UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

Report No. 3719 Revised

MEMORANDUM

To: Executive Committee of Faculty Council (April 6, 2022)
Faculty Council (April 27, 2022)

From: Professor Julie Audet
Chair, Engineering Graduate Education Committee (EGEC)

Date: April 7, 2022

Re: Adding Flexible-Time Option to Civil & Mineral Engineering's PhD Program

REPORT CLASSIFICATION

This is a major policy matter that will be considered by the Executive Committee for endorsing and forwarding to Faculty Council for vote as a regular motion (requiring a simple majority of members present and voting to carry).

PROPOSED

It is proposed to add a flexible-time option to the existing PhD program in Civil & Mineral Engineering to allow practicing professionals in a relevant field of study who require a modified time period and/or content delivery option to complete the requirements of the PhD program.

CONSULTATION PROCESS

The CivMin Graduate Studies Committee, CivMin faculty, other FASE departments, and the Faculty's Engineering Graduate Education Committee were consulted during the development of this proposal and no concerns were raised. This change will not impact other units.

RECOMMENDATION FOR COUNCIL

THAT the addition of a flexible-time option to Civil & Mineral Engineering's existing PhD program, as described in Report 3719 Revised, be approved.

University of Toronto
Major Modification Proposal
Significant Modifications to Existing Graduate and Undergraduate Programs

Program being modified:	Doctor of Philosophy (PhD)
Proposed major modification:	Adding Flexible-Time Option to Existing PhD Program
Department/unit (if applicable):	Civil & Mineral Engineering (CivMin)
Faculty/academic division:	Applied Science & Engineering (FASE)
Dean's Office contact:	Prof. Julie Audet, Vice-Dean, Graduate Studies
Proponent:	Professor Susan Andrews, Associate Chair, Graduate Studies (CivMin)
Version date:	April 5, 2022

1 Summary

The proposed change is the addition of a Flexible-Time option to CivMin's PhD program, allowing practicing professionals in a relevant field of study who require a modified time period and/or content delivery option to complete the requirements of the PhD program.

2 Effective Date

These options will be effective September 1, 2022.

3 Academic Rationale

At times, CivMin receives applications from active professional engineers engaged in professional activities that may include permanent or contractual work, self-employment, consulting or equivalent, with appropriate qualifications and relevant experience who would benefit from acquiring a PhD and who would, in turn, contribute significantly to research in CivMin. Introducing the Flexible-Time option would attract

these professionals and allow them to undertake CivMin's PhD program while continuing to work.

It is anticipated that the addition of the Flexible-Time option would increase the enrolment of PhD students in CivMin by one to two students per year (relative to a typical PhD student population of approximately 150 students).

4 Description of the Proposed Major Modification(s)

The proposed addition of a Flexible-Time option will allow CivMin to admit a few highly-qualified and highly motivated PhD students who are also employed full-time as practicing engineers. The SGS guidelines for the Flexible-Time PhD option require that applicants demonstrate (i) that the research and proposed program of study are related to the applicant's professional career, and (ii) that they will continue their professional activities while registered in the program (see SGS Calendar Regulation 6.1.5 Flexible-Time PhD Studies).

Typically, students will complete 2.0 full-course equivalents (FCEs) as follows:

- Year 1-2: 2.0 FCE and the non-credit seminar JDE1000 Ethics in Research, and form a Supervisory Committee
- Year 2: Prepare a research proposal and pass the Comprehensive Exam
- Year 3-5: Research and writing
- Year 6: Defend the thesis at the Final Oral Examination by August 30

Students in the Flexible-Time option are registered full-time during the first four years and part-time during subsequent years in the program.

Candidacy is achieved upon successful completion of course work and the Comprehensive Exam, normally by the end of Year 2. Throughout the program students are expected to maintain a schedule of regular meetings with their supervisors and with the Supervisory Committees.

The full admission and program requirements for the Flexible-Time options are described in the Proposed Calendar Copy, Appendix B.

5 Impact of the Change on Students

This program modification will not have an impact on existing students since they understand that transfers between the full-time PhD program and the flexible-time PhD program are not permitted. A very small, select number of future students are expected to register as Flexible-Time in the CivMin PhD program. The option has been discussed with potential applicants, with positive feedback on the possibility of this proposed Flex-Time option, and there is interest from faculty in the Department of the possibility of supervising Flexible-Time PhD students.

6 Consultation

These program modifications will not have any impact on other units. The CivMin Graduate Studies Committee, CivMin faculty, other FASE departments, the Faculty's Engineering Graduate Education Committee and the Vice-Provost, Academic Programs, were consulted during the development of this proposal.

7 Resources

The Flexible-Time PhD Program is not eligible for funding support as this option is for working professionals.

There may be opportunities for some department awards (e.g. conference travel), to be determined on a case-by-case basis.

8 UTQAP Process

Steps	**Approvals**
Development/consultation within unit	November 2021-February 2022
Civil & Mineral Engineering Departmental Council	February 25, 2022
Consultation with Dean's Office (and VPAP)	March 2022
VPAP Sign-off	April 5, 2022
Faculty Council	April 27,2022
Submission to Provost's Office	April 2022

Reported to the Provost and included in annual report to AP&P	Per governing council calendar
Ontario Quality Council — reported annually	July 2022

Appendix A: Proposed Learning Outcomes and Degree Level Expectations

Degree Level Expectations	Program Learning Outcomes	How the Program Design/Structure Supports the Degree Level Expectations
1. Depth and Breadth of Knowledge A thorough understanding of a substantial body of engineering or applied science knowledge that is at the forefront of their discipline including, where appropriate, relevant knowledge outside the field.	Depth and breadth of knowledge are understood in the doctoral (PhD) program as the ability to undertake a major research thesis in a field related to civil and mineral engineering, and as fluency in subjects related to this field. This is reflected in students who can apply research, analysis, and design skills within the field of civil and mineral engineering to develop and implement leading-edge technologies in industry and academia.	The program design and requirement elements that ensure these outcomes for depth of knowledge are the production of a thesis consisting primarily of significant original research, supplemented by courses that are chosen in consultation with their advisor. Elements that ensure these student outcomes for breadth of knowledge are the completion of course work that covers the academic field of the student more broadly, and attendance at research seminars to supplement the coursework. Some courses may be taken from outside CivMin, further addressing the breadth requirement.
2. Research and Scholarship The ability to:	Research and scholarship are understood in the doctoral (PhD) program as demonstration of an understanding and	By way of their research, students learn to imagine, design and implement a research plan to generate new knowledge

a) Conceptualize, design and implement research for the generation of new knowledge, applications or understanding at the forefront of the discipline, and to adjust the research design or methodology in the light of unforeseen problems. b) Make informed judgments on complex issues in specialist fields, sometimes requiring new methods; and c) Produce original research, or other advanced scholarship, of a quality to satisfy peer review and to merit publication.	ability to implement established techniques of research and inquiry to create and interpret knowledge related to civil and mineral engineering, to evaluate critically current research and scholarship in civil and mineral engineering. Based on that competence and through their dissertation, PhD students further demonstrate the development and support of a sustained argument in written form, and originality in the application of scientific knowledge. This is reflected in students who are able to: a) Articulate a clear hypothesis or overall goal for their PhD research project (for example, solve a specific problem, develop a new technology, challenge a current paradigm or practice, address a critical bottleneck in the field).	or understanding; they become a specialist in their field; and they articulate their work in the form of a written thesis and other publications that must pass the scrutiny of peer review.

	b) Plan and design critical experiments or simulations to prove or disprove hypotheses or to achieve the overall goal stated in the PhD proposal. c) Interpret analytical, numerical and experimental data and outcomes and appreciate the limitations of the approaches used. d) Acquire in depth knowledge of the relevant literature and understand scientific and engineering concepts relevant to their PhD.	
3. Level of Application of Knowledge The capacity to: a) Undertake pure and/or applied research at an advanced level; and b) Contribute to the development of academic or professional skills, techniques, tools, practices, ideas, theories, approaches, and/or materials.	Level of application of knowledge is understood in the doctoral (PhD) in the CivMin program as competence in and understanding of the fields of civil and mineral engineering beyond that of the undergraduate level, attained through coursework, plus competence in research, attained by creating knowledge or capabilities through the production of a thesis.	By way of coursework, students continue to build competence in the application of knowledge to solve advanced problems, beyond the level achieved at the undergraduate and master's levels. They further develop such skills by focusing extended attention on one problem.

	This is reflected in students who can plan and execute an original and conclusive scientific investigation that develops into a full PhD thesis and results in publication of peer-reviewed papers.	
4. Professional Capacity/Autonomy a) The qualities and transferable skills necessary for employment requiring the exercise of personal responsibility and largely autonomous initiative in complex situations. b) The intellectual independence to be academically and professionally engaged and current. c) The ethical behavior consistent with academic integrity and the use of appropriate guidelines and procedures for responsible conduct of research. d) The ability to evaluate the broader implications of applying knowledge to contexts.	Professional capacity/autonomy is understood in the doctoral (PhD) program in CivMin as personal responsibility, integrity, independent decision-making, and accountability related to the academic process of doctoral research. This is reflected in students who can conduct research and complete a PhD thesis.	The program design and requirement elements that ensure these student outcomes for professional capacity/autonomy are contained within the coursework, where students must demonstrate their capacity for independent, responsible work, and within the thesis requirements, where students must exhibit integrity and responsibility in research and the reporting of research results.

5. Level of Communications Skills The ability to communicate complex and/or ambiguous ideas, issues, and conclusions clearly and effectively.	Level of communications skills is understood in the doctoral (PhD) program as the ability to communicate, both verbally and in written form, results of research and the methodologies employed to produce the results. This is reflected in students who are able to write a full PhD thesis, academic papers, and to present research in an oral format.	The program design and requirement elements that ensure these student outcomes are the expectation that all graduate students practice and learn communication skills via their coursework, in the form of presentations, preparing assignments and projects, often collaboratively with other students. They are also offered the opportunity to regularly present their work at workshops and conferences, and to publish their work in the form of conference and journal papers.
6. Awareness of Limits of Knowledge An appreciation of the limitations of one's own work and discipline, of the complexity of knowledge, and of the potential contributions of other interpretations, methods, and disciplines.	Awareness of limits of knowledge is understood in the doctoral (PhD) program in CivMin as a cognizance of the complexity and multidisciplinary of the knowledge associated with civil and mineral engineering and its application. This is reflected in students who are able to design and implement research projects that prove or disprove a hypothesis, and interpret results with an	The program design and requirement elements that ensure these student outcomes for awareness of limits of knowledge is coursework that exposes students to the limits of knowledge. They further develop that awareness by reviewing the literature related to their own work, as they develop expertise in their specific field.

	appreciation for the limits of the methods used.	

Appendix B: Current Calendar Copy with Changes Tracked or Highlighted

Doctor of Philosophy

Program Description

The PhD program is designed for outstanding individuals interested in a rewarding career in fundamental or applied research. This program involves advanced courses and an intensive research program culminating in a thesis.

Applicants may enter the PhD program via one of three routes: 1) following completion of an MASc degree in engineering, mathematics, physics, or chemistry; 2) transfer from the University of Toronto MASc program; 3) direct entry following completion of an MEng degree or bachelor's degree.

Applicants to the Flexible-Time PhD option are accepted under the same admission requirements as applicants to the full-time PhD option who have completed a master's degree.

PhD Program

Minimum Admission Requirements

- Applicants are admitted under the General Regulations of the School of Graduate Studies. Applicants must also satisfy the Department of Civil Engineering's additional admission requirements stated below.
- A completed undergraduate degree equivalent to a four-year University of Toronto program with a minimum final-year grade point average (GPA) of B+ (3.3 out of 4.0 or 78%). Required grades must be achieved in each of the final two years of undergraduate study. Competitive admission averages are typically near or above 80% (A–).
- Applicants whose primary language is not English and who graduated from a university where the language of instruction and examination was not English must demonstrate proficiency in English. See General Regulations section 4.3 for requirements.

- Applicants must satisfy the department of the ability to undertake advanced research.
- Admission directly from a bachelor's degree is permitted in exceptional cases.
- If a student transfers from a master's degree program to a PhD program, courses taken during the master's program may be applied to the PhD program.

Program Requirements

- **Students with an MASc degree** (or equivalent in the same area of study) must complete a minimum of **2.0 full-course equivalents (FCEs)** (four half courses).
- **Students with an MEng degree** must complete a minimum of **4.5 FCEs** (nine half courses). Up to 3.0 FCEs (six graduate half courses) may be used from the MEng program towards the PhD course requirements.
- Students enrolled in the MASc degree program who **transfer** to the PhD program must complete a total of 4.5 full-course equivalents (FCEs) (nine half courses).
- For **direct-entry** students, more FCEs may be required depending on the student's background preparation. It is normally expected that at least one of the half courses will be taken outside of the student's principal area of research.
- **Comprehensive examination** after completing most of the coursework and preferably within one year after first enrolment in the PhD program. This examination consists of a four- to five-day take-home written examination, followed approximately a week later by an oral examination. The examination is administered by a Comprehensive Examination Committee created and supervised by the department's Graduate Studies Committee.
- **Residence.** Students normally must spend at least two academic years of their program on campus on a full-time basis.
- Students must participate in the non-credit seminar course JDE1000H *Ethics in Research* during their first or second session of registration.
- Students have the option of completing an emphasis in Sustainable Energy as part of their degree program. Please see details in the Civil Engineering MASc, MEng, PhD Emphases section.

Program Length

4 years full-time; 5 years transfer-from-master's; 5 years direct-entry

Time Limit

6 years

PhD Program (Flexible-Time)

Minimum Admission Requirements

- Applicants are admitted under the General Regulations of the School of Graduate Studies. Applicants must also satisfy the Department of Civil and Mineral Engineering's additional admission requirements stated below.
- A completed undergraduate degree equivalent to a four-year University of Toronto program with a minimum final-year grade point average (GPA) of B+ (3.3 out of 4.0 or 78%). Required grades must be achieved in each of the final two years of undergraduate study. Competitive admission averages are typically near or above 80% (A–).
- Applicants whose primary language is not English and who graduated from a university where the language of instruction and examination was not English must demonstrate proficiency in English. See General Regulations section 4.3 for requirements.
- Applicants must satisfy the department of the ability to undertake advanced research.
- In addition, applicants must demonstrate that they are actively engaged in professional activities related to their proposed program of study.

Program Requirements

- **Students with an MASc degree** (or equivalent in the same area of study) must complete a minimum of **2.0 full-course equivalents (FCEs)** (four half courses).
- **Students with an MEng degree** must complete a minimum of **4.5 FCEs** (nine half courses). Up to 3.0 FCEs (six graduate half courses) may be used from the MEng program towards the PhD course requirements.
- Students enrolled in the MASc degree program who **transfer** to the PhD program must complete a total of 4.5 full-course equivalents (FCEs) (nine half courses).
- For **direct-entry** students, more FCEs may be required depending on the student's background preparation. It is normally expected that at least one of the half courses will be taken outside of the student's principal area of research.
- **Comprehensive examination** after completing most of the coursework and preferably within one year after first enrolment in the PhD program. This examination consists of a four- to five-day take-home written examination, followed approximately a week later by an oral examination. The examination is administered by a Comprehensive Examination Committee created and supervised by the department's Graduate Studies Committee.

- **Residence.** Students normally must spend at least two academic years of their program on campus on a full-time basis.
- Students must participate in the non-credit seminar course JDE1000H *Ethics in Research* during their first or second session of registration.
- Students have the option of completing an emphasis in Sustainable Energy as part of their degree program. Please see details in the Civil Engineering MASc, MEng, PhD Emphases section.

Program Length

6 years

Time Limit

8 years