be sufficient faculty to cover, by experience and interest, all of the areas of the curriculum.

Instructions for criterion 3.4.2.1:

Complete Table 3.4.2.1 either by entering your information below or by using the spreadsheet file included with this package. First identify the areas of curriculum; for example, mechanical engineering may have areas of solid mechanics, thermofluids, and materials science. List the faculty member(s) who teach in each area including their academic qualifications (BSc, MSc, PhD, etc.). Also include any non-academic experience, such as any industrial or related experience, that would make the faculty member particularly qualified to teach in the area.

Table 3.4.2.1: Faculty qualifications and experience

Areas of curriculum	Faculty member	Academic qualifications	Licensure status	Related experience
Environmental CIVL 370, 371, 480, 470, 471, 472	B. Anderson	MASc.; PhD	No	Expert consultation for wastewater treatment (e.g., Genivar, JL Richards); wastewater treatment research
	P. Champagne	BSc; BSc(Eng) MASc; PhD	P. Eng	Research in bioresources engineering
	B. Kueper	BASc; PhD	P. Eng	Consulting, groundwater research
	K. Mumford	BASc; MASc; PhD	P. Eng	Environmental engineer with Geomatrix (2002-2004); groundwater research
	K. Novakowski	MSc; PhD	LEL	Long-term consultant related to mining and groundwater contamination (provincial and industrial clients); groundwater research
	K. Rowe	BSc; BE; PhD; DEng	P. Eng	Geo-environmental research
	Y. Filion	BASc; MASc; PhD	P. Eng	Municipal engineer with R.V. Anderson (2000-2002); research in sustainable water distribution systems
Chemistry CIVL 210	P. Champagne	BSc; BSc(Eng) MASc; PhD	P. Eng	Cross-appointed to chemical engineering
	K. Mumford	BASc; MASc; PhD	P. Eng	Environmental Engineer with Geomatrix (2002-2004); Environmental/chemical engineering degree
Geotechnical CIVL 340, 341, 443	K. Rowe	BSc; BE; PhD; DEng	P. Eng	Geo-engineering research
	I. Moore	BE; PhD	P. Eng	Extensive specialist consulting for engineering firms (Golder, Armtec, etc.) and governments (Manitoba, Florida, etc.); geotechnical research
	A. Take	BScE; MSc; PhD	P. Eng	Geo-engineering research
	R. Brachman	BESc; PhD	P. Eng	Geo-engineering research
Hydrotechnical CIVL 250, 350, 450, 451, 455	A. Da Silva	BSc, MSc, PhD	P. Eng	Research engineer, US Army Corps of Engineers; research in hydraulics and water resources
	L. Boegman	BEng; MASc; PhD	Applied	Consulting for Environment Canada and Ontario Ministry of Environment to model water

				quality; research on hydrodynamics in lakes and reservoirs
	Y. Filion	BASc; MASc; PhD	P. Eng	Municipal engineer with R.V. Anderson Associates Ltd. (2000-2002)
	R. Mulligan	BASc; MASc; PhD	P. Eng	1999-2003: Coastal Engineer at Hay & Company Consultants, Vancouver, BC
Numerical Methods CIVL 222	B. Kueper	BASc; PhD	P. Eng	Research on numerical modelling of groundwater systems
	I. Moore	BE; PhD	P. Eng	Research on numerical modelling of geotechnical systems
	K. Mumford	BASc; MASc; PhD	P. Eng	Research on numerical modelling of groundwater systems
Material Science CIVL 215	R. Brachman	BESc; PhD	P. Eng	Research into properties of geo-materials
	B. Anderson	MASc; PhD	No	Research into material properties of water
	I. Moore	BE; PhD	P. Eng	Research into properties of geo-materials
	C. MacDougall	MASc; PhD;	P. Eng	Research in characterization of structural materials
	D. Cree	PhD	P. Eng	Research in material characterization
Solid Mechanics CIVL 230, 231	A. Fam	MSc; PhD	P. Eng	Consulting for several industries, including Advanced Infrastructure Technologies (AIT), Lancaster Composites Inc.; research in structural composites
	I. Moore	BE; PhD	P Eng	Extensive specialist consulting for engineering firms (Golder, Armtec, etc.) and governments (Manitoba, Florida, etc.)
	M. Green	BSc; PhD	P. Eng	Academic leave at Halsall Associates; consulting; research in structural composites
	C. MacDougall	MASc; PhD;	P. Eng	Research in sustainable structures
	N. Hoult	BASc; MASc; PhD	P. Eng	Design engineer at Halsall Associates; research in structural composites and monitoring

Structures CIVL 330, 331, 430, 431, 436	A. Fam	MSc; PhD	P Eng	Consulting for several industries, including Advanced Infrastructure Technologies (AIT), Lancaster Composites Inc., research in structural composites
	M. Green	BSc; PhD	P. Eng	Academic leave at Halsall Associates; consulting; research in structural composites
	N. Hoult	BASc; MASc; PhD	P. Eng	Design engineer at Halsall Associates; research in structural composites and monitoring
	C. MacDougall	MASc; PhD;	P. Eng	Research in sustainable structures
	I. Moore	BE; PhD	P. Eng	Extensive specialist consulting for engineering firms (Golder, Armtec, etc.) and governments (Manitoba, Florida, etc.); research in buried infrastructure

3.4.2.2 **Sufficient number of full-time faculty**

Even though the faculty involved in the delivery of program elements may include full-time and part-time members, there must be a sufficient number of full-time faculty members to assure adequate levels of student-faculty interaction, student curricular counselling and faculty participation in the development, control and administration of the curriculum.

Notes and response for criterion 3.4.2.2:

Conformance with this criterion will be evaluated based on a review of the Summary of Academic Staff table 5.1a and 5.1b. Additional comments may be provided in the following space.

As demonstrated in Table 3.4.2.1, the Department has sufficient full-time faculty members to offer all the elements of the program. Although some courses are taught periodically by adjunct faculty members, the Department is not dependent upon adjunct faculty to teach any one specific course. Nevertheless, one area of weakness is in materials (CIVL 215). The Department has recently hired Duncan Cree as a full-time faculty member to teach this course for the next three years, and plans to hire in the materials area for its next tenure-track position. Several full-time faculty members are well-versed in the intricacies of the curriculum (Novakowski, Green, Fam, da Silva, Brachman, and Filion) and thus the Department maintains very active full-time faculty participation in student curricular counselling (particularly Fam, Green, and da Silva) and development, control, and administration of the curriculum (through the Curriculum Committee and the Management Team). The Department also sustains very vibrant student-faculty interaction although this is currently strained with high enrolment in civil engineering. The Department prides itself on the high level of faculty interaction with students and this is encouraged at several levels including faculty participation in tutorials and laboratories, Civil Weeks, and student-organized social activities (BBQs, curling bonspiel, banquet, etc.). The innovative Civil Weeks are particularly prominent in encouraging faculty-student interaction because each faculty member is responsible for a team of new civil engineering students as part of CIVL 200. Thus, during students' first week in the Department, they have several opportunities to interact and get to know at least one of the professors in a small group setting. Thus, CIVL 200 – Civil Week sets the stage for positive student-faculty interactions later in the program.

3.4.2.3 **Balance of faculty duties**

Faculty administrative and teaching duties should be appropriately balanced to allow for adequate participation in research, scholarly work, professional development activities, and industrial interaction.

Notes and response for criterion 3.4.2.3:

Conformance with this criterion will be evaluated based on a review of the Summary of Academic Staff table. Additional comments may be provided in the following space.

All faculty members in the Department are extremely active in research, scholarly work, professional development, and industrial interaction. The research activity in the Department is one of the highest in the country as measured by NSERC Discovery grants and number of graduate students (based on the 2010 survey of chairs of civil engineering departments). All faculty members currently hold NSERC Discovery grants and some of the grants are amongst the highest in the country (Rowe, Moore, Take, Fam). Professors Moore, Take, and Fam also hold prestigious NSERC Discovery Accelerator Supplements. Three professors (Rowe, Moore, Fam) hold Canada Research Council (CRC) Chairs and Professor Champagne has recently been nominated by Queen's for a CRC Chair.

Faculty members are also actively engaged in professional development and industrial interaction. For example, all faculty members are either engaged in industrial-related research or consulting.

3.4.2.4 **Under no circumstances should a program be critically dependent on one individual.**

Notes regarding criterion 3.4.2.4:

Conformance with this criterion will be evaluated based on a review of the Summary of Academic Staff table. Conformance may also be evaluated based on interviews that take place during the visit. Additional comments may be provided in the following space.

As demonstrated in Table 3.4.2.1, the Department has sufficient full-time faculty members to offer all the elements of the program. For each core course, at least two full-time faculty members have the relevant expertise to offer the course. Most elective courses can also be taught by at least two faculty members.

3.4.3 Leadership

The Dean of Engineering (or equivalent officer) and the head of an engineering program (or equivalent officer with overall responsibility for each engineering program) are expected to provide effective leadership in engineering education and to have high standing in the engineering community. They are expected to be engineers licensed in Canada, preferably in the jurisdiction in which the higher education institution is located. In those jurisdictions where the teaching of engineering is the practice of engineering, the officers are expected to be engineers licensed in that jurisdiction. To evaluate this criterion, the Accreditation Board will rely on the *Statement of interpretation on licensure expectations and requirements*. The document is available in the 2010 Canadian Engineering Accreditation Board's Accreditation Criteria and Procedures document, which is online at www.engineerscanada.ca and from the Accreditation Board secretariat.

Instructions for criterion 3.4.3:

Complete Table 3.4.3 either by entering your information below or by using the spreadsheet file included with this package. Provide the name of the officer, his/her position, her/his professional designation, and the licensing association. If the officer is not an engineer licensed in Canada provide an explanation.

Table 3.4.3: Officers responsible for the engineering department and program

Name of officer	Position	Professional designation	Province/territory where licensed
Woodhouse, K.	**Dean of Engineering**	P.Eng	Ontario
Novakowski, K.	Department Head	LEL	Ontario
Green, M.	Associate Head	P.Eng	Ontario
Fam, A.	Undergraduate Chair	P.Eng	Ontario

3.4.4 Expertise and competence of faculty

Faculty delivering the engineering curriculum are expected to have a high level of expertise and competence, and to be dedicated to the aims of engineering education and of the self-regulating engineering profession, which will be judged by the following factors:

- Level of academic education
- Diversity of professional backgrounds
- Ability to communicate effectively with students
- Experience in teaching, research, and design practice
- Level of scholarship as shown by scientific, engineering and professional publications
- Degree of participation in professional, scientific, engineering and learned societies
- Personal interest in, and documented support of, the curriculum and program-related extra-curricular activities
- Appreciation of the role and importance of the self-regulating engineering profession, and of positive attitudes towards professional licensure and involvement in professional affairs.

Notes for criterion 3.4.4

Conformance with this criterion will be evaluated based on a review of the Summary of Academic Staff table and Academic Staff Information Sheets. Additional comments may be provided in the following space.

Academic education and diversity of professional backgrounds

All faculty members hold PhDs from internationally renowned universities both within Canada (Waterloo-2, UBC-1, Toronto-1, McMaster-1, Dalhousie-1, Western-2, Queen's-1, Manitoba-1, Carleton-1) and internationally (Cambridge, UK–3; Sydney, Australia-2; Western Australia – 1). Faculty members have a diverse background in terms of research and teaching interests covering a wide range of structural, geotechnical, hydrotechnical, and environmental areas. A number of faculty members have industrial experience as summarized in Table 3.4.2.1.

Ability to communicate effectively with students and experience in teaching

All our faculty members are able to communicate effectively with students as evidenced by high ratings by students in undergraduate student assessment of teaching (USAT) surveys. The average rating is approximately 4 out of 5. This high rating is also evidence of the high quality of instruction delivered by our faculty members. In terms of experience, 13 of our 17 faculty members have taught full-time for at least 5 years. Of the four remaining less experienced faculty members (Hoult, Filion, Mumford, Mulligan), two of them (Filion and Hoult) have won teaching awards.

Experience in design practice

Our faculty members have solid experience in design practice either through full-time employment as practicing engineers or through consulting activities as summarized in Table 3.4.2.1.

Experience in research and level of scholarship

All our faculty members are very experienced and active in research, and the level of scholarship is one of the highest in the country as described in section 3.4.2.1.

Participation in professional, scientific, engineering and learned societies

Faculty members are active in several societies and have key roles such as editorships, conference organization, and chairing of technical committees as described in the academic staff information sheets.

Curriculum development and extra-curricular activities

All faculty members have been very involved in the recent curriculum development process. As described in pages 10 and 11, our new curriculum was developed through a process that involved input from all faculty members. Furthermore, each specialty group in the department (structural, geotechnical, hydrotechnical, and environmental) has been active in designing new technical electives that have been delivered for the past two years. Finally, the Department has a very active curriculum committee composed of 5 faculty members and one student member.

3.4.5 Professional status of faculty members

Faculty delivering curriculum content that is engineering science and/or engineering design are expected to be licensed to practice engineering in Canada, preferably in the jurisdiction in which the higher education institution is located. In those jurisdictions where the teaching of engineering is the practice of engineering, they are expected to be licensed in that jurisdiction. To evaluate this criterion, the Accreditation Board will rely on the *Statement of interpretation on licensure expectations and requirements.* The document is available in the 2010 Canadian Engineering Accreditation Board's Accreditation Criteria and Procedures document, which is online at www.engineerscanada.ca and from the Accreditation Board secretariat

Notes for criterion 3.4.5:

Conformance with this criterion will be evaluated based on the higher education institution's responses to Criteria 3.3.4.1 and 3.3.4.3. Additional comments may be provided in the following space.

Professional licensure and the self-regulating engineering profession

The Department is very committed to the engineering profession and regards professional licensure very highly. As a result, of 14 our 17 faculty members are licensed as professional engineers (P.Eng) (Table 3.4.2.1). One additional faculty member (Novakowski) has a limited engineering license (LEL), another is in the final process of obtaining his P.Eng (Boegman), and the remaining faculty member (Anderson) will apply for the new LEL designation this year.

3.4.6 Program financial resources

The program's financial resources must be sufficient to ensure that

3.4.6.1& 3.4.6.2 **Qualified academic staff and qualified support staff can be recruited, retained, and provided with continuing professional development**.

Notes for criteria 3.4.6.1 & 3.4.6.2:

Conformance with this criterion will be evaluated based on a review of the Summary of Staff Changes table. Additional comments may be provided in the following space and programs may wish to present the information in the form of a table of departmental faculty members with an indication of percentage of time spent on each program within the department.

The Faculty of Engineering and Applied Science is known as a very collegial and challenging environment to work in, with distinguished, and award winning, teachers and researchers. During recruitment efforts our Departments are diligent in ensuring that available positions are broadly circulated to reach a wide audience. Advertisements must be placed in either University Affairs or Canadian Association of University Teachers Bulletin. In addition, a notice will be circulated to other engineering departments across Canada, unit websites, appropriate professional journals, and where appropriate, national newspapers and other venues. All members participating in Appointments Committee must complete an equity workshop that covers the principles, and objectives of equity.

Queen's University has a Faculty Recruitment and Support Program (FRSP) devoted to assisting departments with recruitment and retention matters. The Program Coordinator provides in depth knowledge to prospective members on Kingston and the Queen's community from the initial interview visits, through to the relocation to

Queen's. The FRSP hosts an orientation for new faculty in August each year. Additionally, the Senior Staffing Officer meets and provides an orientation to all new faculty members joining Engineering and Applied Science.

A number of ongoing initiatives support the professional development for faculty. Some of these include:

- A combined training and working sessions on CEAB graduate attributes for approximately 20 faculty who are involved in curriculum design and accreditation
- Winners of the first year teaching and learning award receive a membership to ASEE, the largest engineering education society
- Queen's hosted the inaugural Canadian Engineering Education Association conference last summer, and many faculty members attended and presented.
- Engineering and Applied Science faculty facilitate and participate in teaching and learning workshops offered through the Centre for Teaching and Learning.
- New faculty are encouraged to enroll in a teaching and learning program through either our Centre for Teaching and Learning, or at regional workshops.
- Faculty members receive a professional expense to maintain and enhance their academic and professional competence.

In the Faculty of Engineering and Applied Science we are fortunate to have recruited and retained a very talented group of staff. Historically we have experienced minimal turnover. We believe the reputation of the Faculty is known across the Queen's community as a positive and engaging place to work. Over the past few years, when we have filled positions, we've added to our team with a blend of internal Queen's experience and outside perspectives.

In 2009/2010 and 2010/11, the Dean's Office initiated an annual Faculty-wide succession planning, skills assessment, and training initiative for staff that identified current and future training and succession needs, and considered opportunities that would encourage professional growth. We have a number of staff that are working on completing degrees on a part-time basis and those taking advantage of the numerous learning opportunities available through the Human Resources department at Queen's. We support the retention of staff by creating an open and collaborate work environment.

3.4.6.3 & 3.4.6.4 **Infrastructure and equipment can be acquired, maintained, and renewed.**

Notes for criteria 3.4.6.3 & 3.4.6.4:

Conformance with this criterion will be evaluated based on a review of the Summary of Expenditures table and visit information. Additional comments may be provided in the following space.

Based on Table 5.3, the Department has had a relatively healthy infrastructure and equipment budget over the past three years. In terms of equipment acquisition, expenditures have averaged 2.9% of total Departmental budget over the past three years with a high of 3.8% in 2009-10 and a low of 1.8% in 2010-11. If the percentages are expressed in 'non-salary budget' dollars then the average expenditure over 3 years is 38.5%, the high in 2009-10 is 50.1% and the low in 2010-11 is 25.7%. This level of expenditure has allowed the Department to purchase new equipment required as part of the revised curriculum. Examples of equipment purchases include: new equipment for chemistry laboratories in CIVL 210, a new mobile structural testing frame 3 earth dam models, 5 consolidation machines, data acquisition equipment and transducers in all areas, concrete cylinder tester, concrete cylinder end grinder, fume hood replacements, 5 aquifer flow models, hydrology models, 2 survey-grade GPS systems,2 large drying ovens and LCD monitors for 40 PCs transferred from ILC to our computing lab. Also, the renovation to the computing lab was completed in 2008 and approximately $100k of this cost was attributable to the undergrad program.

3.4.7 Authority and responsibility for the engineering program

The Engineering Faculty Council (or equivalent engineering body) must have clear, documented authority and responsibility for the engineering program, regardless of the administrative structure within which the engineering program is delivered.

Instructions and response for criterion 3.4.7:

Identify the council(s) that hold authority and responsibility for the engineering program.

The Faculty Board of the Faculty of Engineering and Applied Science is the governing academic body that controls the academic conduct and integrity of all ten undergraduate engineering programs at Queen's and the academic progress of individual students in the Faculty. The Faculty Board Rules of Procedure and Committee Terms of reference are included in Appendix 3.4.7 A.

The programs in Engineering Physics, Geological Engineering, and Mathematics and Engineering, which are not under the direct administrative supervision of the Dean of Engineering and Applied Science, are under the academic direction and control of the Faculty Board in which the Dean fulfils the role of Chief Executive Officer. All academic staff members who teach core courses in these three engineering science programs are members of Faculty Board. Faculty members from the School of Computing and the

Chemistry Department, who teach core courses to engineering students, are also eligible for membership on the Engineering and Applied Science Faculty Board.

Administrative responsibility for each engineering program begins with the Head of Department for that program and his/her decisions are made under the authority of the appropriate dean. The Dean of Engineering and Applied Science performs this function for the five departments in the Faculty of Engineering and Applied Science and the Dean of Arts and Science is responsible for financial and administrative decisions in the three departments that offer engineering science programs. The Dean of Engineering and Applied Science exercises administrative control through ongoing contact with the heads and through monthly meetings of the Committee of Heads of Departments (department heads of all engineering programs and the Chair of Faculty Board). There naturally exists close cooperation between the two deans in matters that affect the three engineering programs offered through the Faculty of Arts and Science. A memorandum of understanding between the faculties interprets the financial obligations of both faculties to support engineering programs under the auspices of the Provost and Vice-Principal (Academic) (Appendix 3.4.7 B).

Academic responsibility for the first year program rests with the Associate Dean (Academic) who is assisted in this task by the Director (Program Development). Although all departments are involved in the instruction of students in the first year program, they do so with the approval of the Associate Dean (Academic), and only after ensuring that their contributions meet the rigorous academic standards established by the Faculty.

3.4.8 Curriculum committee

Engineering program curriculum changes are expected to be overseen by a formally structured curriculum committee. The majority of the members of the committee are expected to be licensed professional engineers in Canada, preferably in the jurisdiction in which the higher education institution is located. In those jurisdictions where the teaching of engineering is the practice of engineering, they are expected to be licensed in that jurisdiction.

Instructions for criterion 3.4.8:

Complete Table 3.4.8 either by entering your information below or by using the spreadsheet file included with this package. Enter the name of the chair of the committee first. If the member is not an academic faculty member, enter their designation (student, support staff, etc.) in the professional status column. Otherwise enter P.Eng., ing., limited licensee, Engineer in Training, etc. If the academic faculty member has no professional status, leave the last column blank.

Table 3.4.8: Curriculum committee members

3.4.8 Curriculum committee

Table 3.4.8: Curriculum committee members

Name of committee member	Affiliation (dept. program or unit)	Professional status
Chair: Morin, E.	Electrical and Computer Engineering	P.Eng.
Archibald, J.	Robert M. Buchan Department of Mining	P.Eng.
Clapham, L.	Physics, Engineering Physics & Astronomy	P.Eng.
De Souza, E.	Robert M. Buchan Department of Mining	P.Eng.
MacDougall, C.	Civil Engineering	P.Eng.
Plevan, V. (Student)	Engineering Society	
Bunn, A. (Student)	Engineering Society	

Name of committee member	Affiliation (dept. program or unit)	Professional status
Chair: Green, M.	**Civil Engineering**	**P.Eng**
Brachman, R.	Civil Engineering	P. Eng
Filion, Y.	Civil Engineering	P. Eng
Fam, A.	Civil Engineering	P. Eng
Novakowski, K.	Civil Engineering	LEL
Hawkins, L. (Student)	Civil Engineering	

3.5 Accreditation procedures and application

3.5.1 Accreditation applies only to programs, not to departments of faculties.

3.5.2 Application of the accreditation process to an engineering program is undertaken only at the invitation of a particular higher education institution and with the consent of the appropriate regulator.

3.5.3 The accreditation process comprises two parts: program evaluation by a visiting team and accreditation decision by the Accreditation Board. The evaluation of the program is based on detailed data provided by the higher education institution and on the collective opinion of the members of the visiting team. The accreditation decision is made by the Accreditation Board based on qualitative and quantitative considerations.

3.5.4 For purposes of accreditation, a program is characterized by a formally approved and published curriculum that is regarded as an entity by the higher education institution and that can be considered independently. All options in the program are examined. Following the principle that a program is only as strong as its "weakest link", a program is accredited only if all such variations meet the criteria.

Instructions for criterion 3.5.4:

Provide of a copy of the most recent authoritative document that fully defines the program under review.

The most recent authoritative document that fully defines the civil engineering program is the Faculty of Engineering and Applied Science 2010-2011 calendar given in Appendix C. The program is described on pages 34 to 41 of this document.

3.5.5 An accredited program must include the word "engineering" in its title.

3.5.6 The title of an accredited engineering program must be properly descriptive of the curriculum content.

Instructions for criterion 3.5.6:

Attach as Exhibit 4 copies of degree certificates and copies of transcript entries, including all variations which might include options, distinctions, minors, etc.

3.5.7 If a program, by virtue of its title, becomes subject to the content requirements for two or more engineering curricula, then the program must meet the Accreditation Board requirements for each engineering curriculum named.

Notes regarding criterion 3.5.7:

Conformance with this criterion will be evaluated based on a review of the Summary of Curriculum table. Additional comments may be provided in the following space.

Not applicable.

3.5.8 The Accreditation Board does not evaluate or accredit non-engineering degrees, diplomas, or certificates or components thereof; only the engineering degree will be listed in the annual report section on accredited engineering programs.

3.5.9 The Accreditation Board must have evidence that all engineering options contain a significant amount of distinct curriculum content and that the name of each option is descriptive of that curriculum content. The document entitled *Statement of interpretation on curriculum content for options and dual-discipline program* is available in the 2010 Canadian Engineering Accreditation Board's Accreditation Criteria and Procedures document, which is online at www.engineerscanada.ca and from the Accreditation Board secretariat.

Notes regarding criterion 3.5.9:

Conformance with this criterion will be evaluated based on a review of the Summary of Curriculum table. Additional comments may be provided in the following space.

Not applicable. No options.

3.5.10 The Accreditation Board must have evidence that the program name is appropriate for all students graduating in the program regardless of the option taken.

Notes regarding criterion 3.5.10:

Conformance with this criterion will be evaluated based on a review of the Summary of Curriculum table. Additional comments may be provided in the following space.

Not applicable. No options.

3.5.11 Accreditation of a program is granted only after students have graduated from the program. For new programs, an accreditation visit may be undertaken in the final year of the first graduating class.

Notes regarding criterion 3.5.11:

If this is a program from which no students have yet graduated but at least one student is expected to graduate by the time of the decision meeting of the Accreditation Board, attach as Exhibit 5 a copy of the transcript of the student that you believe is most likely to graduate.

3.5.12 Accreditation is granted for a period of time up to and normally not exceeding six years.

3.5.13 Any significant change that takes place during the term of accreditation of an accredited engineering program must be reported to the Accreditation Board. Any change related to an aspect referred to in the *Accreditation Criteria and Procedures* and related regulations is a significant change giving rise to the reporting obligations and may necessitate an immediate reassessment. Any change in the title of an accredited program requires approval by the Accreditation Board for that program's continued accreditation. When a higher education institution supplies information for the renewal or extension of accreditation, it has an obligation to highlight and notify the Accreditation Board of any changes to the program.

3.5.14 The Accreditation Board reserves the right to alter the accreditation status of any program at any higher education institution if it is discovered that such program is not in compliance with any of the Accreditation Board's accreditation criteria or regulations.

4. List of required exhibits

The following information must be provided, and is referenced at various points in the questionnaire. Please number and attach the exhibits at the end of the completed questionnaire.

Exhibit 1: Mission statements, vision statements, strategic plans and similar documents

Provide mission statements, vision statements, strategic plans and similar documents that affect the program being evaluated.

Exhibit 2: Admission, promotion, and graduation

Provide documents describing the processes and policies for admission, promotion, and graduation. Required to satisfy Criteria 3.2 and 3.3.8.1.

Exhibit 3: Advanced standing, prior studies, transfer credits and/or exchange studies

Provide documents describing the procedures to evaluate advanced standing, prior studies, transfer credits and/or exchange studies. Required to satisfy Criterion 3.3.8.1.

Exhibit 4: Degree certificates and transcript entries

Provide copies of degree certificates and transcript entries for all variations of the program. Required to satisfy Criterion 3.5.6.

Exhibit 5: Transcript of the student "most likely to graduate"

If this is a program from which no students have yet graduated but at least one student is expected to graduate by the time of the decision meeting of the Accreditation Board, attach a copy of the transcript of the student that you judge "most likely to graduate".
See Criterion 3.5.11.

5. Data tables

The tables that follow are an integral component of the evaluation process. Complete these tables either by entering your information below or by using the spreadsheet files included with this package. **Higher education institutions are requested to make appropriate linkages among courses so that there is consistency in the assignment of AU and so that if changes are made to the AU allocation for a course that is shared by programs, that change is automatically reflected in the AU tables for all courses**

5.1 Summary of academic staff tables: Instructions

Table 5.1a: Summary of academic staff holding continuing appointments
Complete Table 5.1a for all academics who hold a continuing appointment and teach/taught at least one course during the last two years that contained AU of engineering science and/or engineering design.

Table 5.1b: Summary of academic staff not holding continuing appointments
Complete Table 5.1b for all academics who do not hold a continuing appointment and teach/taught at least one course during the last two years that contained AU of engineering science and/or engineering design.

Explanations of the data to be entered for Tables 5.1a and 5.1b:

- **Column 1**: Enter the names of all academics
- **Column 2**: Enter the rank of the academic as of the date of submitting this documentation. Choose one of the following: Full professor (FP); Emeritus professor (EP); Associate professor (AP); Assistant professor (SP); Lecturer (L); Instructor (I); Senior instructor (SI); Sessional (S); Graduate student (GS)
- **Column 3**: Enter the date of hire.
- **Column 4**: Enter the licensure status. Choose one of the following: P.Eng., ing., limited licensee (Ltd. lic.), or Engineer in Training (EIT). Select "N" if the academic is not licensed.
- **Column 5**: Enter the date of licensure if licensed, or the date of first applying to a professional engineering association if not licensed.
- **Column 6**: If not licensed but deemed to be academically qualified (AQ), enter an "X" in this column.
- **Column 7**: If not licensed but deemed to have satisfied the engineering experience (EE) requirement, enter an "X" in this column.
- **Column 8**: If not licensed but have passed the professional practice (PP) examination, enter an "X" in this column.
- **Columns 9 through 12**: Enter the course numbers for courses taught at the undergraduate and graduate levels during the last two years.

5.1a Summary of academic staff holding continuing appointments

1	2	3	4	5	6	7	8	9	10	11	12
			Professional engineering licensure status					**Teaching**			
								Undergraduate		**Graduate**	
Name of faculty member	**Rank**	**Hire date**	Status	Date applied or licensed	AQ	EE	PP	Last academic	This academic	Last academic	This academic
Anderson, B.C.	FP	1-Sep-1990	N					CIVL 370, CIVL 470	CIVL 370, CIVL 470	CIVL 886	CIVL 886
Boegman, L.	SP	1-Sep-2005	N					CIVL 350, CIVL 451	CIVL 350, CIVL 451	CIVL 855	CIVL 855
Brachman, R.W.I.	AP	1-Jul-2001	P.Eng.					CIVL 340, CIVL 443	CIVL 340, CIVL 443	CIVL 848	CIVL 842
Clapham, L.	FP	11-Jan-1988	P.Eng.						APSC 100		
Cunningham, M.F.	FP	1-Mar-1996	P.Eng.						APSC 131		
da Silva, A.M.	FP	1-Jul-2004	P.Eng.	Oct-99				CIVL 250, CIVL 455	CIVL 250, CIVL 455	CIVL 850, CIVL 857	CIVL 850, CIVL 857
Dean, T.	AP	10-Jan-1994	N						SOFT 423, ELEC 377		
Dumas, G.A.	FP	1-Nov-1985	P.Eng.					CIVL 220, CIVL 230	APSC 161 MECH 333		
Fam, A.Z.	FP	1-Sep-2002	P.Eng.	Feb-04				CIVL 436	CIVL 436	CIVL 834, CIVL 837	CIVL 828, CIVL 837
Filion, Y.	SP	1-Oct-2006	P.Eng.	2005				CIVL 380, CIVL 450	CIVL 380, CIVL 450	CIVL 890	CIVL 890
Frank, B.	AP	1-Sep-2002	P.Eng.						APSC 100		
Grandmaison, E.W.	FP	1-Sep-1973	P.Eng.						CHEE 331, CHEE 342, CHEE 412, CHEE 481		
Green, M.F.	FP	1-Jan-1992	P.Eng.					CIVL 430	CIVL 430	CIVL 892	CIVL 838
Hanes, J.A.	AP	1-Sep-1981	N						APSC 151		

1	2	3	4	5	6	7	8	9	10	11	12
Hoult, N.	SP	1-Sep-2009	P.Eng.	10-Dec				CIVL 431	CIVL 231, CIVL 431		
Krstic, V.D.	FP	20-Oct-1998	P.Eng.						MECH 371, MECH 474, MECH 475		
Lake, K.	FP	1-Aug-1979	N						PHYS 321, APSC 112		
MacDougall, C.	AP	1-Aug-2001	P.Eng.					CIVL 330, CIVL 331	CIVL 330, CIVL 331	CIVL 839	CIVL 836
Matovic, M.D.	SP	1-Sep-1993	P.Eng.						MECH 341, MECH 444		
Moore, I.D.	FP	1-Jul-2001	P.Eng.	Feb-92				CIVL 222	CIVL 222	CIVL 841	
Mumford, K.	SP	1-Jan-2010	P.Eng.	2006					CIVL 371, CIVL 471		
Narayanan, S.	AP	1-Sep-1996	N						APSC 112		
Newstead, W.	AP	8-Sep-1993	N						APSC 131, APSC 132		
Noble, A.	AP	1-Jul-2002	N						APSC 112		
Novakowski, K.S.	FP	1-Aug-2000	LEL					CIVL 460, CIVL 500	CIVL 460, CIVL 500	CIVL 882	CIVL 881
Pilkey, K.	FP	1-Jul-2000	P.Eng.						CIVL 220, CIVL 230, MECH 470		
Pollard, A.	FP	1-Jul-1981	P.Eng.						MECH 330, MECH 441		
Ramsay, J.A.	FP	1-Jul-2001	N						CHEE 229, CHEE 484		
Rudie, K.	FP	1-Jul-1992	P.Eng.						APSC 142, ELEC 270		
Yao, Z.	SP	1-Aug-2009	N						APSC 161		
Zak, G.	AP	1-Nov-1998	P.Eng.						APSC 161, MECH 455		

5.1b Summary of academic staff not holding continuing appointments

1	2	3	4	5	6	7	8	9	10	11	12
			Professional engineering licensure status					**Teaching**			
								Undergraduate		**Graduate**	
Name of faculty member	**Rank**	**Hire date**	Status	Date applied or licensed	AQ	EE	PP	Last academic	This academic	Last academic	This academic
Beddoe, R.A.	S		N						CIVL 200, CIVL 300, CIVL 341, CIVL 400		
Carran, J.	S	1-Sep-2010	N						APSC 131		
Cree, D.	S	1-Jan-2010	P.Eng.					CIVL 215	CIVL 215		
Flynn, L.E.	SP	1-Sep-2007	N						CHEE 370		
Lewis, T.	S	1-Sep-2010	P.Eng.						APSC 381, APSC 480		
Nelson, M.	S	1-Sep-2010	N						CIVL 260		
Sadeghian, P.	S	1-Sep-2010	N					CIVL 231	CIVL 260		
Safari, E.	GS	1-Apr-2004	N						CIVL 210		

5.2 *Summary of staff changes*

Complete this table either by entering your information below or by using the spreadsheet file included with this package. Include all permanent academic faculty who teach/taught program compulsory courses and technical electives containing engineering science and/or engineering design (if technical electives are offered as part of the program) in the last six years. . Please indicate the dates in each column for each faculty member. If a member was appointed and subsequently left within the six year period, enter the name only once and then enter the two dates in the appropriate columns.

Faculty complement for the last six years	**Appointed**	**Retired**	**Resigned**	**Deceased**
Cree, D.	Sept 2011			
Mulligan, R.	July 2011			
Mumford, K.	Jan 2010			
Hoult, N.	Sept 2009			
Filion, Y.	Oct 2006			
Bisby, L.	May 2003		May 2008	
Hall, K.	Sept 1987		Dec 2008	
Boegman. L.	Sept 2005			
Champagne, P.	Jun 2005			
Total count	**9**	**0**	**2**	**0**

5.3 *Summary of program expenditures*

Complete this table either by entering your information below or by using the spreadsheet file included with this package. Include information specific to the program (not the department) for the last three academic years. If necessary, pro-rate departmental expenditures based on student numbers or any other reasonable method of partitioning you can explain and justify.

	Academic year		
Expenditure category	2008/2009	2009/2010	2010/2011
Salaries and benefits			
Continuing academic	$1,532,191	$1,680,070	$1,966,189
Sessional academics	$41,007	$45,386	$50,346
Teaching assistants	$208,986	$220,156	$233,520
Support staff	$485,741	$517,603	$549,056
Benefits	$416,631	$459,161	$497,331
Subtotal	$2,684,556	$2,922,376	$3,296,442
Operating expenditures			
Teaching/office supplies	$56,058	$53,212	$47,672
Other (Tel., Travel, Delivery, Software Licenses)	$22,383	$22,055	$35,990
Subtotal	$78,441	$75,267	$83,662
Equipment expenditures (specify)			
Laboratory Equipment	$87,089	$98,545	$55,984
Computing Equipment	$8209	$21,415	$6045
Subtotal	$95,298	$119,960	$62,029
Other expenditures/acquisitions (specify)			
Renovations and Alterations	$42,153	$20,028	$67,649
Maintenance (Equipment and Facilities)	$3402	$7677	$8620
Ancillary Activities (FORUM, IOH, Job Network,,,)	$20,807	$16,654	$19,281
Subtotal	$66,362	$44,359	95,550

5.4 *Enrolment and degree data - Civil Engineering*

Student head count to be used

Academic year	Total new students entering program[1]	Total students in program[2]	Bachelors degrees conferred[3]
The Civil Engineering program as a whole:			
Current year	122	394	111
Current year (less one)	137	379	96
Current year (less two)	120	326	75
Option: NIL			
Current year	120	390	
Current year (less one)	136	359	
Current year (less two)	0	233	
Option: ZBeng			
Current year	2	2	
Current year (less one)	1	1	
Current year (less two)	0	0	
Option: CE1			
Current year	0	2	
Current year (less one)	0	15	
Current year (less two)	0	76	
Option: CE2			
Current year	0	0	
Current year (less one)	0	4	
Current year (less two)	0	17	

[1] Count of students entering second year in September.

[2] Count of students in second, third and fourth year in September.

[3] Degrees conferred in Spring convocation only

5.5 *Summary of curriculum tables: Instructions*

Complete the following tables by using a self-contained spreadsheet file included with this package:

5.5a Compulsory common core courses

5.5b Program-compulsory courses

5.5c Option-compulsory courses

5.5d Elective courses: include all courses and show the minimum path.

5.5e Program totals

Sample spreadsheet files are available that show the appropriate format from the Engineers Canada website at http://www.engineerscanada.ca/e/pu_ab_1.cfm

In all cases the information must relate to the courses that were most recently offered. For further information please contact the Accreditation Board secretariat.

Follow these guidelines:

- **Column 1**: Enter the course number and an abbreviated (but descriptive) course title.
- **Column 2**: Enter the academic credit units as assigned by the higher education institution.
- **Column 3**: Enter the actual lecture hours in the course. This can be based on the number of weeks of instruction (as calculated for Criterion 3.3.1) times the number of lectures per week, or an actual count of lectures.
- **Column 4**: Enter the actual tutorial plus laboratory hours in the course. These numbers must represent the actual contact hours, not simply a nominal number of hours per week times the number of weeks of instruction.
- **Columns 6 through 13**: Distribute the AU between the categories (Math; NS/natural sciences; CS/complementary studies; ES/engineering science; ED/engineering design). Each course in an engineering program should be described using a maximum of three curriculum categories (ES, ED, NS, Math, CS) with no single category constituting less than 25% of the total AU for a particular course. It is up to the higher education institution offering the program to justify the unique aspects of any course that deviates from these expectations. In such cases, enter a note in the space below the tables to justify the deviation; number the notes consecutively and index them in **Column 17**. For further explanation, please see the *Statement of interpretation on licensure expectations and requirements*.
- **Columns 14 through 16:** Indicate the AU only for curriculum content delivered by faculty members that meet the Accreditation Board accreditation licensure requirements. Please see the *Statement of interpretation on licensure expectations and requirements* for further information. The document is available in the 2010 Canadian Engineering Accreditation Board's Accreditation Criteria and Procedures document, which is online at www.engineerscanada.ca and from the Accreditation Board secretariat.

5.5a Compulsory common core courses

Program	**Civil Engineering**
Option	**All**

1		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
			Hours		Total AU	Curriculum components (AU)								Qualified AU		
Course	Title	AC	Lec.	Lab/ Tut.		Math	NS	M+ NS	CS	ES	ED	ES+ED	Other	ES	ED	ES+ED
APSC 100	Engineering Practice[1]	132	48	168	132	6	16	22	40	40	30	70		40	30	70
APSC 111	Mechanics	42	36	12	42	0	42	42	0	0	0	0		0	0	0
APSC 112	Electricity and Magnetism	42	36	12	42	0	31	31	0	11	0	11		0	0	0
APSC 131	Chemistry and Materials	42	36	12	42	0	31	31	0	11	0	11		0	0	0
APSC 132	Chemistry and the Environment	42	36	12	42	0	31	31	0	11	0	11		0	0	0
APSC 142	Introduction to Computer Programming for Engineers[2]	36	24	24	36	0	0	0	0	24	12	36		24	12	36
APSC 151	Earth Systems and Engineering[3]	48	36	24	48	0	24	24	12	12	0	12		0	0	0
APSC 161	Basic Engineering Graphics	42	24	36	42	0	0	0	0	31	11	42		31	11	42
APSC 171	Calculus I	42	36	12	42	42	0	42	0	0	0	0		0	0	0
APSC 172	Calculus II	42	36	12	42	42	0	42	0	0	0	0		0	0	0
APSC 174	Introduction to Linear Algebra	42	36	12	42	42	0	42	0	0	0	0		0	0	0
	Subtotal	552	384	336	552	132	175	307	52	140	53	193	0	95	53	148

Notes:

1 Administratively, this course is the combination of three "normal" length courses (42AU). The ED and NS are each primarily given in separate modules. ED and NS units are claimed, in spite of the 25% rule, since they each constitute more than 25% of a normal course

2 The ED units primarily come from the software design project in which students are required to program a robot to complete some task. The task is proposed by them and approved by course personnel. The project provides an opportunity for students to create their own design objectives on an open-ended project, determine what sensors and algorithms would be needed, and design a program to meet the design objectives. The project was created by Stan Simmons, P.Eng., including the expectations and grading scheme. The course coordinator, Karen Rudie, P.Eng., is responsible for modifications to the grading scheme, approving changes in objectives of the project, and overseeing the project. Each section will have a presentation on software design process before the project begins, given either by Karen Rudie or another P.Eng. guest speaker.

3 The ED units primarily come from the project, in which students design a casing for a consumer product provided to them, based on some components that must fit inside. The project will be overseen by Genevieve Dumas, a PEng, including setting up the expectations, training TA's, and overseeing TA's who mark it. This is worth 15% of the course grade. There will be one question on the final exam, worth about a quarter of the exam, or slightly over 10% of the overall course mark to be marked by Zak (P. Eng.) or Dumas that is fairly comprehensive and would assess graphical design.

5.5b Program-compulsory courses

Program **Civil Engineering**

Option **All**

1		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
			Hours			Curriculum components (AU)								Qualified AU		
Course	Title	AC	Lec.	Lab/ Tut.	Total AU	Math	NS	M+NS	CS	ES	ED	ES+ED	Other	ES	ED	ES+ED
CIVL 200	Civil Week 1 - Professional Skills	28	8	40	28	0	0	0	14	7	7	14		0	0	0
CIVL 210	Chemistry for Civil Engineers	60	36	48	60	0	15	15	0	30	15	45		0	0	0
CIVL 230	Solid Mechanics I	54	36	36	54	0	0	0	0	54	0	54		54	0	54
CIVL 260	Civil Engineering Design 1	48	36	24	48	0	0	0	12	12	24	36		0	0	0
MATH 224	Applied Mathematics for Civil Engineers	54	36	36	54	54	0	54	0	0	0	0		0	0	0
APSC 221	Economics and Business Practices in Engineering	36	36	0	36	0	0	0	36	0	0	0		0	0	0
CIVL 215	Materials for Civil Engineers	54	36	36	54	0	12	12	0	32	10	42		32	10	42
CIVL 222	Numerical Methods for Civil Engineers	60	48	24	60	45	0	45	0	15	0	15		15	0	15
CIVL 231	Solid Mechanics II	54	36	36	54	0	0	0	0	54	0	54		54	0	54
CIVL 250	Hydraulics I	48	36	24	48	0	4	4	0	22	22	44		22	22	44
CIVL 300	Civil Week - Professional Skills	28	8	40	28	0	0	0	14	7	7	14		0	0	0
CIVL 330	Structural Analysis	48	36	24	48	0	0	0	0	48	0	48		48	0	48
CIVL 340	Geotechnical Engineering 1	48	36	24	48	0	0	0	0	36	12	48		36	12	48
CIVL 350	Hydraulics 2	48	36	24	48	0	0	0	0	15	33	48		0	0	0
CIVL 370	Environmental Engineering 1	48	36	24	48	0	0	0	0	32	16	48		0	0	0
CIVL 331	Structural Design 1	48	36	24	48	0	0	0	0	12	36	48		12	36	48
CIVL 341	Geotechnical Engineering 2	48	36	24	48	0	0	0	0	12	36	48		0	0	0
CIVL 371	Groundwater Engineering	48	36	24	48	0	0	0	0	32	16	48		32	16	48
CIVL 380	Applied Sustainability and Public Health in Civil Engineering	48	36	24	48	12	0	12	0	24	12	36		24	12	36

CIVL 400	Civil Week - Professional Skills	28	8	40	28	0	0	0	14	7	7	14		0	0	0
CIVL 430	Structural Design 2	48	36	24	48	0	0	0	0	12	36	48		12	36	48
CIVL 450	Hydraulics 3	48	36	24	48	12	0	12	0	24	12	36		24	12	36
CIVL 460	Civil Engineering Design 2[1]	72	6	132	72	0	0	0	10	31	31	62		31	31	62
CIVL 470	Municipal Water Engineering	48	36	24	48	0	12	12	0	18	18	36		0	0	0
Plus	MGMT elective	36	36	0	36	0	0	0	36	0	0	0		0	0	0
Plus	3 courses HSS, LNK, PAL or MGMT	108	108	0	108	0	0	0	108	0	0	0		0	0	0
	Subtotal	1296	906	780	1296	123	43	166	244	536	350	886		396	187	583

Notes:

1. K. Novakowski (LEL) is the main instructor for the course. He teaches all ES and ED and supervises every project.
2.

5.5c Option-compulsory courses

Option: __NIL______________________

1		**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
			Hours			**Curriculum components (AU)**								**“Qualified” AU**			
Course number	**Course title**	**AC**	Lec.	Lab/ Tut.	**Total AU**	Math	NS	M+NS	CS	ES	ED	ES+ED	Other	ES	ED	ES+ED	**Note**
	Subtotal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Notes:

1.
2.

5.5d Elective courses

All elective courses must be listed here and the minimum path shown. If no elective courses are offered, please include a statement to that effect in the *Notes* below. **Shading indicates minimum path used for calculation.**

Program	**Civil Engineering**
Option	**All**

1		**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
			Hours			**Curriculum components (AU)**								**Qualified AU**		
Course	**Title**	**AC**	Lec.	Lab/ Tut.	**Total AU**	Math	NS	M+NS	CS	ES	ED	ES+ED	Other	ES	ED	ES+ED
Three of the following																
APSC 381	Fundamentals of Design Engineering	42	36	12	42	0	0	0	0	0	42	42		0	42	42
CIVL 431	STR TE I: Infrastructure Rehabilitation	48	36	24	48	0	0	0	0	32	16	48		32	16	48
CIVL 436	STR TE II: Prestressed Concrete	48	36	24	48	0	0	0	0	24	24	48		24	24	48
CIVL 443	GEO TE I: Geoenvironmental Design	48	36	24	48	0	0	0	0	12	36	48		12	36	48
CIVL 451	HYD TE I: Lake, Reservoir, and Coastal Engineering	48	36	24	48	0	0	0	0	24	24	48		0	0	0
CIVL 455	HYD TE II: River Engineering	48	36	24	48	0	0	0	0	24	24	48		24	24	48
CIVL 471	ENV TE I: Subsurface Contamination	48	36	24	48	0	0	0	0	34	14	48		34	14	48
CIVL 500	Civil Engineering Thesis	48	0	96	48	0	0	0	24	24	0	24		24	0	24
	Min-path	138	72	60	138	0	0	0	0	60	30	114		12	14	66
One of above list or below																
MECH 371	Fracture Mechanics and Dislocation Theory	42	36	12	42	0	11	11	0	20	11	31		20	11	31
MECH 441	Fluid Mechanics III	42	36	12	42	0	0	0	0	42	0	42		42	0	42

MECH 444	Computational Fluid Dynamics	42	36	12	42	0	0	0	0	30	12	42		30	12	42
CHEE 342	Environmental Biotechnology	42	36	12	42	0	0	0	0	42	0	42		42	0	42
CHEE 370	Waste Treatment Processes	42	36	12	42	0	0	0	0	17	25	42		0	0	0
CHEE 481	Air Quality Management	36	36	0	36	0	0	0	0	20	16	36		20	16	36
CHEE 484	Bioremediation	42	36	12	42	0	0	0	0	42	0	42		0	0	0
SURP 853	Environmental Services	36	36	0	36	0	0	0	36	0	0	0		0	0	0
MECH 333	Gender, Engineering and Technology	36	36	0	36	0	0	0	36	0	0	0		0	0	0
MINE 462	Occupational Health and Chemical Safety	42	36	12	42	0	0	0	42	0	0	0		0	0	0
APSC 480	Multi-disciplinary Design Project	108	24	168	108	0	0	0	28	0	80	80		0	80	80
	Min-path	36	0	0	36	0	0	0	0	0	0	0		0	0	0
	Free elective[1]	36	36	0	36	0	0	0	0	0	0	0		0	0	0
	Subtotal	210	108	60	210	0	0	0	0	60	30	114		12	14	66

Notes:

1. Must be approved by advisor for each student
2.

5.5e Program totals

Option: ____________________

Program	**Civil Engineering**														
Option	**All**														
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
		Hours			**Curriculum components (AU)**								**Qualified AU**		
Item	**AC**	Lec.	Lab/ Tut.	**Total AU**	M	NS	M+NS	CS	ES	ED	ES+ED	Other	ES	ED	ES+ED
Compulsory common core courses	552	384	336	552	132	175	307	52	140	53	193	0	95	53	148
Compulsory program courses	1296	906	780	1296	123	43	166	244	536	350	886	0	396	187	583
Compulsory options	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electives	210	108	60	210	0	0	0	0	60	30	114	0	12	14	66
Prior study															
Total	2058	1398	1176	2058	255	218	473	296	736	433	1193	0	503	254	797
Accreditation Board required	-	-	-	**1950**	**195**	**195**	**420**	**225**	**225**	**225**	**900**	**0**	**-**	**225**	**600**