

**UNIVERSITY OF WATERLOO  
SENATE GRADUATE & RESEARCH COUNCIL  
NOTICE OF MEETING**

DATE: Monday 9 November 2020  
TIME: 10:30 a.m. – 12:00 noon  
PLACE: Microsoft Teams

Chair – C. Dean

**Reminder:** chat function to be used to register your vote (“*nay*”, “*abstain*”) or to indicate your wish to speak (“*comment*”, “*question*”)

**AGENDA**

<u>Item</u>	<u>Action</u>
1. Declarations of Conflict of Interest a. Excerpt from Bylaw 1, section 8*	Information
2. Minutes of 5 October 2020* and Business Arising: which is item 5a from 5 October 2020	Decision (SGRC)
3. Co-chairs’ Remarks	Information
4. New Academic Program: PhD in Political Science (Faculty of Arts; Esselment)* (department sponsor: Emmett Macfarlane)	SEN-Regular
5. Research Centres and Institutes	
a. Renewal Guidelines*	Information
b. Renewal Checklist*	Information
c. Renewal: Centre for Computational Mathematics in Industry & Commerce (CCMIC)* (Director Hans De Sterck)	Decision (SGRC)
d. Renewal: Centre for Pavement Advancement and Transportation Technology (CPATT)*(Director Hassan Baaj)	Decision (SGRC)
e. Renewal: Institute for Polymer Research (IPR)* (Director Jean Duhamel)	Decision (SGRC)
6. Academic Program Reviews	
a. <a href="#">Status of Reports under Review</a>	Information
b. Guiding Questions for Final Assessment Reports and Two-Year Progress Reports*	Information
c. Two-Year Progress Report: Systems Design Engineering* (Lisa Aultmann-Hall; reviewer: Hanning with comments by Alyssa Voigt)	Decision (SGRC)
d. Two-Year Progress Report: New PhD in Applied Philosophy* (Patricia Marino; reviewer: Sivoththaman)	Decision (SGRC)
e. Final Assessment Report: Global Governance PhD* (reviewer: WLU, Duncker/Clausi with comments by Alyssa Voigt)	Decision (SGRC)
7. Curricular Submissions	
a. Applied Health Sciences * (Brian Laird)	1;SEN-Regular 2;Decision (SGRC)
b. Engineering* (Siva Sivoththaman)	SEN-Regular
8. Graduate Awards*	
a. Martin Simmons Graduate Scholarship for Locally Focused Architecture – trust	Decision (SGRC)
b. Caivan Future Cities Graduate Scholarship - trust	Decision (SGRC)
c. University of Waterloo Staff Association Award - trust	Information
d. Jon Mark Graduate Scholarship in Communication - endowment	Information

9. Other Business

Information

10. Next Meeting: 14 December 2020 from 10:30 a.m. - 12 noon; location TBD

Information

\*material attached  
\*\* to be distributed separately  
\*\*\*will not be in attendance at meeting  
“SGRC” to be approved on behalf of Senate  
“SEN” to be recommended to Senate for approval

2 November 2020

Kathy Winter, PhD, CPsych  
Assistant University Secretary

# Excerpt from Senate Bylaw 1

## 8. Declarations of conflict of interest

---

8.01	At the beginning of each meeting of Senate or any of Senate’s committees or councils, the chair will call for members to declare any conflicts of interest with regard to any agenda item. For agenda items to be discussed in closed session, the chair will call for declarations of conflict of interest at the beginning of the closed portion of the meeting. Members may nonetheless declare conflicts at any time during a meeting.
8.02	A member shall be considered to have an actual, perceived or potential conflict of interest, when the opportunity exists for the member to use confidential information gained as a member of Senate, or any of Senate’s committees or councils, for the personal profit or advantage of any person, or use the authority, knowledge or influence of the Senate, or a committee or council thereof, to further her/his personal, familial or corporate interests or the interests of an employee of the university with whom the member has a marital, familial or sexual relationship.
8.03	Members who declare conflicts of interest shall not enter into debate nor vote upon the specified item upon which they have declared a conflict of interest. The chair will determine whether it is appropriate for said member to remove themselves from the meeting for the duration of debate on the specified item(s).
8.04	Where Senate or a committee or council of Senate is of the opinion that a conflict of interest exists that has not been declared, the body may declare by a resolution carried by two-thirds of its members present at the meeting that a conflict of interest exists and a member thus found to be in conflict shall not enter into debate on the specified item upon which they have declared a conflict of interest. The chair will determine whether it is appropriate for said member to remove themselves from the meeting for the duration of debate on the specified item(s).

**University of Waterloo**  
**SENATE GRADUATE & RESEARCH COUNCIL**  
**Minutes of the 5 October 2020 Meeting**  
**[in agenda order]**  
**Microsoft Teams Meeting Videoconference**

**Present:** David Billedeau, Jeff Casello, Amelia Clarke, Peter Deadman, Bernard Duncker, Anna Esselment, Ana Ferrer, Nathan Funk, Alison Hitchens, Julie Joza, Adam Kolkiewicz, Brian Laird, Dmitri Marin, Daniel Martel, Bruce Muirhead, Liz Nilsen, Max Salman, Sophia Sanniti, Jerika Sanderson, Siva Sivoththaman, Richard Staines, Mike Szarka, Shirley Tang, Shawn Wettig, Kathy Winter (secretary)

**Resources:** Trevor Clews, Carrie MacKinnon Molson, Amanda McKenzie, Alyssa Voigt.

**Guests:** Jennifer Coghlin, Marianne Simm

**Regrets:** David Clausi, Charmaine Dean\*, Anita Layton, Kareem Tarek Mostafa\*

**Organization of Meeting:** Jeff Casello, co-chair of the council, took the chair, and Kathy Winter acted as secretary. The secretary advised that due notice of the meeting had been given, a quorum was present, and the meeting was properly constituted.

### **1. DECLARATIONS OF CONFLICT OF INTEREST**

No conflicts of interest were declared.

### **2. MINUTES OF 14 SEPTEMBER 2020 AND BUSINESS ARISING**

By consensus, the minutes were approved as distributed – noting one typographical error under agenda item 5.5 HREB membership. That is, Sean Peterson term to end 30 September 2023 not 30 September 2020.

### **3. CO-CHAIRS' REMARKS**

Casello reported: (a) Banting candidates: forty-eight applications received; 20 of those reviewed at the faculty level and 11 subsequently moved forward representing all 6 faculties, (b) Grad student access to campus: new processes in place to receive and approve students' requests to access the campus, including their offices, as well as non-research or laboratory spaces and facilities in a timely fashion, and (c) Field work and research with human participants: all aspects are now in effect (even those involving human participants)—though international travel bans continue to hinder. For questions related to face-to-face human participant research, please contact Joza (Director, Research Ethics). Casello ended by welcoming Marianne Simm, new Director of Graduate Studies and Postdoctoral Affairs.

### **4. ACADEMIC CALENDAR DATES**

Council heard a motion to recommend to Senate to approve the 2021-2022 academic calendar dates and calendar guidelines for establishing academic dates as presented. Coghlin outlined how the dates lay out major academic milestones throughout the year and provide guidance to units throughout the campus community as they conduct academic planning within their respective areas. As a result of the need for flexibility due to COVID-19 impacts, and expected increases in demand for in-person exams for online and remote courses, dates for in-person exams for online and remote courses will be determined at a later date. When scheduled, these exam dates will fall within the defined exam period (i.e. none will be scheduled before the "Examinations Begin" date, nor after the "Examinations End" date). Laird and Wettig. Carried.

### **5. GRADUATE STUDIES AND POSTDOCTORAL AFFAIRS**

**5a. Recording Students' Names.** On behalf of Senate, council heard a motion to approve new text for the Graduate Studies Academic Calendar (and Undergraduate Studies Academic Calendar), as presented, to formalize the University of Waterloo's current practices regarding student name usage on campus. Coghlin outlined how, with the introduction of the chosen/preferred first name option in January 2020, the proposed Calendar text will add transparency for students and ensure they understand their options. The University continues to work on measures to improve equity and inclusion for its students, therefore data related to names, gender identity, and

pronoun use will evolve. Wettig and Sivoththaman. Carried. **NB:** Following the 5 October 2020 Senate Graduate and Research Council (SGRC), this item went to Senate Undergraduate Council where some minor wording changes were made, as presented at **Attachment 1** to these minutes. Those minor changes will be brought forward to SGRC on 9 November 2020 as an information item under Business Arising.

**5b. Item 1: Qualifying Examination Regulations.** Council heard a motion to recommend to Senate to approve new Qualifying Examination Regulations (under [Minimum Requirements for the PhD Degree](#)), effective 1 January 2021, as presented. Minimum requirements for University-level qualifying examination regulations have been developed to provide University-level guidance to students, faculty, and staff on qualifying examinations. Nilsen and Sivoththaman. Carried.

**5b. Item 2: University Responsibilities regarding Supervisory Relationships.** Council heard a motion to recommend to Senate to approve changes to [University Responsibilities regarding Supervisory Relationships](#), effective 1 January 2021, as presented. The University Responsibilities regarding Supervisory Relationships (approved by Senate in April 2020) are being updated to provide better clarity of expectations for students and faculty as to what is expected when a relationship between a student and a supervisor ends. Nilsen and Sivoththaman. Carried - with three [friendly amendments](#) (found on pages 15-18; as depicted in red).

## 6. CURRICULAR SUBMISSIONS

**a. Engineering.** On behalf of Senate, council heard a motion to approve item 1, as presented. Sivoththaman and Kolkiewicz. Carried—with one friendly amendment—ECE 750 topic 35 “Applied Topics in Artificial Intelligence” being re-titled “Social Robotics”. On behalf of Senate, council heard an omnibus motion to approve items 2 and 3 as presented. Sivoththaman and Wettig. Carried.

**b. Mathematics.** On behalf on Senate, council heard an omnibus motion to approve Applied Mathematics items, as presented. Kolkiewicz and Sivoththaman. Carried. On behalf on Senate, council heard an omnibus motion to approve Computer Science items, as presented. Kolkiewicz and Esselment. Carried.

## 7. OTHER BUSINESS

In other business, council discussed the potential unionization of graduate students. Members heard from Billedeau, Vice President Graduate Student Association (GSA), who described the initiative in terms of advocacy—whereby the role of GSA is to inform students and to direct them to union resources such as [Organize uWaterloo](#)—versus being adversarial and advancing the union drive. Casello underscored the University’s position as being eager for graduate students to have the best experience possible whereby challenges can be resolved; he reminded members of the following resource as one illustration, [Graduate Relations website](#).

## 8. NEXT MEETING

The next meeting will be held Monday 9 November 2020 from 10:30 a.m. to 12 noon; Microsoft Teams.

30 October 2020

Kathy Winter, PhD, CPsych,  
Assistant University Secretary

## Attachment 1 to Minutes of 5 October 2020

### 1. REGULATIONS

#### 1.1. Recording Students' Names

**Effective date:** September 1, 2021. The intention is that the new rule will be implemented for all current students as of the effective date – it is not tied to their program requirement term.

**Background and rationale:** New text for the Academic Calendars (Undergraduate and Graduate) is being created to formalize the University of Waterloo's current practices regarding student name usage on campus.

In response to feedback from students, the "Improving Name Usage" project was launched to students in January 2020 to allow them the opportunity to use a chosen/preferred first name broadly on campus, while retaining their legal first name on tax receipts and official documents. This project, influencing 26 information systems throughout campus, required collaboration among a number of key partners, and the participation of number of committees. Privacy and human rights legislation informed the process, and student consultations helped drive decision-making. More specifically, direction was provided, and decisions were made, through numerous meetings with units including the Secretariat, Legal Office, Equity Office, Glow Centre for Sexual and Gender Diversity, and the Gender and Sexual Diversity Working group. Policy 33 (Ethical Behaviour) was also considered during the decision-making process.

With the introduction of the chosen/preferred first name option in January 2020, this proposed Calendar text adds transparency for students and ensures they understand their options. The University continues to work on measures to improve equity and inclusion for its students, and data related to names, gender identity, and pronoun use will evolve. Based on publicly available websites and academic calendars, the University of Waterloo appears to be one of the early adopters of a chosen/preferred name option compared to other Canadian universities.

The University is committed to displaying a student's chosen/preferred first name wherever possible, and to continuing to increase that use across various systems, processes, and documents. Thus, specifics about current use have not been included in the academic calendar text, allowing greater flexibility to make changes by not being tied to the University calendar publication timelines.

- Examples of official documents displaying legal name: transcripts, diplomas, tax receipts, official and/or legal University letters.
- Examples of where chosen/preferred first name is displayed: systems (e.g., LEARN, Quest, WaterlooWorks), class and exam lists, email, WatCard. Students can use this name on forms and in many communication they request (e.g., reference letters).

The legal name is being treated as protected data and employees have access only to students' chosen/preferred first name – unless the employee role demonstrably requires that they have access to the legal name.

Details as well as procedural aspects of changing a student's legal name and/or their chosen/preferred first name are outlined on The Centre's "**updating personal information**" web page.

- A legal name change requires the completion of a **Change of Name Form**, and must be accompanied by legal documentation or photo identification (e.g., marriage certificate, adoption papers, driver's license, passport, etc.). For those that don't have the required documentation or identification, they can have a Commissioner for Taking Affidavits sign a statutory declaration.

- A chosen/preferred first name change is done via WatIAM, requires no documentation, and can be done as often as a student desires.

**Proposed Calendar text:****New Calendar page:** Recording Students' Names

To maintain the integrity of the University of Waterloo's student records, each student is required to provide, either on application for admission or on personal data forms needed for initial registration, their complete legal name. The University requires that individuals use their legal name on all legal records and official documents.

**Students' Chosen/Preferred First Name**

A student's chosen/preferred first name is typically the first name that they commonly use, and may differ from their legal first name. Waterloo also recognizes that, as an inclusive community, many of its members use first names other than their legal first names to identify themselves. The University acknowledges that as per the Ontario Human Rights Code, students have the right to be addressed by their chosen name.

**Changing Students' Names on Official Documents**

Students who wish to change their legal name(s) (first, middle, and/or last) used for official documents are required to provide acceptable documentation or photo identification reflecting the change, or in their absence, complete a statutory declaration.

Note: It is not currently possible to accommodate requests to include accents and special characters on official transcripts nor can these characters be displayed as part of the student's centrally maintained academic record. Students wishing to include accents or special characters in their names on diplomas need to provide that information during the Application to Graduate process.

**More information**

View the [updating name\(s\) web page](#) for options and instructions.

**UNIVERSITY OF  
WATERLOO**



**GRADUATE PROGRAM PROPOSAL  
OF  
DOCTOR OF PHILOSOPHY (PHD)  
IN  
POLITICAL SCIENCE**  
Submitted to the  
Ontario Universities Council on Quality Assurance

**VOLUME I - PROPOSED BRIEF**

FEBRUARY 2020



## TABLE OF CONTENTS

1.	INTRODUCTION.....	1
1.1	Brief Listing of the Program .....	1
1.2	Method Used for Preparation of the Brief.....	6
1.3	Objectives of the Program .....	6
1.4	Admission Requirements .....	9
1.5	Structure.....	10
1.6	Program Content.....	12
1.7	Mode of Delivery.....	15
1.8	Assessment of Teaching and Learning .....	15
1.9	Fields in a Graduate Program [optional].....	17
2.	HUMAN RESOURCES.....	17
2.1	Resources for Graduate Programs Only.....	17
2.2	List of Faculty by Field .....	18
2.3	External Operating Research Funding.....	20
2.4	Graduate Supervision.....	21
2.5	Commitment of Faculty from Other Graduate Programs/Other Institutions .....	21
2.6	Quality of Faculty .....	21
3.	PHYSICAL AND FINANCIAL RESOURCES .....	21
3.1	Library Resources .....	21
3.2	Laboratory Resources.....	23
3.3	Computer Facilities.....	23
3.4	Space .....	23
3.5	Financial Support.....	23
4.	CURRICULUM .....	24
4.1	The Intellectual Development and the Educational Experience of the Student .....	24
4.2	Program Regulations.....	26
4.3	Part-time Studies.....	28
4.4	Curriculum.....	28
4.5	Collateral and Supporting Departments .....	30
4.6	Organizational Structure .....	31
5.	PROJECTED ENROLMENT .....	31
6.	FINANCIAL PLAN.....	32

## **1. INTRODUCTION**

### **1.1 Brief Listing of the Program**

The PhD in Political Science is a new research program that will integrate rigorous requirements and training consistent with disciplinary norms while offering innovative features, flexibility, and professional development designed to prepare students for both traditional academic careers and non-academic career paths.

The research-based program will require the completion of 3.0 units of courses in the first year of study (one course is 0.5 units), a comprehensive examination, mandatory professional development milestones, a thesis proposal and oral defence, and a thesis (in a traditional format or an alternative format, such as a publication model consisting of at least three sole-authored published [or in press] works) and oral thesis defence. There will be a regular and co-op option. The regular, full-time program is designed to be completed as a four-year degree. It will be available to both full-time and part-time students.

Consistent with disciplinary norms, students will be expected to gain expertise in a primary graduate research fields of study and a secondary field or concentration. Major graduate research fields, based on departmental strengths and capacity to offer multiple core courses, will be Canadian Politics, International Relations, and Political Economy. For their secondary field, students may complete either a 2<sup>nd</sup> major field or a 'custom concentration' based on coursework in a designated area of the discipline (comparative politics, democratic theory, public policy, gender and politics, etc.) or a subfield of their major field (security, rights, etc.). Students will be required to take six courses. These include two 'core' courses in one of the program's major graduate research fields (see section 1.6 – Program Content, Core Courses), two courses in the student's second graduate research field or concentration, a required methods course, and one elective. The methods course will be team-taught by three faculty members, covering quantitative and qualitative approaches to political science as well as the epistemology of social science. Students will have the opportunity to take additional methods training as part of their mandatory professional development modules.

The most distinctive element of the program will be its emphasis on professional development and streams designed to accommodate both students seeking academic careers and those who are not. Students will also have the option to take an experiential stream (featuring co-op, a Mitacs placement, or other experiential training, and additional professional development modules) or a teaching stream (featuring additional professional development modules, including a mentored teaching experience). Students in the co-op program will complete 12 months of placement. These options are, to our knowledge, unique in Canada among political science PhD programs. The Political Science Department is well placed to launch what would be the first PhD program at the University of Waterloo with a centrally-administered formal co-op option. Our Master of Public Service program is the largest graduate-level co-op program at the university and the last several years has enjoyed a 100 percent employment rate for cohorts ranging from 37 to 55 students. Students in our MA program who have opted for the co-op option have also seen significant success. For example, in the

2017-18 academic year, in a cohort of 15 MA students eight applied for co-op and all eight received attractive work term employment, including positions at the federal Treasury Board Secretariat, the Ontario Ministry of Economic Development, Job Creation and Trade, and the Financial Intelligence Unit at the Bank of Montreal.

Professional development modules will be offered as a mandatory component of the program and recorded on the students' records as a degree milestone (titled the PhD Professional Development Seminar). Many of these modules, usually consisting of half-day seminars, will be offered by the department in-house. Others are available through the Centre for Teaching Excellence (CTE), Mitacs, or will be developed in collaboration with the Writing and Communications Centre or the Centre for Career Action (CCA). All students will be required to complete a set of six mandatory workshops on topics like research design, communicating research to a broader audience, translating skills for the non-academic job market, and conferencing best practices. Students in the regular program will also complete three additional elective professional development modules. Students who opt to take the experiential or teaching program streams will be expected to complete additional professional development activities (milestones called the PhD Experiential Seminar and the PhD Teaching Seminar -- see section 1.6 for more detail). These options are laid out in the Table below.

	PhD, Political Science, Regular Program	PhD, Political Science, Teaching Stream	PhD, Political Science, Experiential Stream (internship)	PhD, Political Science, Experiential Stream (Co-op)
YEAR 1	<p><b>Fall &amp; Winter:</b></p> <ul style="list-style-type: none"> <li>6 graduate-level courses (consisting of two courses in the student's major field, two in their second field/concentration, a mandatory methods course, and an elective).</li> </ul> <p><b>Spring:</b></p> <ul style="list-style-type: none"> <li>comprehensive exam prep</li> </ul>			
YEAR 2	<p><b>Fall:</b></p> <ul style="list-style-type: none"> <li><b>Comprehensive Examination</b> (September)</li> <li>mandatory professional development workshops counted toward <b>PhD Professional Development Seminar:</b> <ul style="list-style-type: none"> <li><i>Research design and methods workshop</i></li> <li><i>Conducting literature reviews</i></li> </ul> </li> </ul> <p><b>Winter:</b></p> <ul style="list-style-type: none"> <li><b>Thesis Proposal</b> defence (by end of April)</li> <li>mandatory professional development workshops counted toward <b>PhD Professional Development Seminar:</b> <ul style="list-style-type: none"> <li><i>Planning and best practices in fieldwork</i></li> <li><i>Conferencing best practices (completed after proposal defence)</i></li> </ul> </li> </ul> <p><b>Spring:</b></p> <ul style="list-style-type: none"> <li>mandatory professional development workshops counted toward <b>PhD Professional Development Seminar:</b> <ul style="list-style-type: none"> <li><i>Careers in political science and translating skills for a non-academic job market</i></li> <li><i>Communicating research to a broader audience</i></li> </ul> </li> </ul>			
			<ul style="list-style-type: none"> <li>Spring term Year 2 is earliest term a student may start internship placement (normally a minimum of 4 months of internship experience will be required).</li> </ul> <p><b>Internship students must complete certain mandatory professional development workshops counted toward the <u>PhD Experiential Seminar</u> prior to their internship placement (See section 4.4 for details.)</b></p>	<ul style="list-style-type: none"> <li>Spring term Year 2 is earliest term a student may start work-terms (12 months of work-term placement is required).</li> </ul> <p><b>Co-op students must complete certain mandatory professional development workshops counted toward the <u>PhD Experiential Seminar</u> prior to their work-term. (See section 4.4 for details.)</b></p>

	PhD, Political Science, Regular Program	PhD, Political Science, Teaching Stream	PhD, Political Science, Experiential Stream (internship)	PhD, Political Science, Experiential Stream (Co-op)
YEAR 3	<p><b>All terms:</b></p> <ul style="list-style-type: none"> <li>research and writing of dissertation</li> <li>3 elective professional development modules for completion of <b>PhD Professional Development Seminar</b> (See section 4.4 for a list of options).</li> </ul>	<p><b>All terms:</b></p> <ul style="list-style-type: none"> <li>completion of mandatory professional development modules counted toward <b>PhD Teaching Seminar:</b> <ul style="list-style-type: none"> <li>Centre for Teaching Excellence Fundamentals of University Teaching program.</li> <li>2 Guest Lectures in Political Science (students will receive automatic credit if they have the opportunity to teach their own course as a sessional instructor).</li> <li>Develop a syllabus for a (real or prospective) political science course.</li> </ul> </li> </ul>	<p><b>All terms:</b></p> <ul style="list-style-type: none"> <li>completion of mandatory professional development workshops counted toward <b>PhD Experiential Seminar:</b> <ul style="list-style-type: none"> <li>Reflective practices in experiential learning</li> <li>Writing resumes</li> <li>Workshop on parallel career planning</li> <li>One or more modules offered by MITACS or other campus partners (see section 4.4 for details).</li> </ul> </li> </ul>	<p><b>Fall:</b></p> <ul style="list-style-type: none"> <li>completion of mandatory professional development workshops counted toward <b>PhD Experiential Seminar:</b> <ul style="list-style-type: none"> <li>Reflective practices in experiential learning</li> <li>Writing resumes</li> <li>Workshop on parallel career planning</li> <li>One or more modules offered by MITACS or other campus partners (see section 4.4 for details).</li> </ul> </li> </ul> <p><b>Winter:</b></p> <ul style="list-style-type: none"> <li>research and writing of dissertation</li> </ul> <p><b>Spring:</b></p> <ul style="list-style-type: none"> <li>work-term</li> </ul>
YEAR 4	<p><b>Fall:</b></p> <ul style="list-style-type: none"> <li>research and writing of dissertation</li> </ul> <p><b>Winter:</b></p> <ul style="list-style-type: none"> <li>research and writing of dissertation</li> </ul> <p><b>Spring:</b></p> <ul style="list-style-type: none"> <li><b>Thesis Defence</b></li> </ul>	<p><b>Fall:</b></p> <ul style="list-style-type: none"> <li>research and writing of dissertation</li> </ul> <p><b>Winter:</b></p> <ul style="list-style-type: none"> <li>research and writing of dissertation</li> </ul> <p><b>Spring:</b></p> <ul style="list-style-type: none"> <li><b>Thesis Defence</b></li> </ul>	<p><b>Fall:</b></p> <ul style="list-style-type: none"> <li><b>Internship Report</b> (to be submitted one month after end of placement)</li> <li>research and writing of dissertation</li> </ul> <p><b>Winter:</b></p> <ul style="list-style-type: none"> <li>research and writing of dissertation</li> </ul> <p><b>Spring:</b></p> <ul style="list-style-type: none"> <li><b>Thesis Defence</b></li> </ul>	<p><b>Fall:</b></p> <ul style="list-style-type: none"> <li>work-term</li> </ul> <p><b>Winter:</b></p> <ul style="list-style-type: none"> <li>work-term</li> </ul> <p><b>Spring:</b></p> <ul style="list-style-type: none"> <li>return to academic programming</li> <li><b>Work-term Report</b> (to be submitted one month after return from work-term)</li> </ul>

	PhD, Political Science, Regular Program	PhD, Political Science, Teaching Stream	PhD, Political Science, Experiential Stream (internship)	PhD, Political Science, Experiential Stream (Co-op)
<b>YEAR 5</b>	N/A	N/A	N/A	<b>Fall:</b> <ul style="list-style-type: none"> <li>• research and writing of dissertation</li> </ul> <b>Winter/Spring:</b> <ul style="list-style-type: none"> <li>• research and writing of dissertation</li> <li>• <b><u>Thesis Defence</u></b></li> </ul>

## **1.2 Method Used for Preparation of the Brief**

The Political Science Department initiated a discussion about establishing a PhD program in December, 2016. A Department-wide consultation process canvassed every faculty member and several MA students and concluded that there was virtually unanimous and enthusiastic support for examining what a prospective program would look like. The consensus was that the Department stood out among political science departments across Canada of similar size and research stature for lacking a PhD program. Moreover, the Department consensus was that it was well positioned to account for and train students who will enter into traditional academic job markets as well as students who pursue non-academic careers. A survey of PhD-granting Political Science departments in Ontario was also conducted. The findings suggested that those programs provide little explicit attention to non-academic career training, and the Department came to the opinion that flexibility, innovation, and a focus on professional development and opportunities for experiential learning would make a new PhD program distinctive.

In April, 2017, the Department struck a PhD Design Committee of faculty members (Emmett Macfarlane, Jasmin Habib, Veronica Kitchen, and Heather Whiteside) tasked with designing a PhD program that was innovative and unique relative to those at other, comparable universities, and; two, conducting a feasibility study that assessed the impact on our undergraduate program and MA program. The report was delivered to the Department in September, 2017. The design and components for the proposed PhD program reflected those described above (see Section 1.1), and the report was unanimously and enthusiastically approved by the Department.

On October 23, 2017, the Chair of the Department, Anna Esselment, and Emmett Macfarlane met with Doug Peers, Dean of Arts, and Linda Warley, Associate Dean, Graduate Studies, to discuss the proposal and received support to proceed with the formal approval process.

On May 7, 2018 a formal Statement of Interest was sent to the Director of Quality Assurance (Academic Programs) and the Department was advised to proceed with the production of the Volume 1 draft proposal.

Over the summer and fall of 2018, members of the Department's Graduate Committee met and consulted with various units and stakeholders in preparing the draft proposal, including the Centre for Teaching Excellence (CTE), Librarian Jane Forgay, Co-operative Education, and the campus representative for Mitacs (Mike McCleary).

## **1.3 Objectives of the Program**

The objective of the program is to train highly qualified persons in the discipline of political science with the ability to apply the knowledge and skills acquired to myriad political and policy problems. The training will prepare graduates for a diversity of career pathways. Outside of the academic setting there is a longstanding need for the enhanced research skills, developed academic knowledge, methods and tools that can be brought to bear on a range of problems routinely faced by governments, the private sector, local, national, and international organizations, and the non-profit sector. Within academia, there is increasing recognition of the need for professional development to prepare PhD students for non-academic careers paths, as well as additional training

in areas like teaching for doctoral candidates intent on academic careers. This new program is being launched in response to that reality as well as student demand for an innovative and flexible program that provides these opportunities.

The proposed PhD program aligns fully with the Faculty of Arts goals of increasing graduate enrollment and the University's Strategic Plan (2013-2018), which emphasizes "focusing energy and allocating resources into areas that will set this institution apart, ensure the best experience for students and serve as a model for the future of higher education." This means offering experiential education as well as continuing to foster conditions under which "faculty and students engage in transformational research."<sup>1</sup> As envisioned, the proposed PhD program will explicitly reinforce these goals to enhance the University of Waterloo's reputation as an academic institution that focuses on innovative, integrated, and experiential learning, co-operative education, and research of the highest quality, all while delivering a political science education that meets the recognized standards of the discipline. The proposed PhD program similarly fits well within University of Waterloo's current Strategic Mandate Agreement (SMA) with the provincial Ministry. For example, one of the initiatives articulated in SMA2 is the expansion of formal co-op options specifically geared toward graduate students.<sup>2</sup>

In consultation with the CTE, the Department refined a specific list of program learning outcomes, taking into account the Graduate Degree Level Expectations (GDLEs). The chart below shows how the program learning outcomes relate to the GDLEs. On completion of the PhD Program in Political Science, graduates will be intellectual leaders in the field of political science who create knowledge, engage in critical analysis, and demonstrate professionalism. Throughout the degree, our goal is to help students maintain an awareness of how meeting each of these objectives affects their own health and wellness.

**GDLES are as follows:**

1. **Depth and Breadth of Knowledge** - A thorough understanding of a substantial body of knowledge that is at the forefront of their academic discipline or area of professional practice including, where appropriate, relevant knowledge outside the field and/or discipline.
2. **Research and Scholarship** - a) The ability to 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) The ability to make informed judgments on complex issues in specialist fields, sometimes requiring new methods; and c) The ability to produce original research, or other advanced scholarship, of a quality to satisfy peer review, and to merit publication.

<sup>1</sup> University of Waterloo, Strategic Plan 2013. *A Distinguished Past – A Distinctive Future*, p. 7.

<sup>2</sup> *Strategic Mandate Agreement2* – University of Waterloo, Ministry of Advanced Education and Skills Development 2017-20. P. 10.



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.
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; and d) The ability to evaluate the broader implications of applying knowledge to particular contexts.
5. **Level of Communication Skills** - The ability to communicate complex and/or ambiguous ideas, issues and conclusions clearly and effectively
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.

<b>Program Learning Outcomes and Graduate Degree Level Expectations</b>
At the end of the program, students will:
1. Produce original research of the highest quality by combining a broad knowledge of the concepts, theories, and methods used in the study of political science, and their connections to the empirical world of government, politics, and policy-making, with expert knowledge of their own subject area;
2. Develop research questions and designs through a practice of epistemological and methodological reflection and critical analysis while recognizing the limits of their research;
3. Communicate scholarly knowledge in various forms to disparate audiences using appropriate writing, speaking, or other communication skills;
4. Make informed choices about their career as a political scientist;
5. Recognize diverse voices and experiences in research, teaching, professional development, and community engagement
6. Adhere to the highest professional standards of ethics and academic integrity in all aspects of research, teaching, professional development, and community engagement, and cultivate an awareness of how power relationships affect the attainment of those standards.
<b>Teaching Stream – Additional Learning Outcome</b>
Demonstrate knowledge of pedagogical theories and skills applicable to political science, and implement them in all aspects of teaching including curriculum design, course delivery, supervision, and mentorship.
<b>Experiential Stream - Additional Learning Outcome</b>
Use the knowledge and skills developed through course work, research, and professional development milestones in a paid or volunteer work experience, and reflect on how that work experience relates to their own advanced political science research.

This chart maps how the program learning outcomes relate to the Graduate Degree Level Expectations, where 'X' indicates the strongest correlation, 'X' a significant correlation, and 'x' a minor correlation.

GDLES	Learning Outcomes							
	1	2	3	4	5	6	Teaching	Experiential
Depth and breadth of knowledge	X	X	X	X	X			X
Research and scholarship	X	X	X	x	X	X		X
Level of application of knowledge	X	X	X	X	X	X	X	x
Professional capacity/autonomy	x	X	X	X	X	X	X	X
Level of communication skills	X		X		x	x	X	X
Awareness of limits of knowledge	X	X		x	X			

#### 1.4 Admission Requirements

The PhD program in Political Science will have a Fall admit term. Students applying to study part-time may be eligible for a Winter start date, though this would be handled on an individual basis. Admissions requirements are in line with admissions standards for comparable PhD programs in political science, and are designed to ensure that incoming students are prepared to undertake advanced research and knowledge creation work. This means that before entering the program, students should have some advanced knowledge of political science or a related discipline, strong marks, and competency in English, as it is the working language of the program.

Successful applicants must hold a master's degree in Political Science, or a related discipline, with a minimum average of 80% (A-) or equivalent.

Required application documents include:

- [Transcript\(s\)](#)
- Three academic letters of reference
- Supplementary information form;
  - Question 1: Please provide a statement of research (maximum 500 words)
  - Question 2: List up to three potential supervisors
- Résumé
- Writing sample (maximum 25 pages double-spaced)
- If applicable, proof of English language proficiency (ELP) through one of the following accepted examinations:
  - TOEFL (iBT): minimum overall score 100; writing 26; speaking 26

- IELTS (Academic): minimum overall score 7.5; writing 7.0; speaking 7.0
- Or an equivalent score on an accepted examination as per the [Graduate Studies Academic Calendar – English language proficiency](#) guidelines

Applicants with extensive and related professional experience who do not meet the minimum academic admission requirements for the program may be considered for admission, however, additional coursework may be required.

The program will be offered full-time and part-time. Students who are admitted to the program full-time and who remain in good standing will be provided with four years (12 terms) of funding at or above the University minimum. Funding beyond four years is not guaranteed but may be available. Part-time students will not be eligible for department-level funding.

*Note: Applicants who have completed their MA in Political Science at the University of Waterloo are subject to the same admission requirements.*

## 1.5 Structure

The proposed PhD program is designed so that it can be completed in four years by a full-time student completing the regular stream. Students choosing an experiential option (co-op or another experiential-based option) should anticipate extending that time by the length of their co-op work term or internship (in the case of co-op, the completion time would be five years). The structure of the program is designed to accommodate both of these streams. Four years to completion also tracks with anticipated funding provisions. Part-time students will not normally be considered eligible for the co-op option.

Students in the co-op stream would have their funding paused while on their work-terms (12 months). Their funding would resume when they return to the program as a full-time student.

A student in the co-op stream may have a funding package that looks as follows:

Year 1: funded

Year 2: funded

Year 3: work-terms – not funded

Year 4: funded

Year 5: funded

Full time students are expected to be actively engaged with program activities including courses and Departmental offerings during the first four semesters of the program. The goals of this engagement include consistent academic progression and the development of a community of political science scholars. This will allow students to complete their coursework and comprehensive exams, and begin their mandatory professional development modules. Experiential learning students (co-op work terms or other placements) may begin their placements as early as the Winter term of Year 2, and if

they have not defended a proposal before their placement begins, they should defend their proposal reasonably promptly on their return.

The general structure of the program as it relates to meeting the degree level expectations is as follows (the specific structure of the program is further elaborated in Section 4):

**Year 1:** Six required courses.

**Year 2:** Comprehensive exams (September) and mandatory professional development modules. Students may begin experiential placements (co-op or otherwise) no earlier than Spring of Year 2. Students on a full-time schedule will defend their thesis proposals in the Winter term.

**Year 3 & 4:** Students will complete remaining mandatory and optional professional development modules, any required field work for their dissertations, and complete and defend their thesis.

The proposed structure is designed to allow students to lay the foundations for their own independent research through coursework, comprehensive exams, and professional development related to the thesis in the first five semesters of the program. In the remaining semesters, the program becomes even more flexible, allowing students to construct the appropriate path for their research and career goals. Students completing the program part-time will complete courses and professional development at their own pace. This may naturally lead to longer completion times as there are some courses and professional development modules that will only be offered once per year.

The chart below shows how the various components of the degree map onto the program learning outcomes.

Degree Outcome	Major Program Components
1. Produce original research of the highest quality by combining a broad knowledge of the concepts, theories, and methods used in the study of political science, and their connections to the empirical world of government, politics, and policy-making, with expert knowledge of their own subject area;	<ul style="list-style-type: none"> <li>• Coursework</li> <li>• Comprehensive Exams</li> <li>• Thesis Proposal</li> <li>• Thesis &amp; Thesis Defence</li> </ul>
2. Develop research questions and designs through a practice of epistemological and methodological reflection and critical analysis while recognizing the limits of their research;	<ul style="list-style-type: none"> <li>• Thesis Proposal</li> <li>• Mandatory Professional Development Modules</li> <li>• Thesis &amp; Thesis Defence</li> </ul>
3. Communicate scholarly knowledge in various forms to various audiences using appropriate writing, speaking, or other communication skills;	<ul style="list-style-type: none"> <li>• Coursework</li> <li>• Thesis Proposal</li> <li>• Thesis &amp; Thesis Defence</li> <li>• Teaching Assistantship</li> </ul>
4. Make informed choices about their career as a political scientist;	<ul style="list-style-type: none"> <li>• Experiential Learning Placements</li> </ul>

	<ul style="list-style-type: none"> <li>• Optional Professional Development Modules</li> <li>• Supervisory Relationship</li> <li>• Teaching Assistantship</li> </ul>
7. Recognize diverse voices and experiences in research, teaching, professional development, and community engagement	<ul style="list-style-type: none"> <li>• Coursework</li> <li>• Teaching Stream Professional Development Modules</li> <li>• Supervisory Relationship</li> </ul>
8. Adhere to the highest professional standards of ethics and academic integrity in all aspects of research, teaching, professional development, and community engagement, and cultivate an awareness of how power relationships affect the attainment of those standards.	<ul style="list-style-type: none"> <li>• Academic Integrity Module</li> <li>• Teaching Stream Professional Development Modules</li> <li>• Experiential Learning Stream Professional Development Modules</li> <li>• Thesis &amp; Thesis Defence</li> <li>• Supervisory Relationship</li> <li>• Teaching Assistantship</li> </ul>
<b>Teaching Stream</b>	
Demonstrate knowledge of pedagogical theories and skills applicable to political science, and implement them in all aspects of teaching including curriculum design, course delivery, supervision, and mentorship.	<ul style="list-style-type: none"> <li>• Teaching Stream Professional Development Modules</li> <li>• Teaching Assistantship</li> </ul>
<b>Experiential Stream</b>	
Use the knowledge and skills developed through course work, research, and professional development milestones in a paid or volunteer work experience, and reflect on how that work experience relates to their own advanced political science research.	<ul style="list-style-type: none"> <li>• Experiential Learning Work Terms</li> <li>• Reflection exercises</li> </ul>

## 1.6 Program Content

The proposed PhD program provides rigorous training in political science while offering flexibility to students and an innovative array of features designed explicitly for both academic and non-academic career paths. On top of the core requirements of the regular program, students will have the option to take the experiential stream (consisting of the co-op option or another EL-based option), or the teaching stream.

As explored in more detail in Section 4, all students will take six graduate courses in their first year. All courses offered by the Department will be 'graduate only' (limited to MA and PhD students). These include two 'core' courses in one of the program's major fields, two courses in the student's second area (which may be another of the three graduate research fields or a custom concentration), a mandatory team-taught methodology course, and an elective.

**Core courses:** Core courses are designed to help prepare students for comprehensive field examinations in their major field by instilling the advanced theoretical and empirical foundations of Canadian Politics (PSCI 661 – Canadian Political Institutions, PSCI 662 Canadian Political Process), International Relations (PSCI 611 – International Relations Theory, PSCI 612 – Current Issues in International Relations) or Political Economy (PSCI 690 – Theories of Political Economy, PSCI 691 – Developments in Political Economy).

**Research Methods:** PSCI 600 will be a team-taught course covering units on quantitative and qualitative methods in political science and epistemological issues in the social sciences. Students will be exposed to instruction from three different faculty members, and will receive a foundational basis for understanding a diverse array of methodological approaches in the discipline.

**Elective courses:** A suite of electives will be offered each year. These courses will enable students choosing to do their second field as a custom concentration to tailor the content based on coursework. Electives will also help students to fill background gaps for proposed research, provide more detailed understanding of an important area of study, or broaden students' base of advanced understanding. Examples of elective courses that students will have the opportunity to take might include PSCI 624 – Justice and Gender, PSCI 633 – Canadian Public Policy, PSCI 650 – Approaches to the Study of Comparative Politics, PSCI 666 – Rights and Public Policy, and PSCI 680 – Critical Security Studies.

**Comprehensive examination:** each student will complete a written comprehensive field examination in their first (major) field, followed by a mandatory oral exam. The written exam will be based on coursework as well as a reading list determined by relevant faculty. For students on a standard full-time schedule, this comprehensive exam will normally be written early in the fall semester of the 2<sup>nd</sup> year of the program. Students will also complete an exam on their second field or concentration, consisting of a review essay broadly addressing the major theoretical debates, methodological hurdles, or substantive problems posed by existing scholarship in the field (students taking a 2<sup>nd</sup> major field may opt to take the written exam in the format described above).

**Professional Development milestones:** a cohesive program of research design and professional development milestones will be a feature that distinguishes the proposed program from others in Ontario and elsewhere. A core set of modules/seminars will be mandatory for all students. A certain number of elective modules will also be completed according to the goals and objectives of the student, in order to complete the PhD Professional Development Seminar. Students who opt for the experiential or teaching streams will also do additional professional development modules on top of these requirements, comprising the PhD Experiential Seminar and the PhD Teaching Seminar.

Mandatory modules will include research-oriented half-day seminars on 1) research design and methods, 2) conducting literature reviews, 3) best practices in fieldwork, and 4) conferencing best practices. Two additional mandatory professional development modules will focus on 5) careers in political science and translating skills for a non-academic job market, and 6) communicating research to a broader audience. Additional elective modules are listed in more detail in section 4. Students in the experiential stream will take additional modules in reflective practices in experiential learning,

and Centre for Career Action (CCA) workshops on preparing resumes and parallel career planning. Students in the teaching stream will complete the Centre for Teaching Excellence (CTE) [Fundamentals of University Teaching Program](#), conduct two guest lectures in political science, and develop a syllabus for a (real or prospective) political science course.

The Department's proposal for these professional development modules has received strong support from the support units it will collaborate with to develop them. The CCA and the Writing and Communications Centre contributed the following statements for this proposal:

"The Centre for Career Action (CCA) provides career development support and resources for PhD students, including career planning related to work in industry, government, academia, alt-ac, and other workplaces. Two full-time career advisors dedicated to serving graduate students offer workshops, drop-ins and individual appointments for career planning, work search strategies, résumés, cover letters, academic CV preparation and interview practice, in addition to delivering programming for the exploration of alt-ac careers such as the Professional Skills Conference and Exploring Diverse Careers in Academia, a job shadow program for PhD students. We also sponsor and use resources such as [Imagine PhD](#) and [CareerHub](#)."

"The Writing and Communication Centre (WCC) is pleased to express our support of the Department of Political Science in its development of a new PhD program, and particularly with its inclusion of professional development components on communicating research to a general or non-academic audience. Producing public scholarship and engaging public audiences are critical skillsets for academics and for researchers working in public and private sectors. The WCC looks forward to collaborating with the Department of Political Science in developing a custom workshop that supports PhD students in becoming flexible communicators who can adapt to a range of contexts, modes and audiences in order to share their work with precision and clarity. In addition to this specific program, the WCC provides a range of services for graduate students, including appointments and various interactive programs on such topics as writing research proposals, planning and writing papers and theses, and academic public speaking."

**Thesis Proposal:** students will write a thesis proposal situating their research question(s) in the extant literature, outlining their approach, theory, scope, and research methodology, and explaining the original nature of their contribution, along with a timeline and proposed chapter outline. The proposal will be subject to an oral defence before a committee including the student's supervisor and two other faculty members.

**Thesis:** students will have choice in the format of their thesis. Students may choose a traditional dissertation (ranging from 200 to 350 pages in length), or a 'publication model' consisting of at least three sole-authored (submitted, in press, or published) works, at least one of which is in a traditional, peer-reviewed outlet (other publications might include research reports for think tanks, etc.), and including an original introduction, conclusion and any necessary bridging chapters to reflect a coherent project. In rare cases, and with the approval of the student's supervisor and the Department's Graduate Committee, students may opt for a non-traditional thesis format that meets the standards of an original doctoral-level contribution to knowledge, but in a different form (for

example, a documentary). The Department is especially cognizant of the potential for alternative approaches to knowledge-generation and dissemination, such as Indigenous approaches to knowledge, as something to be accommodated on a case-by-case basis.

Regardless of format, the thesis will be subject to an oral defence before a committee, including the supervisor(s), two other political science faculty members, an internal-external examiner from another department/program at the University of Waterloo, and an external examiner.

### 1.7 Mode of Delivery

The proposed PhD program is primarily aimed at full-time students on campus, and we do not anticipate an online component. The program can also be completed part-time, an option that may be attractive to professionals who want to continue to work. Part-time students will have the same requirements for completion as full-time students, over a longer period of time. See sections 1.3, 1.5, and 1.6 above for a description of how the program meets Degree Level Expectations and the core components of delivery.

### 1.8 Assessment of Teaching and Learning

Students will be evaluated in various ways over the course of the program.

**Coursework:** Evaluated according to the instructor’s course design, but likely to include formal assessment of papers, presentations, and seminar participation

**Comprehensive Examinations:** Formal evaluation by committee.

**Professional Development:** These will be tracked as for milestones required for program completion, but each may have other modes of evaluation built in (particularly in the case of workshops offered by campus partners).

**Thesis:** The thesis will be evaluated first by the supervisor and the committee, and ultimately in a defence featuring an internal-external examiner and an external examiner.

Below, we provide more detail on how modes of assessment relate to the various program outcomes.

Program Outcome	Mode of Assessment
1. Produce original research of the highest quality by combining a broad knowledge of the concepts, theories, and methods used in the study of political science, and their connections to the empirical world of government, politics, and policy-making, with expert knowledge of their own subject area;	<ul style="list-style-type: none"> <li>• Coursework – various modes of assessment including papers of various lengths, seminar discussion, presentations, etc.</li> <li>• Comprehensive Examinations</li> <li>• Thesis Proposal and Thesis Defence</li> </ul>
2. Develop research questions and designs through a practice of epistemological and	<ul style="list-style-type: none"> <li>• Thesis Proposal and Thesis Defence</li> <li>• Mandatory Professional Development Modules – milestones but also includes</li> </ul>



methodological reflection and critical analysis while recognizing the limits of their research;	presentations and written work (see section 4.4)
3. Communicate scholarly knowledge in various forms to various audiences using appropriate writing, speaking, or other communication skills;	<ul style="list-style-type: none"> <li>• Coursework - various modes of assessment including papers of various lengths, seminar discussion, presentations, etc.</li> <li>• Thesis Proposal, Thesis, and Thesis Defence</li> <li>• Teaching Assistantship – formal evaluation by course instructor</li> </ul>
4. Make informed choices about their career as a political scientist;	<ul style="list-style-type: none"> <li>• Experiential Learning Placements – evaluation of reflective work or outputs of placement</li> <li>• Optional Professional Development Modules – milestones (see section 4.4)</li> <li>• Supervisory Relationship – ongoing assessment coupled with formal annual progress reporting</li> <li>• Teaching Assistantship – formal evaluation by course instructor</li> </ul>
9. Recognize diverse voices and experiences in research, teaching, professional development, and community engagement	<ul style="list-style-type: none"> <li>• Coursework – assessment of citation practices in written and other work in the course of formal course assessments</li> <li>• Teaching Stream Professional Development Modules – evaluation of citation practices in syllabus</li> <li>• Supervisory Relationship – ongoing coaching and evaluation</li> <li>• Experiential Learning Placements – evaluation by employer; evaluation of reflective work or outputs</li> </ul>
10. Adhere to the highest professional standards of ethics and academic integrity in all aspects of research, teaching, professional development, and community engagement, and cultivate an awareness of how power relationships affect the attainment of those standards.	<ul style="list-style-type: none"> <li>• Academic Integrity Module</li> <li>• Teaching Stream Professional Development Modules</li> <li>• Experiential Learning Stream Professional Development Modules: evaluation of reflective work and other outputs of placement</li> <li>• Thesis &amp; Thesis Defence</li> <li>• Supervisory Relationship</li> <li>• Teaching Assistantship</li> </ul>
<b>Teaching Stream</b>	

<p>1. Demonstrate knowledge of pedagogical theories and skills applicable to political science, and implement them in all aspects of teaching including curriculum design, course delivery, supervision, and mentorship.</p>	<ul style="list-style-type: none"> <li>• Teaching Stream Professional Development Modules: successful completion of Fundamentals of University Teaching and Certificate of University Teaching</li> <li>• Observation &amp; evaluation of Guest Lectures</li> <li>• Evaluation of syllabus</li> </ul>
<b>Experiential Stream</b>	
<p>1. Use the knowledge and skills developed through course work, research, and professional development milestones in a paid or volunteer work experience, and reflect on how that work experience relates to their own advanced political science research.</p>	<ul style="list-style-type: none"> <li>• Evaluation of reflective work</li> <li>• Evaluation of any outputs of the placement (reports, etc. that have been commissioned as part of the placement, and that can be evaluated)</li> </ul>

### 1.9 Fields in a Graduate Program [optional]

The PhD program includes the following as its primary graduate research fields:

- Canadian Politics
- International Relations
- Political Economy

## 2. HUMAN RESOURCES

Table 1 lists the full-time, regular faculty members that will be involved in course instruction and supervision, 20 FTE faculty members in total (19 appointed to Political Science and one cross-appointed with Economics). The faculty complement is extraordinarily well-balanced in terms of gender (10 men, 10 women) and rank/seniority (six assistant professors, eight associate professors, six full professors). As Table 1 indicates, each of the major fields is well covered by faculty members who have primary or secondary expertise (10 in Canadian Politics, nine in International Relations, and ten in Political Economy).

### 2.1 Resources for Graduate Programs Only

The Political Science faculty boasts a number of nationally and internationally-renowned scholars of their respective fields. Together, the 20 faculty members listed in **Table 1** have produced 42 authored books, 48 edited books, 397 refereed journal articles, and 379 book chapters.

**Tables 2 and 2A** list research grant award totals for the past seven years. During this time period the faculty have brought in over \$1.5 million in various awards, mostly from Tri-Council agencies like the Social Sciences and Humanities Research Council and other public sector and non-profit sector funding.

The Department also boasts faculty members who have been awarded various distinctions, including two Trudeau Fellows, two Fulbright scholars, a member of the Royal Society of Canada, a member of the Academy of Social Science of Australia, a Killam Foundation award winner, and three winners of

various book awards, including the Donner Prize for best book in Canadian public policy, the Donald Smiley Prize for best book in Canadian Politics, and the International Studies Associate ISSS Book Award. Seven faculty members have received Faculty-level awards for outstanding contributions to research, teaching, or service. And 13 faculty members have served on editorial boards for scholarly journals or research centres.

**Table 3** outlines faculty graduate supervision experience. Although the Department has not had a PhD program, eight of the faculty members have experience supervising PhD students (mostly through the Global Governance PhD program at the Balsillie School of International Affairs). All faculty members have experience supervising at the MA level. Variance in numbers of students supervised tends to relate to experience/seniority. All but one faculty member currently enjoys full supervisory privileges (the outstanding faculty member is a new hire who has not yet achieved [ADDS](#) status).

Although core courses in the three major fields will be taught by faculty with primary specializations in those fields (see Table 1), the custom concentration option and general design of the proposed program will ensure that all faculty members will contribute to teaching courses and supervising students on a wide range of topics of study.

## **2.2 List of Faculty by Field**

Table 1 lists the faculty members involved in the graduate program and identifies their rank, gender, home unit, supervisory privileges, and field(s) of study.

TABLE 1 Faculty Members Involved in Proposed Program							
Faculty Name	Rank (Professor, Assistant, etc.)	Gender (M/F/U)	Home Unit <sup>1</sup>	Supervisory Privileges <sup>2</sup>	Approved Field of Study <sup>3</sup>		
					Canadian Politics	International Relations	Political Economy
<b>Boychuk, Gerard</b>	Professor	M	Political Science	Full	X		x
<b>Carter, Angela</b>	Assistant	F	Political Science	Full	x		X
<b>Cattanpan, Alana</b>	Assistant	F	Political Science	Master's only	X		
<b>Cooper, Andrew</b>	Professor	M	Political Science	Full		X	x
<b>Drake, Anna</b>	Assistant	F	Political Science	Full	x		
<b>Esselment, Anna</b>	Associate	F	Political Science	Full	X		
<b>Habib, Jasmin</b>	Associate	F	Political Science	Full	X	X	
<b>Helleiner, Eric</b>	Professor	M	Political Science	Full	x	x	X
<b>Henstra, Daniel</b>	Associate	M	Political Science	Full	X		
<b>Huo, Jingjing</b>	Associate	M	Political Science	Full			X
<b>Kitchen, Veronica</b>	Associate	F	Political Science	Full		X	
<b>Lanoszka, Alexander</b>	Assistant	M	Political Science	Full		X	
<b>Macfarlane, Emmett</b>	Associate	M	Political Science	Full	X		
<b>Momani, Bessma</b>	Professor	F	Political Science	Full		X	x
<b>Mufti, Mariam</b>	Assistant	F	Political Science	Full			
<b>Ravenhill, John</b>	Professor	M	Political Science	Full		x	X
<b>Rus, Horatiu</b>	Associate	M	Economics	Full			X
<b>Wang, Hongying</b>	Associate	F	Political Science	Full		X	x
<b>Welch, David</b>	Professor	M	Political Science	Full		X	
<b>Whiteside, Heather</b>	Assistant	F	Political Science	Full	x		X

Notes:

1. This is the home department of the faculty member associated with the program under review.
2. The level of supervisory privileges held by each faculty member, e.g. full, masters only, co-supervision only, etc.
3. The particular fields of study for the program that have been Quality Council approved. If single faculty member is active in more than one approved field of study, a capital X indicates the faculty's primary field of study, and a lower case x represents secondary field(s) of study.

## 2.3 External Operating Research Funding

Table 2 presents the external research funding by source received by the core faculty for the past seven years. Table 2A presents the external operating funding by field received by the core faculty members combined for the past seven years.

TABLE 2 Operating Research Funding (\$) by Source and Fiscal Year <sup>1</sup>						
Fiscal Year <sup>2</sup>	Tri-Agency Awards <sup>3</sup>	Public Sector and Non-Profit Funding <sup>4</sup>	Private Sector Funding <sup>5</sup>	Internal Awards <sup>6</sup>	Equipment Awards <sup>7</sup>	Total
2011/12	\$39,931	\$66,096	\$0	\$15,400	\$0	\$121,427
2012/13	\$53,220	\$89,471	\$0	\$8,000	\$0	\$150,691
2013/14	\$14,610	\$75,769	\$0	\$48,000	\$0	\$138,379
2014/15	\$30,275	\$53,406	\$0	\$16,000	\$0	\$99,681
2015/16	\$178,840	\$96,351	\$0	\$8,000	\$0	\$283,191
2016/17	\$306,481	\$75,000	\$0	\$0	\$0	\$381,481
2017/18	\$236,841	\$95,000	\$0	\$10,000	\$0	\$341,841
<b>Totals</b>	<b>\$860,198</b>	<b>\$551,093</b>	<b>\$0</b>	<b>\$105,400</b>	<b>\$0</b>	<b>\$1,516,691</b>

Notes:

1. Data is reported on the primary investigator only. Table includes research awards for primary investigators included in Table 1.
2. Data is reported on the fiscal year. Waterloo's fiscal year runs from May 1<sup>st</sup> in one year until April 30<sup>th</sup> in the subsequent year, and includes three consecutive terms – Spring, Fall, and Winter. Please update the seven year window as appropriate.
3. Excludes equipment grants (e.g. NSERC RTI).
4. Excludes equipment grants and internal awards (e.g. CFI, UW-RIF, UW-SSHRC).
5. Includes funding received from Industry partners.
6. Includes UW-RIF and UW-SSHRC.
7. Includes NSERC-RTI and CFI.

TABLE 2A Total External Operating Funding (Combined Over the Seven Most Recent Fiscal Years <sup>1</sup> ) by Primary Field of Study <sup>2</sup>					
Field <sup>3</sup>	Tri-Agency Awards <sup>4</sup>	Public Sector and Non-Profit Funding <sup>5</sup>	Private Sector Funding <sup>6</sup>	Equipment Awards <sup>7</sup>	Total
Canadian Politics	\$134,628	\$47,594	\$0	\$0	\$182,222
International Relations	\$319,490	\$416,597	\$0	\$0	\$736,087
Political Economy	\$200,078	\$70,000	\$0	\$0	\$270,078
Unassigned	\$206,002	\$16,901	\$0	\$0	\$222,903
<b>Total</b>	<b>\$860,198</b>	<b>\$551,092</b>	<b>\$0</b>	<b>\$0</b>	<b>\$1,411,290</b>

Notes:

1. Data is reported as the combined funding over the seven most recent fiscal years by approved field of study.
2. Data is reported on the primary investigator only. Table includes research awards for primary investigators included in Table 1.
3. Faculty members' primary field of study is specified in Table 1.
4. Excludes equipment grants (e.g. NSERC RTI).
5. Excludes equipment grants and internal awards (e.g. CFI, UW-RIF, UW-SSHRC).

6. Includes funding received from Industry partners.

7. Includes NSERC-RTI and CFI.

## 2.4 Graduate Supervision

Table 3 presents the number of completed thesis supervisions for each of the core faculty members over the course of their career, and the number of thesis supervisions currently underway.

TABLE 3 Completed and Current Numbers of Thesis Supervisions by Faculty Member						
Faculty Name and Rank <sup>1</sup>	Total Completed Over Career <sup>2</sup>			Current <sup>3</sup>		
	Master's	PhD	PDF	Master's	PhD	PDF
Boychuk, Gerard	19	2		3		
Carter, Angela	1				1	
Cattapan, Alana				2		
Cooper, Andrew	62	4	2			
Drake, Anna	8			1		
Esselment, Anna	6			2		
Habib, Jasmin	32			3	3	
Helleiner, Eric	34	7	1	1	3	
Henstra, Daniel	18					
Huo, Jingjing	8			1		
Kitchen, Veronica	29			2	1	
Lanoszka, Alexander	5					
Macfarlane, Emmett	7					1
Momani, Bessma	16	3	4			
Mufti, Mariam	3			2		
Ravenhill, John	30	17			1	
Rus, Horatiu	8	1				
Wang, Hongying	14	18	2			
Welch, David	21	11	3	2	2	
Whiteside, Heather	7			2	2	

Notes:

1. Faculty members and ranks as specified in Table 1.
2. Number of thesis supervisions completed thus far over the faculty member's career.
3. Number of current thesis supervisions underway for each faculty member.

## 2.5 Commitment of Faculty from Other Graduate Programs/Other Institutions

N/A

## 2.6 Quality of Faculty

See section 2.1.

## 3. PHYSICAL AND FINANCIAL RESOURCES

### 3.1 Library Resources

### ***Level of support***

The University of Waterloo Library currently provides a high level of support for the Political Science department's undergraduate and master's programs. The addition of a PhD program, with a focus on fields already taught and researched in the department (Canadian Politics, International Relations, and Political Economy), can be easily covered by the Library's Political Science fund and by other subject funds intersect with these fields. With respect to the proposed experiential and teaching streams, the Library acquires a broad array of literature through its general funds that would support field/co-op work term reports and research projects in these areas as well.

### ***Collection strengths***

The Library provides access to full text journals, monographs, government information, and various databases that facilitate research within these fields. Databases particularly relevant to researchers in these fields are: ProQuest Politics (includes Political Science, Worldwide Political Science Abstracts, Public Affairs Information Service, and Policy File), Canadian Business and Current Affairs, Scopus, Web of Science, EconLit, LexisNexis Academic, and HeinOnline. Numeric and geospatial data sets are available through platforms and services including ODESI (Ontario Data Documentation, Extraction Service and Infrastructure), Inter-university Consortium for Political and Social Research, and Scholars GeoPortal.

To complement the experiential/teaching streams, the Library acquires materials of interest to the practitioner undertaking various types of fieldwork.

The University of Waterloo Library partners with other Ontario and Canadian universities to further expand access to resources. Consortial purchases are regularly arranged through our membership in the Ontario Council of University Libraries (OCUL) and the Canadian Research Knowledge Network (CRKN).

### ***Library Services***

The Liaison Librarian is available to provide research, teaching and learning support for graduate students and faculty. Instructional support can take the form of modules (for example: screencasts, videos, activities in LEARN), research guides, and classroom sessions. The Liaison Librarian also offers research consultations with individuals and teams to support coursework and research publications. Additional ways that the Library can assist PhD students in this program include information and advice relating to scholarly communication, open access publishing options; copyright; research data management; and bibliometrics and research impact.

### ***More information***

The Library would be happy to be meet with the program reviewers to discuss this report and answer their questions.

For additional information about University of Waterloo Library and the support it provides for programs, please visit <https://uwaterloo.ca/library/about/policies-and-guidelines/support-academic-programs>.

Report written by Jane Forgay, Liaison Librarian for Political Science, [jdforgay@uwaterloo.ca](mailto:jdforgay@uwaterloo.ca).

Reviewed by Kathy MacDonald, Department Head, Information Services and Resources, Dana Porter Library, [kamacdonald@uwaterloo.ca](mailto:kamacdonald@uwaterloo.ca).

Approved by Victoria Chu, Associate University Librarian, [victoria.chu@uwaterloo.ca](mailto:victoria.chu@uwaterloo.ca) and Beth Sandore Namachchivaya, University Librarian, [bsnamachchivaya@uwaterloo.ca](mailto:bsnamachchivaya@uwaterloo.ca).

### **3.2 Laboratory Resources**

Not applicable.

### **3.3 Computer Facilities**

All students are provided a University of Waterloo email address, and University of Waterloo Identity Access Management account (WatIAM), giving them access to the student information system Quest, and the online learning management tool LEARN. Students will also be able to access the University of Waterloo's wireless network eduroam, which can be used in their graduate office space, in the Department more broadly, and across campus.

PhD and MA students in the Department of Political Science will share access to an OKI C363dn Multifunction Colour Laser Printer (which includes scanning and copying capabilities). Students will be responsible for ink cartridge replacements through their Graduate Student Association funding.

Students in the Faculty of Arts have access to computer lab space managed by the Arts Computing Office, including a 24 hour lab. These labs offer software (including STATA, and SPSS) and other resources that, if applicable, can supplement students' research and coursework needs.

### **3.4 Space**

The Political Science Department is located on the third floor of Hagey Hall. There are 18 faculty offices, each of about 133 sq. ft. (Professor Horatiu Rus has an office in the Department of Economics). There is also an office for the Department Chair, of approximately 266 sq. ft. The department currently houses four additional offices for sessional instructors, visiting professors, postdoctoral fellows, and contract faculty, and three offices for each of its staff members.

The Department has a common room (HH 341 – approx. 400 sq. ft.) used for meetings, speaking events and as an undergraduate study space, and the graduate students have their own lounge space (HH 346 – approx. 400 sq. ft.). HH 346 is equipped with 15 carrel desks, a kitchenette (sink, coffee maker, microwave), a smart TV, and a printer.

A couple of offices within the departmental space were recently re-allocated to other units by the Faculty of Arts. Ideally, the Department will be able to offer PhD students their own office space, at four to five students per office, consistent with other Faculty of Arts departments in Hagey Hall (for example, the Department of Philosophy). Two of the existing offices may be converted for this purpose, but as the new PhD program grows, more space will be necessary. Shared office and common space for graduate students currently totals approximately 1,066 sq. ft.

### **3.5 Financial Support**



Full-time PhD students in good academic standing in year 1-4 of the program would be guaranteed the [Faculty of Arts minimum funding rates](#). Currently, for 2019, this is \$100,000 over four years (\$25,000/year, \$8,333/term).

\*\* see co-op report in appendix

### **External funding:**

PhD students in the Department of Political Science would be eligible, and encouraged, to apply for external funding, including but not limited to the following awards/scholarships:

- Social Sciences and Humanities Research Council
  - Joseph-Armand Bombardier Canada Graduate Scholarships Doctoral (\$35,000 per year for up to three years)
  - SSHRC Doctoral Fellowship (\$20,000 per year for up to four years)
- Ontario Graduate Scholarship (\$15,000 for one year)
- Trudeau Foundation Scholarship (\$60,000 per year for a maximum of three years)
- Vanier Canada Graduate Scholarship (\$50,000 per year for up to three years)

The University of Waterloo also provides additional funding for recipients of major federally and provincially funded competition-based scholarships through the [President's Graduate Scholarship \(PGS\)](#). The PGS is awarded each year a student holds one of the eligible graduate scholarships, and is valued at \$10,000/year. Students receiving a PGS for the first year of their doctoral program are eligible to receive \$15,000.

Students in good academic standing will also be eligible to apply for funding opportunities through Graduate Studies Postdoctoral Affairs, including the Graduate Studies Research Travel Assistantship for attending and presenting research at a professional conference, and the International Student Experience Award for students taking part in an international co-op work term with a limited salary, international volunteer work, or overseas academic exchanges.

## **4. CURRICULUM**

### **4.1 The Intellectual Development and the Educational Experience of the Student**

#### **Professional and Intellectual Development**

The goal of the program is to produce graduates who are intellectual leaders in their fields, no matter what kind of career students choose to pursue after graduation. As such, we have integrated directly into the curriculum modes of intellectual development that many other programs leave to the discretion of students. The program is structured so that students can choose their own pathways according to their preferences, needs, and goals. Further, we are conscious of the immense pressures on graduate students, so we have built the program in order to accommodate part-time students,

and to incorporate modules on practical skills as well as mental health and wellness that may help students to manage various stressors.

There are a number of mandatory professional development modules (comprising the PhD Professional Development Seminar milestone) that we believe are integral to any student's success in the program and as a graduate, and that contribute directly to achieving degree outcomes. These include workshops on research design, literature reviews, best practices for conferences and fieldwork, communicating research to non-academic audiences, and career planning and translating skills for a non-academic job market. Beyond that, students will be required to complete additional professional development modules from a set of electives (see section 4.4) that will support their intellectual development and career goals. Students may choose to complete a set of optional module as part of the regular stream of the program, or complete specific sets of optional modules in order to complete the teaching (PhD Teaching Seminar) or experiential (PhD Experiential Seminar) stream milestones. The optional modules are milestones in the degree in order to ensure that students take advantage of these co-curricular opportunities that are essential to meeting the degree outcomes.

### **Experiential Learning**

For their milestones, Teaching Stream students complete the Fundamentals of University Teaching Program offered by the University of Waterloo's Centre for Teaching Excellence, and will be given the opportunity to deliver guest lectures in the Political Science department, as well to develop a syllabus for a hypothetical course. Where the opportunity exists, students may also have the opportunity to teach as sessional instructors in the department.

Students in the Experiential Stream will complete 8 months (non-co-op experiential option) or 12 months (co-op option) of work experience as part of their degrees. This will give them valuable connections, experience, and potential job opportunities over the course of their degree, while also potentially enhancing their research through related job experience. Further details on this option are below in section 4.2. Co-curricular modules that focus on career-related skills will prepare students for this experience, and in any given year, we can identify several appropriate workshops from Centre for Career Action and MITACS that students can take to fulfill their requirements. Examples of these are workshops on parallel career planning, networking, or project management.

Students in the regular program may receive credit for completing modules that are part of the Teaching or Experiential Streams, but also for completing workshops offered by Counselling Services, the Writing Centre, or developed in-house by the Political Science Department. Examples of these are workshops on public speaking and publication, reducing anxiety, and writing grant proposals (see section 4.4).

### **Other Factors Related to Educational Experience**

The Political Science Department participates in four existing graduate programs (MA in Political Science, Master of Public Service, MA in Global Governance, PhD in Global Governance), and so we are well placed to provide an excellent graduate experience. Students in our program may easily take courses in the Global Governance and Public Service programs, providing further opportunities for them to tailor their education according to their needs. Our MA students run a research conference

and a journal each year, and we anticipate that PhD students would participate in the planning and execution of these as well. The Faculty of Arts provides opportunities for graduate students to apply for conference funding through various initiatives.

At the Department level, we provide a comprehensive orientation to the program, and new students are required to participate in orientations provided by the Faculty of Arts and the University, and to complete the module on academic integrity. Faculty members also have an excellent track record of winning competitive grants, and are often able to hire students as researchers on their projects.

## **4.2 Program Regulations**

### Admissions

As part of the admission requirements for the program, successful applicants must hold a master's degree in Political Science, or a related discipline, with a minimum average of 80% (A-) or equivalent. Please see section 1.4 for more details on admission requirements.

### Course requirements

In order to be considered in good academic standing, students must obtain a minimum average of 80% in the set of courses which they present in fulfilment of the course requirements for the PhD in Political Science. Please see sections 1.6 and 4.4 for more details on course requirements.

### Comprehensive examinations

As outlined in section 1.6, students will complete a written comprehensive field examination in their first (major) field, followed by a mandatory oral exam before a committee of three faculty members. The written exam will be based on coursework as well as a reading list determined by relevant faculty. For students on a standard full-time schedule, this comprehensive exam will normally be written early in the fall semester of the 2<sup>nd</sup> year of the program. Students will also complete an exam on their second field (or custom concentration), consisting of a review essay broadly addressing the major theoretical debates, methodological hurdles, or substantive problems posed by existing scholarship in the field. The review essay will be assessed by two faculty members.

### Professional development requirements

Required professional development milestones are credit/no credit based on attendance and participation in workshops and completion of any necessary work, tests or assignments associated with them. Students will be required to provide written confirmation for completion of any milestones in conjunction with campus partners (i.e. those not offered in-house by the Department). Please see sections 1.6 and 4.4 for more details on professional development milestones.

### Thesis Proposal Defence

As outlined in section 1.6, students will write a thesis proposal situating their research question(s) in the extant literature, outlining their approach, theory, scope, and research methodology, and explaining the original nature of their contribution, along with a timeline and proposed chapter outline. The proposal will be subject to an oral defence before a committee including the student's supervisor and two other faculty members.

### Thesis Examinations

The structure of the PhD program's thesis examination process is well within the University's guidelines for thesis examination regulations: <https://uwaterloo.ca/graduate-studies-postdoctoral-affairs/current-students/phd-thesis-examination-regulations> - please see section 1.6 for more details.

### Co-op

Students in the experiential stream have the option of completing their PhD as a co-op program where students combine their academic studies with practical work experience in positions related to their professional interests. Co-op will be available to students in all PhD fields (Canadian Politics, International Relations, Political Economy)). Students in the co-op program will complete 12 total months of work experience. Students would not be eligible to do a co-op term until after the completion of coursework and comprehensive examinations.

Drawing on existing strengths at the University of Waterloo through services provided by Co-operative Education & Career Action (CECA), students will be able to complete three co-op work terms (12 months) as part of their PhD. [Note: the requirement for 12 months of placement in co-op reflects, in part, the fact that students will get formal recognition of the co-op option on their degree, something not available for other experiential options]. The Department of Political Science has a proven track record of co-op work terms at the undergraduate and MA level.

Co-op will allow PhD students to apply their knowledge gained through academic course work and professional development modules to real-world scenarios, workplaces, and problems. Employment opportunities in public, private, and non-profit organizations that range from research and planning positions to public relations and organizational functions such as staffing, training, and supervisory activities are anticipated.

The purpose and benefits of co-op are as follows.

Students will:

- Combine academic study with paid work experience
- Refine their application package and interview skills
- Build a professional network

The procedures for evaluation will follow work term report guidelines already in place at the MA level, requiring a 15-20 page report investigating an aspect of the co-op experience from an academic perspective.

Co-operative Education has produced a feasibility report (see Appendix) noting the potential administrative and resource challenges as it prepares to expand graduate-level co-op opportunities and launch what would be the first centrally-administered co-op option at the PhD level. We are happy to note that the feasibility report indicates that Co-op is eager to work with the department to develop the program, and that the office is confident it can deliver high quality work terms and the resources, services, and supports to facilitate them.

### Mitacs and other placements

Students in the experiential stream also have the option of undertaking an internship through Mitacs or finding an alternative placement. Mitacs' internships differ from co-op experiences in that Mitacs internships are designed to support collaborative research projects (i.e., research projects that are of interest to for-profit or eligible not-for-profit organizations and of benefit to the researcher, and mutually agreed upon by the two parties). Students will be eligible to complete internships for periods ranging from four months to one year.

As with co-op, the placements will allow PhD students to apply their knowledge gained through academic course work and professional development modules to real-world scenarios, workplaces, and problems. Employment opportunities in private, and non-profit organizations range from research and planning positions to public relations and organizational functions such as staffing, training, and supervisory activities.

As with co-op, students will be expected to complete a work term report following existing guidelines, requiring a 15-20 page report investigating an aspect of the collaborative research experience from an academic perspective.

### **4.3 Part-time Studies**

The program will be offered full-time and part-time, students will have the option to select their enrolment status at the time of application.

Admitted full-time students in the program may switch to part-time status at the approval and discretion of the Graduate Officer. Students switching to part-time status will no longer be eligible for departmental funding.

### **4.4 Curriculum**

#### Core course descriptions

*The required Methods course and core courses for the three Major Fields are indicated below. These courses are new and will be developed to coincide with the start of the new program. Elective courses are pre-existing and included in the Graduate Calendar.*

**PSCI 600 – Political Science Methods:** This is a team-taught course examining different approaches to the study of political science, with units focusing on quantitative methods, qualitative methods, and an exploration of the epistemology of social science.

**PSCI 611: International Relations Theory:** This course examines the major theories of International Relations (IR) and the current state of the field. It addresses the major IR theories, how they inform advanced research, and how they relate to the conduct of world politics.

**PSCI 612: Current Issues in International Relations:** This course examines recent trends in world politics, their origins, and their policy implications.

**PSCI 661 - Canadian Political Institutions:** This course examines the structure and operation of central institutions in government, including dominant theories and approaches to their study. Topics may include the constitution, Parliament, the executive, courts, federalism and intergovernmental relations, political parties, provincial and municipal governance, and the bureaucracy.

**PSCI 662 - Canadian Political Process:** This course examines the political process and societal cleavages in Canada, with a focus on new directions and debates in research. Topics may include elections and voting behaviour, social policy, gender, regionalism and nationalism, Indigenous politics, political culture, interest groups and social movements, and rights.

**PSCI 690: Theories of Political Economy:** An advanced examination of theoretical approaches to the study of political economy. The course explores both historical and contemporary approaches and how they inform political economy research.

**PSCI 691: Developments in Political Economy:** A survey of recent developments in the field of political economy that combines local, national, comparative, and international perspectives on states and markets, politics and business, wealth and power.

### Professional Development Milestones

As noted in section 1.6 (Program Content) all students will be required to complete six mandatory modules in professional development:

- 1) Research design and methods (half-day seminar, in the department, including peer presentations, normally completed in the Fall of Year 2)
- 2) Conducting literature reviews (presentation in co-operation with the Writing Centre, normally completed in the Fall of Year 2)
- 3) Planning and best practices in fieldwork (half-day seminar, in the department, normally completed in the Winter of Year 2)
- 4) Conferencing best practices (half-day seminar, in the department, including writing abstracts, preparing conference presentations, being a good discussant. Normally completed after completion of dissertation proposal defence)
- 5) Careers in political science and translating skills for a non-academic job market (half-day seminar, in the department, normally completed after completion of dissertation proposal defence)
- 6) Communicating research to a broader audience (half-day seminar, in the department, normally completed after completion of dissertation proposal defence)

Students in the regular program will complete 3 additional elective modules from the following list in order to complete the **PhD Professional Development Seminar** milestone:

- Practice job talk / job interview (offered by the department)
- Workshops or courses providing additional training in social science methods (with approval by the associate chair, graduate studies)
- Completion of CTE workshop aimed at graduate students (with approval by the associate chair, graduate studies)
- Completion of a relevant MITACS Edge workshop/course (with approval by the associate chair, graduate studies)

- Completion of a relevant Writing and Communications Centre workshop (with approval by the associate chair, graduate studies)
- Completion of a relevant Centre for Career Action workshop (with approval by the associate chair, graduate studies)
- Completion of a Counselling Services workshop on mindfulness, cognitive therapy, or practical skills to reduce anxiety
- Completion of any course or workshop relevant to professional development offered by a campus partner (with approval by the associate chair, graduate studies)

Students in the experiential stream will complete the **PhD Experiential Seminar** milestone, composed of the following modules:

- 1) Reflective practices in experiential learning (half-day seminar, in the department, to be completed prior to the co-op term or internship/placement)
- 2) Writing resumes (workshop offered by the Career Centre or in the department, to be completed prior to the co-op term or internship/placement)
- 3) Workshop on parallel career planning (offered by the Career Centre or in the department)
- 4) One or more modules offered by MITACS or other campus partners, such as those featuring networking skills, foundations of project management, writing strategic business reports, or any seminar or workshop with the approval of the associate chair, graduate studies.

Students in the teaching stream will complete the **PhD Teaching Seminar** milestone, composed of the following modules:

- 1) Complete the Centre for Teaching Excellence Fundamentals of University Teaching Program.
- 2) 2 Guest Lectures in Political [students will receive automatic credit if they have the opportunity to teach their own course].
- 3) Develop a syllabus for a (real or prospective) political science course.

### Comprehensive Examination Requirements

#### **PhD Comprehensive Examination**

Students are required to meet the University-level PhD Comprehensive Examination minimum requirements outlined in the “[Minimum requirements for the PhD degree](#)” section of the Graduate Studies Academic Calendar (GSAC), with certain noted exceptions that are specific to the Faculty of Arts Comprehensive Examination minimum requirements:

- Comprehensive examination purpose: Consistent with University-level minimum requirements.
- Timing: Consistent with University-level minimum requirements.
- Committee: Consistent with University-level minimum requirements with the exception that in the Faculty of Arts, the Graduate Chair can approve the committee for comprehensive examinations.
- Who Chairs an examination: Consistent with University-level minimum requirements
- Format / Content: Consistent with University-level minimum requirements.
- Academic integrity: Consistent with University-level minimum requirements.

## **4.5 Collateral and Supporting Departments**

N/A

#### **4.6 Organizational Structure**

The PhD program in Political Science will be housed within the Faculty of Arts as part of the Department of Political Science. The program will be overseen by Associate Chair, Graduate Studies, in the Department of Political Science, with administrative and advising assistance from the Graduate Program Coordinator. Admission and program decisions will be made in consultation with the Graduate Committee (the faculty composition of the Graduate Committee is reviewed and assigned yearly).

#### **5. PROJECTED ENROLMENT**

The proposed start date for the program is Fall 2021. It is anticipated to start with approximately 4 full-time domestic students and admit 4 full-time domestic students per year for the first 7 years.



Table 4 shows the projected student intake and total enrolment in the proposed program over the next seven academic years.

**Table 4**

<b>Projected Student Intake and Enrolment</b>				
<b>Fiscal Year</b>	<b>FULL-TIME</b>			
	<b>Year One Intake</b>		<b>Total Fiscal Year Enrolment</b>	
	<b>Domestic</b>	<b>International</b>	<b>Domestic</b>	<b>International</b>
<b>2021/22</b>	4	--	7.85	--
<b>2022/23</b>	4	--	18.66	--
<b>2023/24</b>	4	--	28.83	--
<b>2024/25</b>	4	--	37.84	--
<b>2025/26</b>	4	--	40.96	--
<b>2026/27</b>	4	--	41.01	--
<b>2027/28</b>	4	--	41.01	--

Notes:

Enrolment transitions estimated based on Arts PhD transitions; assuming all domestic students, all full-time

## **6. FINANCIAL PLAN**

A financial viability analysis (FVA) investigating the financial parameters and assumptions of this proposed program was constructed by Institutional Analysis and Planning (IAP) and discussed in detail with the Faculty of Arts. IAP has not identified significant financial challenges to this proposal moving forward with the proposed enrolment, tuition rates, and costs as outlined in the FVA. The Faculty of Arts has acknowledged that this program will require additional financial resources in excess of what is generated by the program to operate, and that these will be the responsibility of the Faculty of Arts. The financial viability analysis was approved by the Provost on April 17<sup>th</sup>, 2020.

## Appendix

# PHD IN POLITICAL SCIENCE CO-OPERATIVE PROGRAM

## Co-operative Education Feasibility Report

Prepared by:

Rachel Jenson, Faculty Relations Manager, Co-operative Education

Contributions by:

Beth McLay, Market Research Manager, Co-operative Education

### Executive Summary

The proposed Political Science PhD program is being developed with the inclusion of experiential learning elements through both an experiential learning option and a teaching option, in an effort to adequately prepare students for future careers in both traditional academic and educational roles, as well as across various industries. The Co-operative plan will be optional to fulltime doctoral students and administered by the Co-operative Education (CE) department.

The Department of Political Science has a strong relationship with CE and currently has co-op plans available at both the undergraduate and graduate level. Political Science graduate students albeit small in number, obtain high levels employment through the employment process or jobs arranged on their own. Analysis of recent co-op work term records suggest that there are existing employers who may have work opportunities for PhD students however, these are primarily four-month work terms.

Although the number of students expected to pursue the co-op option is small, CE cautions that this will be the first PhD co-op plan centrally supported at UWaterloo. Processes, student support, messaging, and job development activities are currently primarily geared for an undergraduate student population and a standard four-month work term, creating a potential gap in the type of employment opportunities that will be more relevant and suitable for doctoral students. Student expectations will need to be managed with respect to the level of competition they may face in the employment process, particularly if they have limited work experience. CE

has launched an initiative to assess and scope a work-integrated learning framework along with the supports and resources suitable for graduate students. Until that work is completed and properly funded, new Master's and PhD Co-op plans will operate within current CE processes and policies.

CE is eager to work with the Political Science department to implement a PhD-level co-op program. With additional resources, we are confident we will be able to provide Political Science doctoral students with high quality co-op work terms and the resources, services, and supports that are hallmarks of Waterloo's co-op programs. The following items will need to be developed with the Political Science department and CE upon program approval:

1. Articulation of a co-op requirement framework for the Political Science PhD program in the Academic Calendar and student handbooks (as appropriate) that includes details such as admission to a co-op program and relevant deadlines, sequence and length of work term(s), mid-term evaluation and site visit, employer evaluation, work report, full-time registration status, co-op fee, granting co-op credit, and other co-op guidelines, policy, and process as required.
2. Work term details. The length and composition of the work term will require clarification and in our view should be driven by the pedagogy of work-integrated learning and the program. Completing two or three work terms back-to-back may create restrictions in the job search process (e.g., campus interviews) and operationally, a 12-month work term will require process modification.
3. Development of resources and supports for students including preparation for the application process and job search support/resources, communications appropriate for graduate students, admission to the co-op plan (including a co-op plan code), recruitment term support requirements (on- or off-campus), work-term support staff training, and return to campus. Both the Centre for Career Action and WatPD will be involved in this step, along with the department. Additional funding resources may be required from the Political Science department to cover shortfall not covered by the existing fee structure.
4. Advise CE of any future changes to curriculum, program enrollment, and/or ratio of international students participating in the program. In the event of an increase in enrollment, Political Science will assist CE with any business development necessary to ensure adequate employment opportunities for the size of the program.

# Table of Contents

<b>1.0 Proposal Overview</b> .....	<b>1</b>
1.1 Proposal Objective and Rationale .....	1
1.2 Context/Competition.....	2
1.3 Societal Goals/Employability Expectations .....	2
<b>2.0 Proposal Data and Logistics</b> .....	<b>4</b>
2.1 Enrollment and Admission.....	4
2.2 Co-op Sequence.....	4
2.3 Current Employment Data for Students in Similar Program/Plan .....	5
<b>3.0 Timeline/Resources</b> .....	<b>8</b>
<b>4.0 Appendix A</b> .....	<b>9</b>
<b>5.0 Appendix B</b> .....	<b>11</b>
<b>6.0 Appendix C</b> .....	<b>12</b>
<b>7.0 Appendix D</b> .....	<b>14</b>

# Proposed Program

New Co-op Program: PhD in Political Science, Co-op

Faculty/Department Sponsor: Heather Whiteside and Emmett Macfarlane, Department of Political Science

Co-operative Education Representative: Rachel Jenson, Faculty Relations Manager

Anticipated Effective Date: Fall 2020

## 1.0 Proposal Overview

### 1.1 Proposal objective and rationale

The Department of Political Science has proposed a new PhD program with an effective date of Fall 2020, with the first work term sequence starting in Winter 2022. In an effort to provide experiential learning opportunities for their students, the program is seeking to include a co-op option, as part of their experiential education stream. Additional options also include Mitacs, individual experiential learning terms, and a teaching stream, with the intention of preparing students for future work in academia or industry.

The proposed Co-op plan would have PhD candidates participating in the Co-operative Education (CE) employment process using the WaterlooWorks system. Co-op is designed to mimic real-world employment practices, and as such can be highly competitive and resource intensive for students during that particular time. Work experiences are not guaranteed placements, meaning students are accountable for engaging in co-op preparation and recruitment activities in order to secure employment. Students drive their experiential learning by applying to job postings that are of interest to them, and align with their career goals.

The proposed PhD in Political Science will include three areas of study for students to choose: Canadian politics, international relations and political economy, and all will have the option of co-op. CE and the Department of Political Science expect overlap with existing co-op programs, particularly other Master of Arts co-op plans such as Public Service, Economics and Political Science.

## 1.2 Context/competition

The University of Waterloo currently has 120 Undergraduate co-op programs and approximately 10 Master's co-op programs that operate under the accountability of Co-operative and Experiential Education (CEE). Political Science would be the first centrally supported Co-op plan at the doctorate level.

The University of Waterloo established an alternating work-study framework for undergraduate co-op programs with expectation that students would progress throughout their studies continuously building upon their knowledge and skills to be increasingly more competent in their area of study and impactful to their employers in the workplace. Master's Co-op plans are structured differently, with one or two work terms held consecutively due to the shorter program lengths (typically two or three academic terms). Graduate co-op programs have been created to fit-in with the undergraduate co-op model, and as such, there is a lack of differentiation between the two groups and how they are supported in co-op.

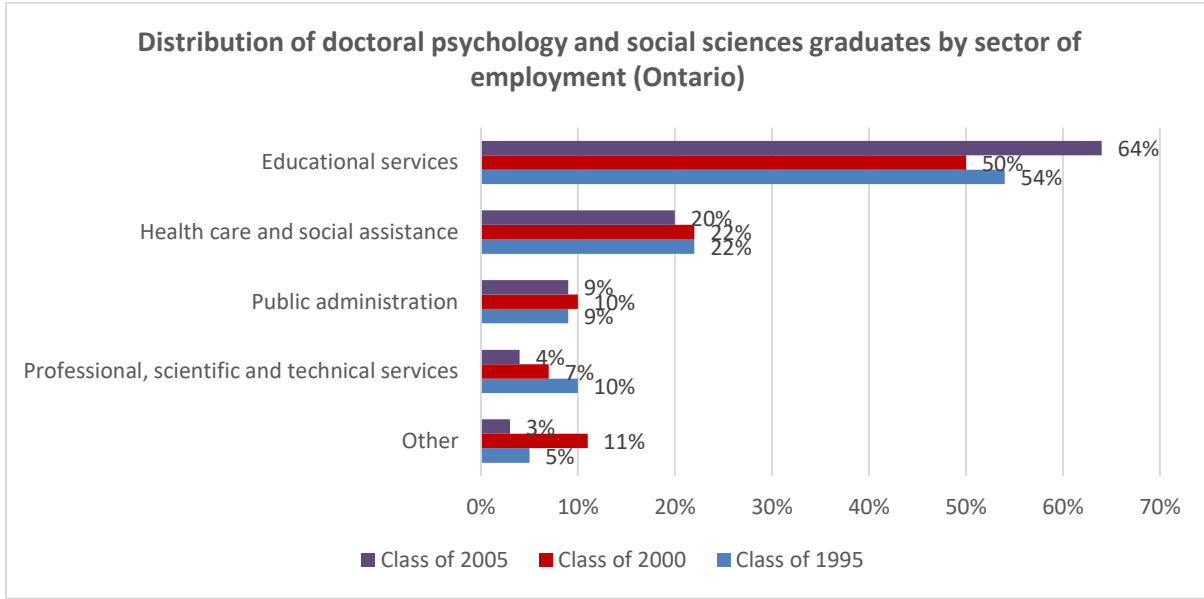
Across campus, there is strong desire in growing enrollment and strengthening the co-op programs that exist at the graduate level. At the same time, there are concerns within Co-operative and Experiential Education (CEE) that gaps exist in our structure and support model, which need to be addressed holistically in order to create stronger and more sustainable graduate co-op programs.

## 1.3 Societal goals/employability expectations

An analysis of Labour Force Survey and National Graduates Survey data indicates that the employment rate for graduates of above bachelor's degrees (graduate programs) has remained fairly stable at above 86% and that over a third of doctoral graduates in the field of study that includes Political Science (Psychology and Social Sciences) are currently being employed outside of academia.

The Ontario job market forecast for the employment sectors where these graduates are employed indicates only slight growth over the next four years, largely through job attrition. Coupled with the number of Canadian universities that currently offer PhD in Political Science programs, and the relatively few external job postings for PhD

education level jobs in social sciences, graduates may encounter some initial challenges finding relevant work in Ontario. Job experience, through the co-op stream, may provide a competitive advantage for graduates of the PhD in Political Science program at UWaterloo.



Source: Profile and Labour Market Outcomes of Doctoral Graduates from Ontario Universities, Statistics Canada 2012 (Catalogue no.81-595-M No. 098)

The employment outlook for the main sectors of employment for graduates with a doctorate degree in Psychology and Social Sciences in Ontario indicates slight employment growth rates between 4% and 10% over the next four years. Job openings in these sectors are expected to come predominately from replacement (retirement, death and emigration) jobs.

See Appendix A for the forecasted employment outlook for three areas of potential graduate employment: University professors and lecturers, Health care and social assistance – Government managers and Public Administration - Government managers.

## 2.0 Proposal Data and Logistics

### 2.1 Enrollment and admission

The PhD in Political Science Co-op plan is expected to attract a small number of students annually, likely only one to two students per cohort year. Students will apply for entry into co-op following the completion of year-one, by the Fall term of second year. Composition of students in the program will primarily be Canadian students.

### 2.2 Co-op sequence

Students pursuing the co-op option would begin work in year-two of the program, following the completion of six required courses, field exams and professional development modules. During the fall of second year, co-op students would participate in the co-op employment process with access to co-op job postings in WaterlooWorks. Only students pursuing their studies full-time will be eligible for the co-op option.

The co-op work experience will be 12 months in length, and students may choose to work with a single employer for the duration of their work term, or may choose/become matched with four or eight month work terms. Political Science Co-op students must complete 12 months of work in order to graduate with the co-op designation.

#### Proposed Co-op Internship Study-Work Sequence:

Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter
Study	Study	Study	Study	<b>Work</b>	<b>Work</b>	<b>Work</b>	Study	Study	Study	Study

Following the work experience(s), students will spend the remainder of their doctorate program completing professional development modules, fieldwork for their dissertations and completion of their capstone research projects.

CE currently does not have a 12-month work term option, and as such, jobs are developed and advertised for only four or eight month periods. Political Science students matched with a four or eight-month job may extend their work term length, provided the



employer is willing to accommodate a longer term student, or will need to participate in WaterlooWorks recruitment activities a second or even a third time to complete the 12-month work requirement. Students will receive CE off-campus support as required, allowing full participation in the co-op employment process while working elsewhere.

Additionally, jobs posted in WaterlooWorks may or may not be applicable for graduate students. CE suggests that Political Science and/or a graduate Career Advisor within the Centre for Career Action meet with co-op students individually to evaluate job postings before they apply to jobs in WaterlooWorks. This time-sensitive activity during open application periods will maximize the opportunity for connection to curriculum and students' longer-term career goals.

Co-op students also have the option of arranging their own co-op employment for co-op credit, which may be a preferred route for doctoral students. At the graduate level, and with shorter durations in a workplace setting as part of the degree, the importance of job alignment with the program and students' career goals is greater. Therefore, CE will evaluate job opportunities for their validity and basic co-op requirements, and will collaborate with Political Science for assessment of the job quality and relevance to the program for students at the doctoral level. This will require a creative approach to job approvals, which is not the case for other programs, but is intended to ensure students' connection between their area of study/research and the workplace.

At the graduate level the co-op fee is assessed during the work term, and only once the student secures employment for that particular term. Political Science PhD Co-op students will be required to pay three co-op fees as determined by the co-op fee assessment schedule.

The proposed work-study sequence will comply with Co-operative Education and Work-Integrated Learning Canada (CEWIL) accreditation standards as a Co-op Internship, which states the ratio of work terms to academic terms is 30%, so co-op programs with eight (8) academic terms require three (3) work terms.

### 2.3 Current employment data for students in a similar program/plan

#### Internal Competition

It is expected that Political Science co-op students will find employment from existing co-op employers for similar programs and that no job development will be required. PhD students will compete for jobs alongside Master's and Undergraduate students. In fact, third, fourth and/or fifth work term undergraduate students may be as equally or even more employable with employers depending on their needs and the amount of relevant experience they bring.

An analysis of existing UWaterloo Arts graduate student co-op placements, particularly from the Master of Public Service and Master of Arts in Political Science programs provides some insight into the potential co-op job market for the PhD in Political Science co-op program. See Appendix B for a listing of job titles and Appendix C for a listing of employer organizations for MA Political Science and MA Public Service students over the past three years.

A total of 463 graduate students from the Faculty of Arts were scheduled for co-op over the nine terms in 2016 to 2018. Just under 70% (311) of all these students were from the Master of Public Service program. The Master of Arts in Political Science program had a small, but growing number of students scheduled for co-op work terms.

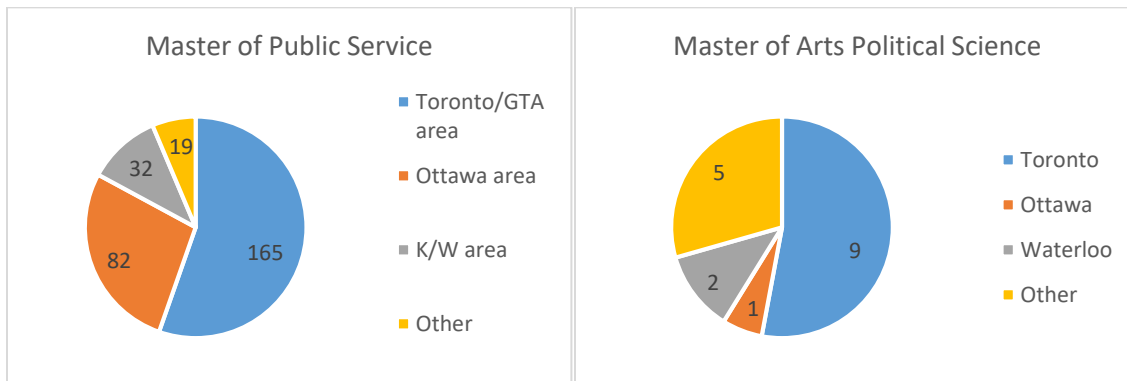
**Number of Arts Graduate Students Scheduled for Co-op Work Terms by Program 2016-2018:**

	W16	S16	F16	W17	S17	F17	W18	S18	F18	Grand Total
<b>Master of Public Service</b>	2	48	48	1	53	53	0	53	53	311
<b>Master of Arts Political Science</b>	0	5	3	0	0	0	2	9	9	28
<b>Master of Arts English</b>	0	8	8	0	1	1	0	7	7	32
<b>Master of Arts Economics</b>	1	12	12	1	14	14	0	15	14	83
<b>Master of Arts Sociology</b>	0	1	1	0	1	1	1	3	3	9
<b>Total</b>	<b>3</b>	<b>74</b>	<b>72</b>	<b>2</b>	<b>69</b>	<b>68</b>	<b>2</b>	<b>87</b>	<b>86</b>	<b>463</b>

CE analysis of current co-op employers of Arts graduate students indicates that there are co-op employers who may be relevant for PhD in Political Science students. However, it is important to note that co-op positions at these employers have not been developed specifically for the doctorate level and therefore, student expectations for the type of work and level of responsibility may have to be managed, especially if the student has limited previous job experience.

Co-op jobs for Master of Public Service and Master of Arts in Political Science are predominately located in the GTA and Ottawa areas indicating that PhD Political Science students will likely need to relocate outside of the Kitchener/Waterloo area for their co-op work term.

**Number of co-op hires by location for Master of Public Service and Master of Arts in Political Science 2016-2018:**



The employment rate for Master of Arts in Political Science co-op students for the nine work terms in 2016 to 2018 is 100%. The Master of Public Service co-op employment rate for the same period is a strong 98.7%. The department of Political Science has been actively involved in the job search efforts of their Master's students, including utilizing their own professional networks to connect students to co-op opportunities. It is important to note the only graduate program that is mandatory co-op is Master of Public Service. Students from all other programs may elect to drop co-op if they are unable to

secure a job for a particular work term, thus inflating the employment rates as those students are not reflected in the data.

**Total Arts Graduate Students Employment Rates by Program 2016-2018:**

	W16	S16	F16	W17	S17	F17	W18	S18	F18	Total
<b>Master Public Service</b>	100.0%	95.8%	100.0%	100.0%	100.0%	100.0%	n/a	96.2%	100.0%	98.7%
<b>Master of Arts Political Science</b>	n/a	100.0%	100.0%	n/a	n/a	n/a	100.0%	100.0%	100.0%	100.0%
<b>Master of Arts English</b>	n/a	100.0%	100.0%	n/a	100.0%	100.0%	n/a	100.0%	100.0%	100.0%
<b>Master of Arts Economics</b>	100.0%	91.7%	100.0%	100.0%	100.0%	100.0%	n/a	100.0%	100.0%	98.8%
<b>Master of Arts Sociology</b>	n/a	100.0%	100.0%	n/a	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
<b>Total</b>	100.0%	95.9%	100.0%	100.0%	100.0%	100.0%	100.0%	97.7%	100.0%	98.9%

**External Competition**

University of Victoria is the only CEWIL accredited university in Canada that offers co-op for PhD in Political Science program. It is a three-year degree with three 16-week work terms. Several Canadian universities offer doctorate degrees in Political Science:

- |                       |                                |
|-----------------------|--------------------------------|
| Carleton University   | Concordia University           |
| McMaster University   | Dalhousie University           |
| Queen's University    | McGill University              |
| University of Guelph  | Simon Fraser University        |
| University of Ottawa  | University of Alberta          |
| University of Toronto | University of British Columbia |
| Western University    | University of Calgary          |
| York University       | University of Montreal         |
|                       | University of Victoria         |

In recognition that many PhD students will be pursuing careers outside of academia, and the intention of co-op to adequately prepare individuals for work in various industries, an environmental scan of current employment opportunities for graduates was

undertaken. See Appendix D for list of recent job postings for applicable social sciences/political science positions that require a graduate degree.

### **3.0 Timelines/Resources**

Due to the proposed enrollment in Political Science Co-op (one to two students annually), it is not feasible for CE to do any targeted job development for this program. CE will absorb the small number of students into existing support, operating processes, job development and work term check-ins that already exist at the undergraduate level.

Collaborative work needs to be done with CCA and the department to build stronger alignment of co-op preparations resources and messaging. While co-op preparation resources and one-to-one interactions are offered by CCA, students must individually seek them out; as such, a more systematic approach is required to ensure high quality support for graduate students.

Further discussions with the Department of Political Science and CE will be required over the next year to further clarify aspects of a Political Science Co-op degree and address conditions previously stated.

### **4.0 Recommendation**

- Supportable as proposed
- Supportable with conditions
- Not supportable

### **5.0 Endorsements**

---

Emmett Macfarlane, Associate Chair, Graduate Studies,  
Department of Political Science

---

Date

---

Anna Esselment, Chair,  
Department of Political Science

---

Date

---

Robert Park, Associate Dean Co-op and Planning,  
Faculty of Arts

---

Date

---

Rachel Jenson, Faculty Relations Manager,  
Co-operative Education

---

Date

---

Richard Wikkerink, Director, Student and Faculty Relations,  
Co-operative Education

---

Date

---

Ross Johnson, Executive Director,  
Co-operative Education

---

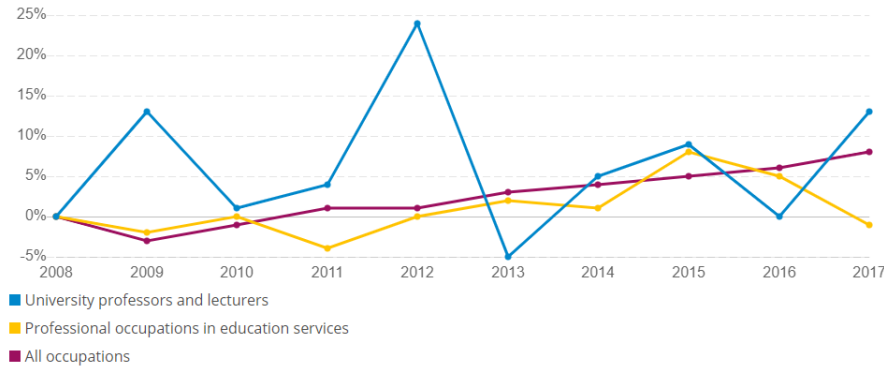
Date

# Appendix A

## Educational Services - University professors and lecturers, NOC 4011

### Job growth

Projected change in employment levels from 2017 - 2021: 9.1% - 10%



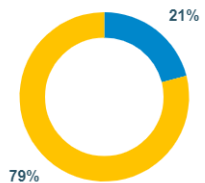
University professors and lecturers

■ New jobs (2017-2021)  
■ Replacement jobs (2017-2021)

## Health care and social assistance – Government managers – health and social policy development and program administration, NOC 0411

### Job growth

Projected change in employment levels from 2017 - 2021: 5.1% - 6%

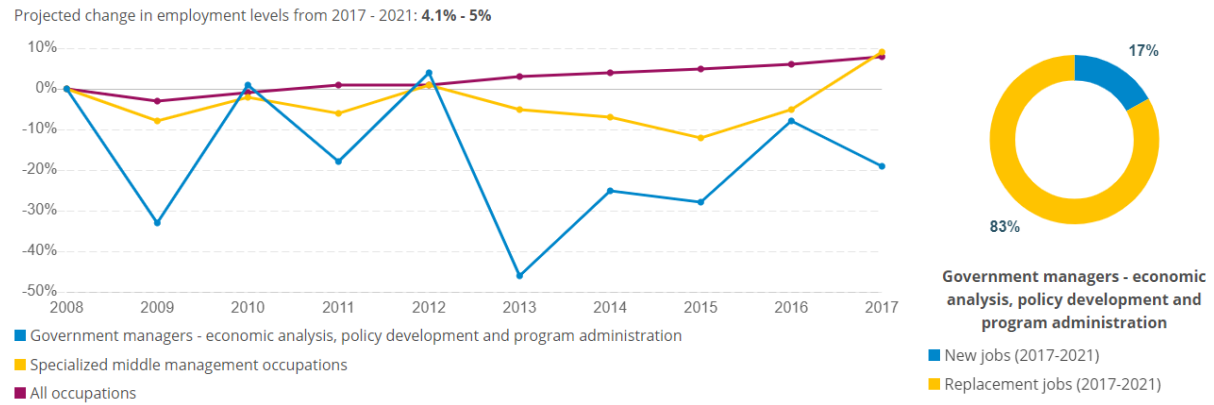


Government managers - health and social policy development and program administration

■ New jobs (2017-2021)  
■ Replacement jobs (2017-2021)

## Public Administration - Government managers - economic analysis, policy development and program administration, NOC 0412

## Job growth



Source: Ontario Labour Market Reports using Statistics Canada data <https://www.ontario.ca/page/labour-market>



## Appendix B

### Top Co-op Job Titles and Number of Jobs for Master of Public Service and Master of Arts in Political Science 2016-2018:

Co-op Job Titles and # of Positions			
Master of Public Service		Master of Arts Political Science	
Research Analyst	33	Summer Student	2
Analyst	18	Business Process Review and Compliance	2
Policy Co-op	16	Special Projects & Reception Assistant	2
Policy/Junior Policy Analyst	14	Anti-Money Laundering Investigator	2
Research Assistant	8	Planning Analyst	2
PERL Policy Co-op	11	Senior Researcher	1
Junior Business Analyst	6	Trade Policy Advisor	1
Junior Project Analyst	5	Junior Program Advisor	1
Industry Analyst	4	Policy Intern	1
Change, Release and Deployment Mgmt Assistant	4	Research Assistant - Analytics & Intelligent Systems Group (Banking Analytics Research, Regulatory)	1
Strategic Planning and Performance Management Analyst	4	Advisor	1
Project Coordinator	3	Policy Assistant	1
Health Performance & Accountability Analyst	3		
Solution Architect Trainee	3		
Advisor, Clean Tech & Advanced Manufacturing Branch	3		
Problem Resolution/Service Complaints Officer	3		
Advisor, Advanced Manufacturing Branch	3		

## Appendix C

### Top Co-op Hires by Organization for Master of Public Service and Master of Arts in Political Science 2016-2018:

# of Hires by Organization			
Master of Public Service		Master of Arts Political Science	
Ontario Ministry of Infrastructure	20	Toronto Transit Commission	2
Treasury Board Secretariat	19	Randstad Canada	2
Employment and Social Development Canada	19	Ontario Ministry of Trade	2
Regional Municipality of Peel	12	Environment and Climate Change Canada	2
Ontario Ministry of Economic Development and Growth	11	Government of Alberta	2
Innovation Science and Economic Development Canada	11	University of Waterloo	2
Environment and Climate Change Canada	9	Ontario Ministry of Community and Social Services	1
University of Waterloo	9	Canadian Feed the Children	1
Toronto Transit Commission	8	National Research Council Canada	1
Statistics Canada	7	National University of Singapore	1
The Regional Municipality of York	7	Northern Policy Institute	1
Ontario Ministry of Finance	7		
Ontario Min of Econ Dev, Employment & Infrastructure	7		
Ontario Ministry of Community and Social Services	6		
Office of the Premier and Cabinet Office	6		
Ontario Ministry of Education	5		
Ontario Ministry of Transportation	5		
Health Canada	4		
City of Waterloo	4		
Agriculture and Agri-Food Canada	4		

Ontario Ministry of Municipal Affairs	4		
Ontario Ministry of Health and Long-Term Care	4		
Public Services and Procurement Canada (PSPC)	4		
Ericsson Canada Inc	4		
Ontario Lottery & Gaming Corporation	4		
Canada Revenue Agency	4		
Federal Economic Development Agency	4		
Ontario Ministry of Agriculture, Food and Rural Affairs	4		
Ontario Ministry of Advanced Education and Skills Development	4		

## Appendix D

Company	Location	Job Title	Summary	Qualifications	Degree
<b>Government of Canada – Fisheries and Oceans Canada</b>	Ottawa, ON	Policy Analyst/ Senior Policy Analyst	<ul style="list-style-type: none"> <li>No summary given</li> </ul>	<ul style="list-style-type: none"> <li>Significant experience with decision-making for senior management</li> <li>Policy research or analysis to support development of policies, plans or legislative frameworks</li> <li>Experience in preparing position papers</li> <li>Experience in economic and/or policy research and analysis in areas related to fisheries, oceans, natural resources or sustainable development</li> </ul>	<ul style="list-style-type: none"> <li>Postgraduate Degree from a recognized university</li> </ul>
<b>Bank of Canada</b>	Ottawa, ON	PhD Internship	<ul style="list-style-type: none"> <li>Spend two to four months pursuing dissertation and presenting and promoting research</li> <li>May have access to Bank's data sets</li> </ul>	<ul style="list-style-type: none"> <li>Must submit cover letter which states how research is relevant to the Bank of Canada</li> <li>Letter of recommendation supporting writing, research, and empirical and/or modelling skills</li> </ul>	<ul style="list-style-type: none"> <li>Working toward PhD</li> </ul>
<b>Government of Canada – Statistics Canada</b>	Ottawa, ON	Statistics Canada Analytical Studies Research Fellowship	<ul style="list-style-type: none"> <li>Allows students in a doctoral programme who are working on theses to access data available only at Statistics Canada</li> <li>Economic Analysis, Health Analysis, Social Analysis and Modelling databases</li> </ul>	<ul style="list-style-type: none"> <li>Provide research proposal and cover letter</li> <li>References</li> </ul>	<ul style="list-style-type: none"> <li>Working toward PhD</li> </ul>

Company	Location	Job Title	Summary	Qualifications	Degree
<b>Mitacs</b>	Ottawa, ON	Policy Analyst	<ul style="list-style-type: none"> <li>• Conduct policy research and prepare materials including briefings, presentations, proposals, submissions and other policy documents</li> <li>• Monitor trends in innovation policy, PhD education, research funding and others</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate report/proposal writing</li> <li>• Project management</li> <li>• Experience in leading complex projects, working effectively with multiple projects</li> </ul>	<ul style="list-style-type: none"> <li>• Master's Degree in Economics, Public Policy, Political Science, or related field</li> </ul>
<b>The YMCA of Greater Toronto</b>	Toronto, ON	Manager, Program Research and Development	<ul style="list-style-type: none"> <li>• Monitoring community well-being, impact measurement and evaluation</li> <li>• Lead primary survey research and secondary data collection to maintain and develop YMCA of greater Toronto</li> <li>• Sustainability and Revenue Generation</li> <li>• Designing and executing and interpreting quantitative and qualitative research methodologies to understand needs and behaviours and customer trends</li> </ul>	<ul style="list-style-type: none"> <li>• Strong qualitative and quantitative research skills and appropriate univariate and multivariate statistical methods</li> <li>• Proficiency with statistical software such as SPSS or SAS</li> <li>• Demonstrate analytical and report creation skills</li> </ul>	<ul style="list-style-type: none"> <li>• A level of education and experience equivalent to a PhD or a Master's degree in social or health sciences</li> <li>• 3 years' experience in a social or health science setting</li> </ul>

Company	Location	Job Title	Summary	Qualifications	Degree
<b>Baxter</b>	Mississauga, ON	Senior Manager, Government Policy & Reimbursement	<ul style="list-style-type: none"> <li>• Develop and execute market access strategies that align with franchise strategy</li> <li>• Engage externally as needed with key influencers around policy, pricing and advocacy issues</li> <li>• Assist with the development and implementation of public relations and government affairs strategy</li> </ul>	<ul style="list-style-type: none"> <li>• 5-7+ years of combined Market Access, Medical Affairs and/or Marketing experience required</li> <li>• Medical device and/or pharmaceutical industry experience</li> <li>• Project management skills and experience</li> </ul>	<ul style="list-style-type: none"> <li>• Bachelor's Degree required</li> <li>• Master's or advanced degree, preferred</li> <li>• Preferred: Health administration, public affairs/political science, public health,</li> <li>• Marketing, HEOR, science</li> </ul>
<b>Government of Canada</b>	Saint-Jean-sur-Richelieu, QC	Lecturer/Assistant/ Associate/Professor Inventory	<ul style="list-style-type: none"> <li>• The Royal Military College is offering post-secondary education in humanities, sciences and engineering</li> </ul>	<ul style="list-style-type: none"> <li>• High level of scholarly productivity as demonstrated by the publication of research in peer-reviewed and scholarly journals</li> <li>• Experience with university administration and academic service</li> <li>• Experience teaching at a military university</li> </ul>	<ul style="list-style-type: none"> <li>• Some positions will require a PhD from a recognized post-secondary institution within the specified areas of expertise</li> <li>• Areas of expertise: Humanities and social sciences, Physical Sciences, Engineering</li> </ul>

Company	Location	Job Title	Summary	Qualifications	Degree
<b>Women's College Hospital</b>	Toronto, ON	Evaluation Scientist	<ul style="list-style-type: none"> <li>Design and develop a theory-based program evaluation model for the University of Toronto MD program and WCH</li> <li>Mentor, collaborate and consult with other education scientists and graduate students regarding research programs</li> </ul>	<ul style="list-style-type: none"> <li>3 – 5 years experience in research environment and/or academic hospital</li> <li>Experience as a research lead demonstrated by a record of prior publications in peer-reviewed education journals</li> </ul> <p>Knowledge and skills in educational design, program evaluation approaches, models and methodologies</p>	<ul style="list-style-type: none"> <li>PhD degree with a focus on Behavioral or Social Sciences</li> </ul>
<b>Canadian Nurses Association</b>	Ottawa, ON	Lead Government Relations	<ul style="list-style-type: none"> <li>Responsible for overall management of CNA's government portfolio</li> <li>Leads strategies to optimize CNA's interface with Canada's elected officials at federal, provincial and territorial levels</li> <li>Collaborates with CNA's internal teams to develop CNA's position on policy issues</li> </ul>	<ul style="list-style-type: none"> <li>5 – 7 years experience in government or parliamentary relations, ideally at federal level</li> <li>Strong understanding of political and governmental processes; the federal policy cycle, structures, and current priorities</li> <li>Knowledge and strong insight into nursing and health policy issues and how they relate at the federal, provincial and territorial governments</li> </ul>	<ul style="list-style-type: none"> <li>Master's degree in Political Science, Health Policy, Public Administration, Communications or other relevant field of study</li> </ul>

Company	Location	Job Title	Summary	Qualifications	Degree
<b>Canadian Wildlife Federation</b>	Ottawa, ON	National Aquatic Habitat Conservation Partnership Manager	<ul style="list-style-type: none"> <li>• 6 month contract</li> <li>• Strategize direction for the development of national aquatic habitat conservation partnership</li> <li>• Approach potential stakeholders from government, industry, Indigenous organizations, academia</li> <li>• Liaise with scientists, government officials, Indigenous organizations and other NGOs to share information, develop contacts, and promote ongoing engagement in the partnership</li> </ul>	<ul style="list-style-type: none"> <li>• Experience reviewing and synthesizing scientific literature, as well as laws, regulations, and government policy</li> <li>• Project management experience, including planning meetings and chairing teleconferences</li> </ul>	<ul style="list-style-type: none"> <li>• Requires minimum Master's degree or Bachelor's degree with relevant 3-5 years of work experience in related fields (Biology, Environmental Science, Studies, Law, or Policy)</li> </ul>
<b>ITK</b>	Ottawa, ON	Inuit Health Survey National Lead	<ul style="list-style-type: none"> <li>• Responsible for the overall coordination and implementation of a permanent Inuit Health Survey (IHS) across Inuit Nunangat as well as in a number of urban centres in southern Canada</li> <li>• Collaboratively develop and implement national and regional work plans and budgets</li> <li>• Liaise with all Federal, Territorial, and Provincial Government departments, Inuit organizations and non-government organizations on</li> </ul>	<ul style="list-style-type: none"> <li>• Experience in project management and program delivery</li> <li>• Must have excellent oral and written communication skills (English required, Inuktut a definite asset)</li> <li>• Experience in public relations, speaking with media, speaking to the public and other diverse audiences, and negotiation skills</li> <li>• 3-8 years of work experience in similar positions</li> </ul>	<ul style="list-style-type: none"> <li>• A Masters degree in a relevant discipline, such as public health, health sciences, epidemiology, public policy and political or social science with a minimum of 3 years of related work experience; a PhD would be a definite asset</li> </ul>



			<p>planning and implementing the HIS</p> <ul style="list-style-type: none"> <li>• Coordinate and provide guidance on survey design, questionnaire development, rationale for clinical tests, data storage and management, and data analysis</li> <li>• Monitor and analyse developing external trends, policies, programs and issues with actual or potential impact on Inuit health and wellness</li> </ul>		
--	--	--	--	--	--

**Sources:** Indeed and Google Jobs

## **APPENDIX E**

Appendix E contains the following curricular submissions:

### **Calendar submissions**

PhD, Political Science, regular, teaching, and experiential streams  
PhD, Political Science, Co-op

### **Course submissions**

#### *Course Revisions*

PSCI 600

PSCI 661

PSCI 662

#### *New courses*

PSCI 610

PSCI 611

PSCI 690

PSCI 691

### **Milestone submissions**

*Academic Integrity Workshop*

*PhD Professional Development Seminar*

*PhD Experiential Seminar*

*PhD Teaching Seminar*

*PhD Comprehensive Examination*

*PhD Internship*

*Internship Report*

*Graduate Studies Work Report*

*PhD Thesis Proposal*

*PhD Thesis*

Prior to form submission, review the [new graduate program instructions](#). For questions about the form submission, contact [Trevor Clews](#), Graduate Studies and Postdoctoral Affairs.

**Faculty:** Arts

**Program:** Doctor of Philosophy (PhD) in Political Science

**Program contact name(s):** Shelby Davies, Emmett Macfarlane

**Form completed by:** Shelby Davies

**Note:** new courses and milestones also require the completion/submission of the SGRC Course/Milestone-New/Revision/Inactivation form ([PC docx version](#)).

**Proposed effective date:** Term: Fall Year: 2021

**[Graduate Studies Academic Calendar \(GSAC\)](#) section** (include the link to the section (web page) where the new program will be located):

<https://uwaterloo.ca/graduate-studies-academic-calendar/arts/departments-political-science>

## Proposed Graduate Studies Academic Calendar content:

### DOCTOR OF PHILOSOPHY (PHD) IN POLITICAL SCIENCE

#### Graduate research fields

- Canadian Politics
- International Relations
- Political Economy

#### Program information

- **Admit term(s)**
  - Fall
- **Delivery mode**
  - On-campus
- **Program type**
  - Doctoral
  - Research
- **Registration option(s)**
  - Full-time
  - Part-time
- **Study option(s)**

## Proposed Graduate Studies Academic Calendar content:

- Thesis

### Admission requirements

- **Minimum requirements**
  - Students must hold a Master's degree with a minimum 80% average or equivalent in political science, or a related discipline.
  - Experienced professionals in the private or public sectors will be considered for admission, but additional course work may be required.
- **Application materials**
  - Résumé
  - Supplementary information form
  - Transcript(s)
  - Writing sample
- **References**
  - Number of references: 3
  - Type of references: normally from academic sources
- **[English language proficiency \(ELP\) \(if applicable\)](#)**

### Degree requirements

In addition to the regular stream of the program, students have the option of taking the teaching stream (featuring additional professional development modules, including a mentored teaching experience) and the experiential stream (which may include entry into the co-op program – described separately – or another placement and other experiential training, including additional professional development modules).

#### Thesis option:

#### Regular stream:

- **[Graduate Academic Integrity Module \(Graduate AIM\)](#)**
- **Courses**
  - Students must complete 6 (0.50 unit weight) graduate-level courses:
    - PSCI 600 Political Science Methods
    - 2 core courses in one of the program's three graduate research fields
    - 2 courses in the student's second area (which may be another of the three graduate research fields or a custom concentration)
    - 1 elective (may be taken outside the Department of Political Science at the approval of the Associate Chair, Graduate Studies)
  - If selecting the Canadian Politics research field, students must complete the following core courses:
    - PSCI 661 Canadian Political Institutions
    - PSCI 662 Canadian Political Process
  - If selecting the International Relations research field, students must complete the following core courses:
    - PSCI 610 International Relations Theory
    - PSCI 611 Current Issues in International Relations
  - If selecting the Political Economy research field, students must complete the following core courses:

## **Proposed Graduate Studies Academic Calendar content:**

- PSCI 690 Theories of Political Economy
- PSCI 691 Developments in Political Economy
- Students entering the PhD program from the University of Waterloo's Master of Arts (MA) in Political Science program may have already completed some of the required core courses for their chosen research fields. To meet formal course requirements for the PhD degree, these students must complete 6 new (0.50 unit weight) graduate-level courses that satisfy their comprehensive examination preparation.
- Reading courses may supplement regular offerings in the program, although it is understood that they will be approved at the discretion of the Department. Students will normally be permitted to take 1 reading course as part of their degree.
- Students are required to maintain an overall average of 80% in their graduate-level coursework.
  
- **Link(s) to courses**
  - Political Science (PSCI) courses
  - Graduate course search
  
- **Academic Integrity Workshop**
  
- **PhD Professional Development Seminar**
  - Students must complete the following mandatory professional development workshops (typically in Year 2 and 3 of the program). The six mandatory workshops are offered by the Department:
    - Research design and methods
    - Conducting literature review
    - Planning and best practices in fieldwork
    - Conferencing best practices (completed after proposal defence)
    - Careers in political science and translating skills for a non-academic job market
    - Communicating research to a broader audience
  - Students must also complete 3 additional professional development workshops to satisfy the requirements of the PhD Professional Development Seminar. Workshops must be approved by the Associate Chair, Graduate Studies, but may include the following:
    - Practice job talk / job interview
    - Workshops or courses providing additional training in social science methods
    - CTE workshop aimed at graduate students
    - MITACS Edge workshop/course
    - Writing Centre workshop
    - Career Centre workshop
    - Counselling Services workshop on mindfulness, cognitive therapy, or practical skills to reduce anxiety
    - Completion of any course or workshop relevant to professional development offered by a campus partner
  
- **PhD Comprehensive Examination**
  - Students are required to meet the University-level PhD Comprehensive Examination minimum requirements outlined in the "Minimum requirements for the PhD degree" section of the Graduate Studies Academic Calendar (GSAC), with certain noted exceptions that are specific to the Faculty of Arts Comprehensive Examination minimum requirements:
    - Comprehensive examination purpose: Consistent with University-level minimum requirements.
    - Timing: Consistent with University-level minimum requirements.
    - Committee: Consistent with University-level minimum requirements with the exception that in the Faculty of Arts, the Graduate Chair can approve the committee for comprehensive examinations.

## **Proposed Graduate Studies Academic Calendar content:**

- Who Chairs an examination: Consistent with University-level minimum requirements.
- Format / Content: Consistent with University-level minimum requirements.
- Academic integrity: Consistent with University-level minimum requirements.
- In addition to the University-level and Faculty-level PhD Comprehensive Examination minimum requirements, students in the PhD in Political Science program are also required to meet the following requirements:
  - At the end of their coursework, typically in September of Year 2, students are required to sit two exams.
  - The first exam will be from one of the three graduate research fields of the program the student has selected to study in. It will be comprised of a written exam, followed by an oral exam.
  - The second exam may follow the same format as the first if the student's second field is also one of the three graduate research fields of the program. Alternatively, the student may elect to submit a review essay broadly addressing the major theoretical debates, methodological hurdles, or substantive problems posed by existing scholarship in the field.
  - If the second area of study is a custom concentration, the comprehensive exam will consist of a review essay broadly addressing the major theoretical debates, methodological hurdles, or substantive problems posed by existing scholarship in the field.

### **• PhD Thesis Proposal**

- Students will write a thesis proposal situating their research question(s) in the extant literature, outlining their approach, theory, scope, and research methodology, and explaining the original nature of their contribution, along with a timeline and proposed chapter outline. The proposal will be subject to an oral defence, normally by the end of the sixth term, before a committee including the student's supervisor and two other faculty members.

### **• PhD Thesis**

- Students will have choice in the format of their thesis. Students may choose a traditional dissertation (ranging from 200 to 350 pages in length), or a 'publication model' consisting of at least three sole-authored published (or in press) works, at least one of which is in a traditional, peer-reviewed outlet (other publications might include research reports for think tanks, etc.), and including an original introduction, conclusion and any necessary bridging chapters to reflect a coherent project. In rare cases, and with the approval of the student's supervisor and the Department's Graduate Committee, students may opt for a non-traditional thesis that meets the standards of an original doctoral-level contribution to knowledge, but in a different form (for example, a documentary). The Department is especially cognizant of the potential for alternative approaches to knowledge-generation and dissemination, such as Indigenous approaches to knowledge, as something to be accommodated on a case-by-case basis.
- Normally, students should complete and defend the dissertation within four years of starting the program. Regardless of format, the thesis will be subject to an oral defence before a committee, including the supervisor, two other Political Science faculty members, an internal-external examiner from another department/program at the University of Waterloo, and an external examiner.

### **Teaching stream:**

#### **• [Graduate Academic Integrity Module \(Graduate AIM\)](#)**

#### **• Courses**

- Students must complete 6 (0.50 unit weight) graduate-level courses:
  - PSCI 600 Political Science Methods

## **Proposed Graduate Studies Academic Calendar content:**

- 2 core courses in one of the program's three graduate research fields
- 2 courses in the student's second area (which may be another of the three graduate research fields or a custom concentration)
- 1 elective (may be taken outside the Department of Political Science at the approval of the Associate Chair, Graduate Studies)
- If selecting the Canadian Politics research field, students must complete the following core courses:
  - PSCI 661 Canadian Political Institutions
  - PSCI 662 Canadian Political Process
- If selecting the International Relations research field, students must complete the following core courses:
  - PSCI 610 International Relations Theory
  - PSCI 611 Current Issues in International Relations
- If selecting the Political Economy research field, students must complete the following core courses:
  - PSCI 690 Theories of Political Economy
  - PSCI 691 Developments in Political Economy
- Students entering the PhD program from the University of Waterloo's Master of Arts (MA) in Political Science program may have already completed some of the required core courses for their chosen research fields. To meet formal course requirements for the PhD degree, these students must complete 6 new (0.50 unit weight) graduate-level courses that satisfy their comprehensive examination preparation.
- Reading courses may supplement regular offerings in the program, although it is understood that they will be approved at the discretion of the Department. Students will normally be permitted to take 1 reading course as part of their degree.
- Students are required to maintain an overall average of 80% in their graduate-level coursework.
  
- **Link(s) to courses**
  - Political Science (PSCI) courses
  - Graduate course search
  
- **Academic Integrity Workshop**
  
- **PhD Professional Development Seminar**
  - Students must complete the following mandatory professional development workshops (typically in Year 2 and 3 of the program). The six mandatory workshops are offered by the Department:
    - Research design and methods
    - Conducting literature review
    - Planning and best practices in fieldwork
    - Conferencing best practices (completed after proposal defence)
    - Careers in political science and translating skills for a non-academic job market
    - Communicating research to a broader audience
  
- **PhD Teaching Seminar**
  - Students who participate in the teaching stream of the program will be required to complete the PhD Teaching Seminar. The following mandatory professional development workshops must be completed:
    - Centre for Teaching Excellence Fundamentals of University Teaching program (student may begin this program as early as Year 1)
    - 2 Guest Lectures in Political Science (students will receive automatic credit if they have the opportunity to teach their own course as a sessional instructor)

## **Proposed Graduate Studies Academic Calendar content:**

- Develop a syllabus for a real or prospective Political Science course
- **PhD Comprehensive Examination**
  - Students are required to meet the University-level PhD Comprehensive Examination minimum requirements outlined in the “Minimum requirements for the PhD degree” section of the Graduate Studies Academic Calendar (GSAC), with certain noted exceptions that are specific to the Faculty of Arts Comprehensive Examination minimum requirements:
    - Comprehensive examination purpose: Consistent with University-level minimum requirements.
    - Timing: Consistent with University-level minimum requirements.
    - Committee: Consistent with University-level minimum requirements with the exception that in the Faculty of Arts, the Graduate Chair can approve the committee for comprehensive examinations.
    - Who Chairs an examination: Consistent with University-level minimum requirements.
    - Format / Content: Consistent with University-level minimum requirements.
    - Academic integrity: Consistent with University-level minimum requirements.
  - In addition to the University-level and Faculty-level PhD Comprehensive Examination minimum requirements, students in the PhD in Political Science program are also required to meet the following requirements:
    - At the end of their coursework, typically in September of Year 2, students are required to sit two exams.
    - The first exam will be from one of the three graduate research fields of the program the student has selected to study in. It will be comprised of a written exam, followed by an oral exam.
    - The second exam may follow the same format as the first if the student’s second field is also one of the three graduate research fields of the program. Alternatively, the student may elect to submit a review essay broadly addressing the major theoretical debates, methodological hurdles, or substantive problems posed by existing scholarship in the field.
    - If the second area of study is a custom concentration, the comprehensive exam will consist of a review essay broadly addressing the major theoretical debates, methodological hurdles, or substantive problems posed by existing scholarship in the field.
- **PhD Thesis Proposal**
  - Students will write a thesis proposal situating their research question(s) in the extant literature, outlining their approach, theory, scope, and research methodology, and explaining the original nature of their contribution, along with a timeline and proposed chapter outline. The proposal will be subject to an oral defence, normally by the end of the sixth term, before a committee including the student’s supervisor and two other faculty members.
- **PhD Thesis**
  - Students will have choice in the format of their thesis. Students may choose a traditional dissertation (ranging from 200 to 350 pages in length), or a ‘publication model’ consisting of at least three sole-authored published (or in press) works, at least one of which is in a traditional, peer-reviewed outlet (other publications might include research reports for think tanks, etc.), and including an original introduction, conclusion and any necessary bridging chapters to reflect a coherent project. In rare cases, and with the approval of the student’s supervisor and the Department’s Graduate Committee, students may opt for a non-traditional thesis that meets the standards of an original doctoral-level contribution to knowledge, but in a different form (for example, a documentary). The Department is especially cognizant of the potential for alternative approaches to knowledge-generation and dissemination, such as Indigenous approaches to knowledge, as something to be accommodated on a case-by-case basis.



## **Proposed Graduate Studies Academic Calendar content:**

- Normally, students should complete and defend the dissertation within four years of starting the program. Regardless of format, the thesis will be subject to an oral defence before a committee, including the supervisor, two other Political Science faculty members, an internal-external examiner from another department/program at the University of Waterloo, and an external examiner.

### **Experiential stream:**

- [\*\*Graduate Academic Integrity Module \(Graduate AIM\)\*\*](#)

- **Courses**

- Students must complete 6 (0.50 unit weight) graduate-level courses:
  - PSCI 600 Political Science Methods
  - 2 core courses in one of the program's three graduate research fields
  - 2 courses in the student's second area (which may be another of the three graduate research fields or a custom concentration)
  - 1 elective (may be taken outside the Department of Political Science at the approval of the Associate Chair, Graduate Studies)
- If selecting the Canadian Politics research field, students must complete the following core courses:
  - PSCI 661 Canadian Political Institutions
  - PSCI 662 Canadian Political Process
- If selecting the International Relations research field, students must complete the following core courses:
  - PSCI 610 International Relations Theory
  - PSCI 611 Current Issues in International Relations
- If selecting the Political Economy research field, students must complete the following core courses:
  - PSCI 690 Theories of Political Economy
  - PSCI 691 Developments in Political Economy
- Students entering the PhD program from the University of Waterloo's Master of Arts (MA) in Political Science program may have already completed some of the required core courses for their chosen research fields. To meet formal course requirements for the PhD degree, these students must complete 6 new (0.50 unit weight) graduate-level courses that satisfy their comprehensive examination preparation.
- Reading courses may supplement regular offerings in the program, although it is understood that they will be approved at the discretion of the Department. Students will normally be permitted to take 1 reading course as part of their degree.
- Students are required to maintain an overall average of 80% in their graduate-level coursework.

- **Link(s) to courses**

- Political Science (PSCI) courses
- Graduate course search

- **Academic Integrity Workshop**

- **PhD Professional Development Seminar**

- Students must complete the following mandatory professional development workshops (typically in Year 2 and 3 of the program). The six mandatory workshops are offered by the Department:
  - Research design and methods
  - Conducting literature review
  - Planning and best practices in fieldwork

## **Proposed Graduate Studies Academic Calendar content:**

- Conferencing best practices (completed after proposal defence)
- Careers in political science and translating skills for a non-academic job market
- Communicating research to a broader audience
  
- **PhD Experiential Seminar**
  - Students who participate in the experiential stream of the program will be required to complete the PhD Experiential Seminar. The following mandatory professional development workshops must be completed:
    - Reflective practices in experiential learning (must be completed prior to internship placement) (offered by the Department)
    - Writing resumes (must be completed prior to internship placement) (Centre for Career Action)
    - Parallel career planning (Centre for Career Action)
    - MITACS or other campus partner module(s) (as approved by the Associate Chair, Graduate Studies)
  
- **PhD Comprehensive Examination**
  - Students are required to meet the University-level PhD Comprehensive Examination minimum requirements outlined in the “Minimum requirements for the PhD degree” section of the Graduate Studies Academic Calendar (GSAC), with certain noted exceptions that are specific to the Faculty of Arts Comprehensive Examination minimum requirements:
    - Comprehensive examination purpose: Consistent with University-level minimum requirements.
    - Timing: Consistent with University-level minimum requirements.
    - Committee: Consistent with University-level minimum requirements with the exception that in the Faculty of Arts, the Graduate Chair can approve the committee for comprehensive examinations.
    - Who Chairs an examination: Consistent with University-level minimum requirements.
    - Format / Content: Consistent with University-level minimum requirements.
    - Academic integrity: Consistent with University-level minimum requirements.
  - In addition to the University-level and Faculty-level PhD Comprehensive Examination minimum requirements, students in the PhD in Political Science program are also required to meet the following requirements:
    - At the end of their coursework, typically in September of Year 2, students are required to sit two exams.
    - The first exam will be from one of the three graduate research fields of the program the student has selected to study in. It will be comprised of a written exam, followed by an oral exam.
    - The second exam may follow the same format as the first if the student’s second field is also one of the three graduate research fields of the program. Alternatively, the student may elect to submit a review essay broadly addressing the major theoretical debates, methodological hurdles, or substantive problems posed by existing scholarship in the field.
    - If the second area of study is a custom concentration, the comprehensive exam will consist of a review essay broadly addressing the major theoretical debates, methodological hurdles, or substantive problems posed by existing scholarship in the field.
  
- **PhD Internship**
  - Students in the experiential stream have the option of undertaking an internship through Mitacs or finding an alternative placement (at the approval of the student’s supervisor and the Associate Chair, Graduate Studies). Students will be eligible to go on placements for periods ranging from four months to one year.

### **Proposed Graduate Studies Academic Calendar content:**

- **PhD Internship Report**
  - Required for students who are participating in the experiential stream. Students must complete and submit a PhD Internship Report within one month of the completion of their placement.
  
- **PhD Thesis Proposal**
  - Students will write a thesis proposal situating their research question(s) in the extant literature, outlining their approach, theory, scope, and research methodology, and explaining the original nature of their contribution, along with a timeline and proposed chapter outline. The proposal will be subject to an oral defence, normally by the end of the sixth term, before a committee including the student's supervisor and two other faculty members.
  
- **PhD Thesis**
  - Students will have choice in the format of their thesis. Students may choose a traditional dissertation (ranging from 200 to 350 pages in length), or a 'publication model' consisting of at least three sole-authored published (or in press) works, at least one of which is in a traditional, peer-reviewed outlet (other publications might include research reports for think tanks, etc.), and including an original introduction, conclusion and any necessary bridging chapters to reflect a coherent project. In rare cases, and with the approval of the student's supervisor and the Department's Graduate Committee, students may opt for a non-traditional thesis that meets the standards of an original doctoral-level contribution to knowledge, but in a different form (for example, a documentary). The Department is especially cognizant of the potential for alternative approaches to knowledge-generation and dissemination, such as Indigenous approaches to knowledge, as something to be accommodated on a case-by-case basis.
  - Normally, students should complete and defend the dissertation within four years of starting the program. Regardless of format, the thesis will be subject to an oral defence before a committee, including the supervisor, two other Political Science faculty members, an internal-external examiner from another department/program at the University of Waterloo, and an external examiner.

### **Department of Political Science website**

**Departmental approval date** (mm/dd/yy): 09/20/2019

**Reviewed by GSPA** (for GSPA use only)  date (mm/dd/yy): 05/04/2020

**Faculty approval date** (mm/dd/yy):

**Senate Graduate & Research Council (SGRC) approval date** (mm/dd/yy):

**Senate approval date** (mm/dd/yy) (if applicable):

Prior to form submission, review the [new graduate program instructions](#). For questions about the form submission, contact [Trevor Clews](#), Graduate Studies and Postdoctoral Affairs.

**Faculty:** Arts

**Program:** Doctor of Philosophy (PhD) in Political Science - Co-operative Program

**Program contact name(s):** Shelby Davies, Emmett Macfarlane

**Form completed by:** Shelby Davies

**Note:** new courses and milestones also require the completion/submission of the SGRC Course/Milestone-New/Revision/Inactivation form ([PC docx version](#)).

**Proposed effective date:** Term: Fall Year: 2021

**[Graduate Studies Academic Calendar \(GSAC\)](#) section** (include the link to the section (web page) where the new program will be located):

<https://uwaterloo.ca/graduate-studies-academic-calendar/arts/department-political-science>

## Proposed Graduate Studies Academic Calendar content:

### DOCTOR OF PHILOSOPHY (PHD) IN POLITICAL SCIENCE – CO-OPERATIVE PROGRAM

#### Graduate research fields

- Canadian Politics
- International Relations
- Political Economy

#### Program information

- **Admit term(s)**
  - Fall/Winter/Spring
- **Delivery mode**
  - On-campus
- **Program type**
  - Co-operative
  - Doctoral
  - Research
- **Registration option(s)**
  - Full-time
  - Part-time

## Proposed Graduate Studies Academic Calendar content:

- **Study option(s)**
  - Thesis

### Admission requirements

- **Minimum requirements**
  - Students in the PhD in Political Science program can apply to transfer into the PhD in Political Science Co-operative Program after completing at least one academic term. Admission will be decided based on the student's progress to date, and is subject to approval by the Department Associate Chair, Graduate Studies.

### Degree requirements

#### Thesis option:

- [Graduate Academic Integrity Module \(Graduate AIM\)](#)
- **Courses**
  - Students must complete 6 (0.50 unit weight) graduate-level courses:
    - PSCI 600 Political Science Methods
    - 2 core courses in one of the program's three graduate research fields
    - 2 courses in the student's second area (which may be another of the three graduate research fields or a custom concentration)
    - 1 elective (may be taken outside the Department of Political Science at the approval of the Associate Chair, Graduate Studies)
  - If selecting the Canadian Politics research field, students must complete the following core courses:
    - PSCI 661 Canadian Political Institutions
    - PSCI 662 Canadian Political Process
  - If selecting the International Relations research field, students must complete the following core courses:
    - PSCI 610 International Relations Theory
    - PSCI 611 Current Issues in International Relations
  - If selecting the Political Economy research field, students must complete the following core courses:
    - PSCI 690 Theories of Political Economy
    - PSCI 691 Developments in Political Economy
  - Students entering the PhD program from the University of Waterloo's Master of Arts (MA) in Political Science program may have already completed some of the required core courses for their chosen research fields. To meet formal course requirements for the PhD degree, these students must complete 6 new (0.50 unit weight) graduate-level courses that satisfy their comprehensive examination preparation.
  - Reading courses may supplement regular offerings in the program, although it is understood that they will be approved at the discretion of the Department. Students will normally be permitted to take 1 reading course as part of their degree.
  - Students are required to maintain an overall average of 80% in their graduate-level coursework.
- **Link(s) to courses**
  - Political Science (PSCI) courses
  - Graduate course search

## **Proposed Graduate Studies Academic Calendar content:**

- **Academic Integrity Workshop**
  
- **PhD Professional Development Seminar**
  - Students must complete the following mandatory professional development workshops (typically in Year 2 and 3 of the program). The six mandatory workshops are offered by the Department:
    - Research design and methods
    - Conducting literature review
    - Planning and best practices in fieldwork
    - Conferencing best practices (completed after proposal defence)
    - Careers in political science and translating skills for a non-academic job market
    - Communicating research to a broader audience
  
- **PhD Experiential Seminar**
  - The following mandatory professional development workshops must be completed:
    - Reflective practices in experiential learning (must be completed prior to internship placement) (offered by the Department)
    - Writing resumes (must be completed prior to internship placement) (Centre for Career Action)
    - Parallel career planning (Centre for Career Action)
    - MITACS or other campus partner module(s) (as approved by the Associate Chair, Graduate Studies)
  
- **PhD Comprehensive Examination**
  - Students are required to meet the University-level PhD Comprehensive Examination minimum requirements outlined in the “Minimum requirements for the PhD degree” section of the Graduate Studies Academic Calendar (GSAC), with certain noted exceptions that are specific to the Faculty of Arts Comprehensive Examination minimum requirements:
    - Comprehensive examination purpose: Consistent with University-level minimum requirements.
    - Timing: Consistent with University-level minimum requirements.
    - Committee: Consistent with University-level minimum requirements with the exception that in the Faculty of Arts, the Graduate Chair can approve the committee for comprehensive examinations.
    - Who Chairs an examination: Consistent with University-level minimum requirements.
    - Format / Content: Consistent with University-level minimum requirements.
    - Academic integrity: Consistent with University-level minimum requirements.
  - In addition to the University-level and Faculty-level PhD Comprehensive Examination minimum requirements, students in the PhD in Political Science program are also required to meet the following requirements:
    - At the end of their coursework, typically in September of Year 2, students are required to sit two exams.
    - The first exam will be from one of the three graduate research fields of the program the student has selected to study in. It will be comprised of a written exam, followed by an oral exam.
    - The second exam may follow the same format as the first if the student’s second field is also one of the three graduate research fields of the program. Alternatively, the student may elect to submit a review essay broadly addressing the major theoretical debates, methodological hurdles, or substantive problems posed by existing scholarship in the field.
    - If the second area of study is a custom concentration, the comprehensive exam will consist of a review essay broadly addressing the major theoretical debates, methodological hurdles, or substantive problems posed by existing scholarship in the

**Proposed Graduate Studies Academic Calendar content:**

field.

- **Graduate Studies Work Report**
  - Students must complete and submit a work-term report within one month of the completion of the work-term(s).
- **PhD Thesis Proposal**
  - Students will write a thesis proposal situating their research question(s) in the extant literature, outlining their approach, theory, scope, and research methodology, and explaining the original nature of their contribution, along with a timeline and proposed chapter outline. The proposal will be subject to an oral defence, normally by the end of the sixth term, before a committee including the student's supervisor and two other faculty members.
- **PhD Thesis**
  - Students will have choice in the format of their thesis. Students may choose a traditional dissertation (ranging from 200 to 350 pages in length), or a 'publication model' consisting of at least three sole-authored published (or in press) works, at least one of which is in a traditional, peer-reviewed outlet (other publications might include research reports for think tanks, etc.), and including an original introduction, conclusion and any necessary bridging chapters to reflect a coherent project. In rare cases, and with the approval of the student's supervisor and the Department's Graduate Committee, students may opt for a non-traditional thesis that meets the standards of an original doctoral-level contribution to knowledge, but in a different form (for example, a documentary). The Department is especially cognizant of the potential for alternative approaches to knowledge-generation and dissemination, such as Indigenous approaches to knowledge, as something to be accommodated on a case-by-case basis.
  - Normally, students should complete and defend the dissertation within four years of starting the program. Regardless of format, the thesis will be subject to an oral defence before a committee, including the supervisor, two other Political Science faculty members, an internal-external examiner from another department/program at the University of Waterloo, and an external examiner.

**Department of Political Science website**

**Departmental approval date** (mm/dd/yy): 09/20/2019

**Reviewed by GSPA** (for GSPA use only)  date (mm/dd/yy): 05/04/2020

**Faculty approval date** (mm/dd/yy):

**Senate Graduate & Research Council (SGRC) approval date** (mm/dd/yy):

**Senate approval date** (mm/dd/yy) (if applicable):

Faculty: Arts

Effective term: Term/Year Spring 2021

Course  New  Revision  Inactivation Milestone  New  Revision  Inactivation 

New milestone title: Choose an item.

For course revisions, indicate the type(s) of changes:

*Description and title change to better align with PhD in Political Science program.*

Course Subject code: PSCI Course number: 600

Course Title (max. 100 characters incl. spaces): Political Science Methods

Course Short Title (max. 30 characters incl. spaces): Political Science Methods

Grading Basis: NUMERICAL

Course Credit Weight: 0.50

Course Consent Required:  Choose an item.

Course Description: The course is a critical examination of different approaches to the study of political science. The seminar is intended to accomplish two goals: first, to foster a collegial atmosphere in which students pursue a common course of intensive study; and second, to expose students to the most recent theoretical developments in normative, empirical, analytical or historical approaches to political science.

New course description (for revision only): This team-taught course examines different approaches to the study of political science, with units focusing on quantitative methods, qualitative methods, and an exploration of the epistemology of social science.

Meet Type(s): Seminar Choose an item. Choose an item. Choose an item.

Primary Meet Type: Seminar

[Requisites:](#)Special topics course: Yes  No Cross-listed: Yes  No 

Course Subject(s) to be cross-listed with and approval status:

Sections combined/heldwith:

**Rationale for request:**

PSCI 600 will be a required course for all PhD and MA Political Science students. The updated course description and title will better serve both programs.

Prepared by: Shelby Davies

Date: 4-May-20



Faculty: Arts

Effective term: Term/Year Spring 2021

Course  New  Revision  Inactivation

Milestone  New  Revision  Inactivation

New milestone title: Choose an item.

For course revisions, indicate the type(s) of changes:

*Title and description change to better align with Canadian Politics field of PhD in Political Science program.*

Course Subject code: PSCI Course number: 661

Course Title (max. 100 characters incl. spaces): Canadian Political Institutions

Course Short Title (max. 30 characters incl. spaces): Cndn Political Institutions

Grading Basis: NUMERICAL

Course Credit Weight: 0.50

Course Consent Required:  Choose an item.

Course Description: Selected aspects of Canadian national politics

New course description (for revision only): This course examines the structure and operation of central institutions in government, including dominant theories and approaches to their study. Topics may include the constitution, Parliament, the executive, courts, federalism and intergovernmental relations, political parties, provincial and municipal governance, and the bureaucracy.

Meet Type(s): Seminar Choose an item. Choose an item. Choose an item.

Primary Meet Type: Seminar

[Requisites:](#)

Special topics course: Yes  No

Cross-listed: Yes  No

Course Subject(s) to be cross-listed with and approval status:

Sections combined/heldwith:

**Rationale for request:**

PSCI 661 will be one of two required courses for students enrolled in the Canadian Politics field of the PhD in Political Science program. The updated course description and title will better fit with the field.

Faculty: Arts

Effective term: Term/Year Spring 2021

Course  New  Revision  Inactivation

Milestone  New  Revision  Inactivation

New milestone title: Choose an item.

For course revisions, indicate the type(s) of changes:

*Title and description change to better align with Canadian Politics field of PhD in Political Science program.*

Course Subject code: PSCI Course number: 662

Course Title (max. 100 characters incl. spaces): Canadian Political Process

Course Short Title (max. 30 characters incl. spaces): Canadian Political Process

Grading Basis: NUMERICAL

Course Credit Weight: 0.50

Course Consent Required:  Choose an item.

Course Description: Selected aspects of Canadian provincial politics.

New course description (for revision only): This course examines the political process and societal cleavages in Canada, with a focus on new directions and debates in research. Topics may include elections and voting behaviour, social policy, gender, regionalism and nationalism, Indigenous politics, political culture, interest groups and social movements, and rights

Meet Type(s): Seminar Choose an item. Choose an item. Choose an item.

Primary Meet Type: Seminar

[Requisites:](#)

Special topics course: Yes  No

Cross-listed: Yes  No

Course Subject(s) to be cross-listed with and approval status:

Sections combined/heldwith:

**Rationale for request:**

PSCI 662 will be one of two required courses for students enrolled in the Canadian Politics field of the PhD in Political Science program. The updated course description and title will better fit with the field.

Prepared by: Shelby Davies

Date: 4-May-20

Faculty: Arts

Effective term: Term/Year Spring 2021

Course  New  Revision  Inactivation

Milestone  New  Revision  Inactivation

New milestone title: Choose an item.

For course revisions, indicate the type(s) of changes:  
(e.g. consent, description, title, requisites)

Course Subject code: PSCI Course number: 610

Course Title (max. 100 characters incl. spaces): International Relations Theory

Course Short Title (max. 30 characters incl. spaces): International Relations Theory

Grading Basis: NUMERICAL

Course Credit Weight: 0.50

Course Consent Required:  Choose an item.

Course Description: This course examines the major theories of International Relations (IR) and the current state of the field. It addresses the major IR theories, how they inform advanced research, and how they relate to the conduct of world politics.

New course description (for revision only):

Meet Type(s): Seminar Choose an item. Choose an item. Choose an item.

Primary Meet Type: Seminar

[Requisites:](#)

Special topics course: Yes  No

Cross-listed: Yes  No

Course Subject(s) to be cross-listed with and approval status:

Sections combined/heldwith:

**Rationale for request:**

PSCI 610 will be one of two required courses for students enrolled in the International Relations field of the PhD in Political Science program.

Faculty: Arts

Effective term: Term/Year Spring 2021

Course  New  Revision  Inactivation Milestone  New  Revision  Inactivation 

New milestone title: Choose an item.

For course revisions, indicate the type(s) of changes:  
(e.g. consent, description, title, requisites)

Course Subject code: PSCI Course number: 611

Course Title (max. 100 characters incl. spaces): Current Issues in International Relations

Course Short Title (max. 30 characters incl. spaces): Curr. Issues in Intl Relations

Grading Basis: NUMERICAL

Course Credit Weight: 0.50

Course Consent Required:  Choose an item.

Course Description: This course examines recent trends in world politics, their origins, and their policy implications.

New course description (for revision only):

Meet Type(s): Seminar Choose an item. Choose an item. Choose an item.

Primary Meet Type: Seminar

[Requisites:](#)Special topics course: Yes  No Cross-listed: Yes  No 

Course Subject(s) to be cross-listed with and approval status:

Sections combined/heldwith:

**Rationale for request:**

PSCI 611 will be one of two required courses for students enrolled in the International Relations field of the PhD in Political Science program.

Prepared by: Shelby Davies

Date: 4-May-20

Faculty: Arts

Effective term: Term/Year Spring 2021

Course  New  Revision  Inactivation Milestone  New  Revision  Inactivation 

New milestone title: Choose an item.

For course revisions, indicate the type(s) of changes:  
(e.g. consent, description, title, requisites)

Course Subject code: PSCI Course number: 690

Course Title (max. 100 characters incl. spaces): Theories of Political Economy

Course Short Title (max. 30 characters incl. spaces): Theories of Political Economy

Grading Basis: NUMERICAL

Course Credit Weight: 0.50

Course Consent Required:  Choose an item.

Course Description: An advanced examination of theoretical approaches to the study of political economy. The course explores both historical and contemporary approaches and how they inform political economy research.

New course description (for revision only):

Meet Type(s): Seminar Choose an item. Choose an item. Choose an item.

Primary Meet Type: Seminar

[Requisites:](#)Special topics course: Yes  No Cross-listed: Yes  No 

Course Subject(s) to be cross-listed with and approval status:

Sections combined/heldwith:

**Rationale for request:**

PSCI 690 will be one of two required courses for students enrolled in the Political Economy field of the PhD in Political Science program.

Faculty: Arts

Effective term: Term/Year Spring 2021

Course  New  Revision  Inactivation Milestone  New  Revision  Inactivation 

New milestone title: Choose an item.

For course revisions, indicate the type(s) of changes:  
(e.g. consent, description, title, requisites)

Course Subject code: PSCI Course number: 691

Course Title (max. 100 characters incl. spaces): Developments in Political Economy

Course Short Title (max. 30 characters incl. spaces): Devels. in Political Economy

Grading Basis: NUMERICAL

Course Credit Weight: 0.50

Course Consent Required:  Choose an item.

Course Description: A survey of recent developments in the field of political economy that combines local, national, comparative, and international perspectives on states and markets, politics and business, wealth and power.

New course description (for revision only):

Meet Type(s): Seminar Choose an item. Choose an item. Choose an item.

Primary Meet Type: Seminar

[Requisites:](#)Special topics course: Yes  No Cross-listed: Yes  No 

Course Subject(s) to be cross-listed with and approval status:

Sections combined/heldwith:

**Rationale for request:**

PSCI 691 will be one of two required courses for students enrolled in the Political Economy field of the PhD in Political Science program.

Faculty: Arts

Effective term: Term/Year Fall 2021

Course  New  Revision  Inactivation

Milestone  New  Revision  Inactivation

New milestone title: Academic Integrity Workshop

For course revisions, indicate the type(s) of changes:  
(e.g. consent, description, title, requisites)

Course Subject code: Choose an item. Course number:

Course Title (max. 100 characters incl. spaces):

Course Short Title (max. 30 characters incl. spaces):

Grading Basis: CREDIT/NO CREDIT

Course Credit Weight: Choose an item.

Course Consent Required:  Choose an item.

Course Description:

New course description (for revision only):

Meet Type(s): Choose an item. Choose an item. Choose an item. Choose an item.

Primary Meet Type: Choose an item.

[Requisites:](#)

Special topics course: Yes  No

Cross-listed: Yes  No

Course Subject(s) to be cross-listed with and approval status:

Sections combined/heldwith:

### Rationale for request:

Required milestone for all Faculty of Arts graduate students. Will be required for all students enrolled in the PhD in Political Science and PhD in Political Science – Co-operative programs.

---

Prepared by: Shelby Davies

Date: 27-Sep-19

Faculty: Arts

Effective term: Term/Year Fall 2021

Course  New  Revision  Inactivation Milestone  New  Revision  Inactivation 

New milestone title: Graduate Studies Work Report

For course revisions, indicate the type(s) of changes:  
(e.g. consent, description, title, requisites)

Course Subject code: Choose an item. Course number:

Course Title (max. 100 characters incl. spaces):

Course Short Title (max. 30 characters incl. spaces):

Grading Basis: CREDIT/NO CREDIT

Course Credit Weight: Choose an item.

Course Consent Required:  Choose an item.

Course Description:

New course description (for revision only):

Meet Type(s): Choose an item. Choose an item. Choose an item. Choose an item.

Primary Meet Type: Choose an item.

[Requisites:](#)Special topics course: Yes  No Cross-listed: Yes  No 

Course Subject(s) to be cross-listed with and approval status:

Sections combined/heldwith:

**Rationale for request:**

Required milestone for all students enrolled in the PhD in Political Science - Co-operative program. The Work Report will be submitted for Department evaluation (CR/NCR basis) one month after placement ends. The milestone should be added to the following program: Doctor of Philosophy (PhD) in Political Science - Co-operative Program

Prepared by: Shelby Davies

Date: 27-Sep-19



Faculty: Arts

Effective term: Term/Year Fall 2021

Course  New  Revision  Inactivation Milestone  New  Revision  Inactivation 

New milestone title: PhD Comprehensive Examination

For course revisions, indicate the type(s) of changes:  
(e.g. consent, description, title, requisites)

Course Subject code: Choose an item. Course number:

Course Title (max. 100 characters incl. spaces):

Course Short Title (max. 30 characters incl. spaces):

Grading Basis: CREDIT/NO CREDIT

Course Credit Weight: Choose an item.

Course Consent Required:  Choose an item.

Course Description:

New course description (for revision only):

Meet Type(s): Choose an item. Choose an item. Choose an item. Choose an item.

Primary Meet Type: Choose an item.

[Requisites:](#)Special topics course: Yes  No Cross-listed: Yes  No 

Course Subject(s) to be cross-listed with and approval status:

Sections combined/heldwith:

**Rationale for request:**

Required milestone for all students enrolled in Political Science at the PhD-level. The milestone should be added to the following programs:

- 1) Doctor of Philosophy (PhD) in Political Science
- 2) Doctor of Philosophy (PhD) in Political Science - Co-operative Program

Prepared by: Shelby Davies

Date: 27-Sep-19

Faculty: Arts

Effective term: Term/Year Fall 2021

Course  New  Revision  Inactivation

Milestone  New  Revision  Inactivation

New milestone title: PhD Experiential Seminar

For course revisions, indicate the type(s) of changes:  
(e.g. consent, description, title, requisites)

Course Subject code: Choose an item. Course number:

Course Title (max. 100 characters incl. spaces):

Course Short Title (max. 30 characters incl. spaces):

Grading Basis: CREDIT/NO CREDIT

Course Credit Weight: Choose an item.

Course Consent Required:  Choose an item.

Course Description:

New course description (for revision only):

Meet Type(s): Choose an item. Choose an item. Choose an item. Choose an item.

Primary Meet Type: Choose an item.

[Requisites:](#)

Special topics course: Yes  No

Cross-listed: Yes  No

Course Subject(s) to be cross-listed with and approval status:

Sections combined/heldwith:

### Rationale for request:

This milestone will be required for all students completing the Experiential Stream of the PhD in Political Science or the PhD in Political Science - Co-operative program. Students will be required to complete the following workshops: *Reflective practices in experiential learning*, *Writing resumes*, *Parallel career planning*, *MITACS* or *other campus partner module(s)* (as approved by Graduate Officer). Workshops will be offered in the Department, or through the support of campus partners (ex. Parallel Career Planning is offered by the Centre for Career Action). Attendance will be tracked in the Department; once all workshops are complete, a milestone completion form will be submitted for students for the PhD Experiential Seminar. The milestone should be added to the following programs:

- 1) Doctor of Philosophy (PhD) in Political Science

2) Doctor of Philosophy (PhD) in Political Science - Co-operative Program

---

Prepared by: Shelby Davies

Date: 27-Sep-19

Faculty: Arts

Effective term: Term/Year Fall 2021

Course  New  Revision  Inactivation Milestone  New  Revision  Inactivation 

New milestone title: PhD Internship

For course revisions, indicate the type(s) of changes:  
(e.g. consent, description, title, requisites)

Course Subject code: Choose an item. Course number:

Course Title (max. 100 characters incl. spaces):

Course Short Title (max. 30 characters incl. spaces):

Grading Basis: CREDIT/NO CREDIT

Course Credit Weight: Choose an item.

Course Consent Required:  Choose an item.

Course Description:

New course description (for revision only):

Meet Type(s): Choose an item. Choose an item. Choose an item. Choose an item.

Primary Meet Type: Choose an item.

[Requisites:](#)Special topics course: Yes  No Cross-listed: Yes  No 

Course Subject(s) to be cross-listed with and approval status:

Sections combined/heldwith:

**Rationale for request:**

Required milestone for all students completing the Experiential Stream of the PhD in Political Science program. The Internship will usually be a minimum 4-months in length, and will be completed after the student's PhD Thesis Proposal has been successfully defended. The milestone should be added to the following program: Doctor of Philosophy (PhD) in Political Science

Prepared by: Shelby Davies

Date: 27-Sep-19

Faculty: Arts

Effective term: Term/Year Fall 2021

Course  New  Revision  Inactivation

Milestone  New  Revision  Inactivation

New milestone title: PhD Internship Report

For course revisions, indicate the type(s) of changes:  
(e.g. consent, description, title, requisites)

Course Subject code: Choose an item. Course number:

Course Title (max. 100 characters incl. spaces):

Course Short Title (max. 30 characters incl. spaces):

Grading Basis: CREDIT/NO CREDIT

Course Credit Weight: Choose an item.

Course Consent Required:  Choose an item.

Course Description:

New course description (for revision only):

Meet Type(s): Choose an item. Choose an item. Choose an item. Choose an item.

Primary Meet Type: Choose an item.

[Requisites:](#)

Special topics course: Yes  No

Cross-listed: Yes  No

Course Subject(s) to be cross-listed with and approval status:

Sections combined/heldwith:

**Rationale for request:**

Required milestone for all students completing the Experiential Stream of the PhD in Political Science program. The Internship Report will be submitted for Department evaluation (CR/NCR basis) one month after placement ends. The milestone should be added to the following program: Doctor of Philosophy (PhD) in Political Science

---

Prepared by: Shelby Davies

Date: 27-Sep-19

Faculty: Arts

Effective term: Term/Year Fall 2021

Course  New  Revision  Inactivation Milestone  New  Revision  Inactivation 

New milestone title: PhD Professional Development Seminar

For course revisions, indicate the type(s) of changes:  
(e.g. consent, description, title, requisites)

Course Subject code: Choose an item. Course number:

Course Title (max. 100 characters incl. spaces):

Course Short Title (max. 30 characters incl. spaces):

Grading Basis: CREDIT/NO CREDIT

Course Credit Weight: Choose an item.

Course Consent Required:  Choose an item.

Course Description:

New course description (for revision only):

Meet Type(s): Choose an item. Choose an item. Choose an item. Choose an item.

Primary Meet Type: Choose an item.

[Requisites:](#)Special topics course: Yes  No Cross-listed: Yes  No 

Course Subject(s) to be cross-listed with and approval status:

Sections combined/heldwith:

**Rationale for request:**

This milestone will be required for all students enrolled in Political Science at the PhD-level. Students will be required to complete the following workshops, offered in the Department of Political Science and administered by faculty members: *Research design and methods*, *Conducting literature review*, *Planning and best practices in fieldwork*, *Conferencing best practices*, *Careers in political science and translating skills for a non-academic job market*, and *Communicating research to a broader audience*. Workshop attendance will be tracked in the Department; once all workshops are complete, a milestone completion form will be submitted for students for the PhD Professional Development Seminar. The milestone should be added to the following programs:

- 1) Doctor of Philosophy (PhD) in Political Science

2) Doctor of Philosophy (PhD) in Political Science - Co-operative Program

---

Prepared by: Shelby Davies

Date: 27-Sep-19

Faculty: Arts

Effective term: Term/Year Fall 2021

Course  New  Revision  Inactivation

Milestone  New  Revision  Inactivation

New milestone title: PhD Teaching Seminar

For course revisions, indicate the type(s) of changes:  
(e.g. consent, description, title, requisites)

Course Subject code: Choose an item. Course number:

Course Title (max. 100 characters incl. spaces):

Course Short Title (max. 30 characters incl. spaces):

Grading Basis: CREDIT/NO CREDIT

Course Credit Weight: Choose an item.

Course Consent Required:  Choose an item.

Course Description:

New course description (for revision only):

Meet Type(s): Choose an item. Choose an item. Choose an item. Choose an item.

Primary Meet Type: Choose an item.

[Requisites:](#)

Special topics course: Yes  No

Cross-listed: Yes  No

Course Subject(s) to be cross-listed with and approval status:

Sections combined/heldwith:

### Rationale for request:

This milestone will be required for all students completing the Teaching Stream of the PhD in Political Science program. Students will be required to complete the following: *Centre for Teaching Excellence Fundamentals of University Teaching program, 2 Guest Lectures in Political Science (students will receive automatic credit if they have the opportunity to teach their own course as a sessional instructor), Develop a syllabus for a real or prospective Political Science course.* Students will be required to show the Department of Political Science proof of completion for the Fundamentals of University Teaching program. Progress for the other two components will be tracked in the Department. Once complete, a milestone completion form will be submitted for students for the PhD Teaching Seminar. The milestone should be added to the following program: Doctor of Philosophy (PhD) in Political Science





Faculty: Arts

Effective term: Term/Year Fall 2021

Course  New  Revision  Inactivation Milestone  New  Revision  Inactivation 

New milestone title: PhD Thesis

For course revisions, indicate the type(s) of changes:  
(e.g. consent, description, title, requisites)

Course Subject code: Choose an item. Course number:

Course Title (max. 100 characters incl. spaces):

Course Short Title (max. 30 characters incl. spaces):

Grading Basis: CREDIT/NO CREDIT

Course Credit Weight: Choose an item.

Course Consent Required:  Choose an item.

Course Description:

New course description (for revision only):

Meet Type(s): Choose an item. Choose an item. Choose an item. Choose an item.

Primary Meet Type: Choose an item.

[Requisites:](#)Special topics course: Yes  No Cross-listed: Yes  No 

Course Subject(s) to be cross-listed with and approval status:

Sections combined/heldwith:

**Rationale for request:**

Required milestone for all students enrolled in Political Science at the PhD-level. The milestone should be added to the following programs:

- 1) Doctor of Philosophy (PhD) in Political Science
- 2) Doctor of Philosophy (PhD) in Political Science - Co-operative Program

Prepared by: Shelby Davies

Date: 27-Sep-19

Faculty: Arts

Effective term: Term/Year Fall 2021

Course  New  Revision  Inactivation

Milestone  New  Revision  Inactivation

New milestone title: PhD Thesis Proposal

For course revisions, indicate the type(s) of changes:  
(e.g. consent, description, title, requisites)

Course Subject code: Choose an item. Course number:

Course Title (max. 100 characters incl. spaces):

Course Short Title (max. 30 characters incl. spaces):

Grading Basis: CREDIT/NO CREDIT

Course Credit Weight: Choose an item.

Course Consent Required:  Choose an item.

Course Description:

New course description (for revision only):

Meet Type(s): Choose an item. Choose an item. Choose an item. Choose an item.

Primary Meet Type: Choose an item.

[Requisites:](#)

Special topics course: Yes  No

Cross-listed: Yes  No

Course Subject(s) to be cross-listed with and approval status:

Sections combined/heldwith:

### Rationale for request:

Required milestone for all students enrolled in Political Science at the PhD-level. The milestone should be added to the following programs:

- 1) Doctor of Philosophy (PhD) in Political Science
- 2) Doctor of Philosophy (PhD) in Political Science - Co-operative Program

---

Prepared by: Shelby Davies

Date: 27-Sep-19

**UNIVERSITY OF  
WATERLOO**



**NEW GRADUATE PROGRAM PROPOSAL  
OF  
PHD  
IN  
POLITICAL SCIENCE**

**Submitted to the  
Ontario Universities Council on Quality Assurance**

**VOLUME II – FACULTY CURRICULA VITAE**

February 2019

[Vol II available here](#)



UNIVERSITY OF  
**WATERLOO**

## EXTERNAL REVIEWERS' REPORT FOR NEW PROGRAMS

Reviewers' Report on the Proposed PhD Program in Political Science at the University of Waterloo.

### **Name**

Loleen Berdahl  
Professor  
Department of Political Studies  
University of Saskatchewan  
280 Arts, 9 Campus Drive  
Saskatoon SK S7N 5A5  
Loleen.berdahl@usask.ca

### **Name**

Christopher Alcantara  
Professor and Graduate Chair  
Department of Political Science  
The University of Western Ontario  
151 Richmond St.  
London, Ontario N6A 3K7  
calcanta@uwo.ca

### **SUMMARY**

*Please provide a brief synopsis of your review (2-4 paragraphs) that answers the following questions:*

- What is the overall assessment of the quality of the proposed program? *Describe.*
- Provide a summary of your recommendations. *Please include the full list of recommendations in Section 4.*

Our overall assessment is that the quality of the proposed program is high. The admissions criteria and curriculum meet the current state of the discipline for political science. The three sub-discipline areas are appropriate given the faculty research and teaching areas of strength. The program is innovative in its inclusion of an optional experiential learning component. The program also includes explicit professional development training, a much-needed element in political science doctoral training.

Our recommendations focus on simplifying the program and ensuring sufficient student support in terms of office space, opportunity, and funding. We strongly recommend that the department revise the language of the program to recognize “specializations” rather than “streams”, and we recommend that the specializations be limited to two. We recommend that students' office space be embedded in the department's main space, that students be allowed maximum flexibility with the timing of their experiential placements, and that students be guaranteed the opportunity to teach or co-teach a full semester class. We encourage the department to find

options to extend the funding period for students completing one or both of the specializations, and to explore options to strengthen methodological training. Finally, we encourage the department to work directly with the co-op and alumni offices as the program develops.

## 1. DETAILS OF THE SITE VISIT

### 1.1 Outline of the Visit

- With whom did you meet?

We met with the following individuals:

Gerald Boychuk, Professor, Political Science;

Kirsty Budd, Faculty Relations Manager, Arts, Co-op Education;

Jeff Casello, Associate Vice-President, Graduate Studies and Postdoctoral Affairs;

Alana Cattapan, Assistant Professor, Political Science;

Martin Cook, Acting Dean, Faculty of Arts;

Shelby Davies, Administrative Manager, Political Science;

Anna Drake, Assistant Professor; Political Science;

Maha Eid, Graduate Programs Coordinator, Political Science;

Anna Esselment, Associate Dean, Graduate Studies, Faculty of Arts;

Jane Forgay, Librarian, Information Services and Resources;

Jasmin Habib, Associate Professor, Political Science;

Dan Henstra, Associate Professor, Political Science;

Veronica Kitchen, Associate Professor, Political Science;

Emmett Macfarlane, Associate Chair, Graduate Studies, Political Science;

Amanda McKenzie, Director, Quality Assurance (Academic Programs);

John Ravenhill, Chair, Political Science;

Jim Rush, Vice-President Academic & Provost;

Richard Wikkerink, Director, Student & Faculty Relations, Co-op Education.

- What facilities were seen?

None. Our visit occurred remotely through Microsoft Teams as a result of the COVID-19 Pandemic.

- Discuss any other activities relevant to the appraisal.

None.

### 1.2 Effectiveness

*In order to continuously improve the effectiveness and efficiency of site visits, please comment on the following:*

- How effective was the proposal brief in preparing you for the visit?

The brief provided a great overview of the proposed structure of the new program. However, it would have been helpful had the brief provided a clear statement justifying the need, purpose and rationale for the new PhD program in political science. We also found that the brief didn't really give enough details on how the comprehensive exam process would be structured. This latter comment was also something mentioned independently to us by one of the senior members of UW's leadership team. Finally, some indication of departmental and university support would have been helpful, such as the outcomes of departmental votes on motions relating to the new program proposal and the inclusion of the appendices mentioned in the brief would have been helpful.

- How could the logistics of the visit be improved?

It might have been helpful to have the university provide someone who could take minutes for each meeting and to arrange for two meetings with the graduate chair: one at the beginning of the visit and one at the end after and before the first and exit interview with the AVP of GSPA, respectively.

## 2. EVALUATION CRITERIA

### 2.1 Objectives

*For the following Yes/No questions, if 'No', please explain.*

- Is the program consistent with the [University of Waterloo's mission](#) and relevant academic strategic plans?

Yes. The new program builds on the University of Waterloo's "brand" by proposing a potentially innovative experiential PhD program in political science while at the same time leveraging the department's strong and research-oriented faculty members in Canadian politics, International Relations, and International Political Economy to offer a research-oriented PhD.

- Are the program requirements and learning outcomes
  - in alignment with the University of Waterloo's [Undergraduate](#) or [Graduate](#) Degree Level Expectations?

Yes. The program requirements and learning outcomes make sense with some caveats described below.

- clear and appropriately communicated?

Yes.

- How do the program name and credential earned (e.g., BA, MSc, PhD, etc.)
  - reflect the content of the program?

The program name and credential earned make sense and reflect the content of the program. In our recommendations, we suggest the department use the language of “specializations” rather than “streams”; that the number of specializations be limited to two, both of which can be completed by all students; and that the teaching and learning specialization be strengthened to provide better training to the student.

- advance the program’s objectives?

The name and credential indicate the kind of training expected from a PhD political science program in Canada.

## 2.2 Admission requirements

*For the following Yes/No questions, if ‘No’, please explain.*

- Are admission requirements appropriately aligned with the learning outcomes established for completion of the program?

Yes, the admission requirements are similar to those used by PhD programs at other Canadian Universities. The logic of the new program is that all PhD students should receive the same base training (e.g. coursework, comprehensive exams, and three professional development modules) before choosing their specialization(s) in year 2. In one of our meetings, however, we raised the question about whether PhD students in the internship or co-op specializations would be disadvantaged when competing for co-op placements against undergrad and MPS/MA students for a number of reasons. The one response we received was that they would expect PhD students interested in the internship or co-op options are likely to be students with previous working experience and so would likely have no problems gaining a co-op placement. If that is a potential target for these options, then perhaps including work experience as part of the admission materials would be useful.

- Is there sufficient explanation of alternative requirements, *if any*, for admission into a graduate, second-entry or undergraduate program, such as minimum grade point average, additional languages or portfolios, along with how the program recognizes prior work or learning experience?

UW rules suggest that students cannot double count courses towards multiple degrees. Therefore, students entering the program will not be able to waive any of the course requirements on the basis of previous experience. Students who complete their MA at UW will have to take other courses, which may include courses they didn’t take during their MA (and the program commits to offering a minimum of 11 PhD/MA courses per year) and courses offered in the MPS and Balsillie programs. These rules seem reasonable.

## 2.3 Structure

*For the following Yes/No questions, if ‘No’, please explain.*

- Are the program’s structure and regulations appropriate to meet the specified program learning outcomes and Degree Level Expectations?



Yes, although we recommend that students in the teaching specialization be required and offered the opportunity to teach or team-teach their own course and that their regular funding package be topped up to ensure the TA portion of their funding matches that paid to a sessional instructor.

- For graduate programs, is there a clear rationale for program length that ensures that the program requirements can be reasonably completed within the proposed time period?

Yes, the program length is consistent with how the majority of PhD programs are constructed in Canada. That being said, most political science PhDs in Canada take an average of 6 years to complete and so we would strongly encourage the university to provide 5 years of funding for the new PhD program. As the university knows, the Ontario government provides students with 6 years of graduate funding. To the best of our knowledge, all political science MA programs in Ontario are 1 year programs and so we encourage the university to consider offering UW PhD students five years of funding to reflect this fact and to ensure this new program is competitive within what is already a highly competitive PhD market in Ontario.

## 2.4 Program Content

*For the following Yes/No questions, if 'No', please explain.*

- Does the curriculum reflect the current state of the discipline or area of study?

For the most part, yes. The one exception is the methodological training offered, which consists of a 0.5 credit course on epistemology, quantitative methods, and qualitative methods, and two half-day professional development modules on fieldwork and the thesis proposal. While acceptable, this level of doctoral methods training is extremely modest. It would be useful for the program to leverage the department's diverse strengths in qualitative methods to offer a graduate course on that topic, and to inform students of the option of taking other methods courses from nearby universities, such as Guelph, Laurier, McMaster, and Western.

- What evidence is there of any significant innovation, distinctiveness or creativity in the content and/or delivery of the program?

As far as we know, UW's proposed PhD experiential specialization will be the first political science program in Canada to require and offer an internship or co-op placement. This unique specialization is innovative, distinctive, and creative, and we applaud the department for proposing it. It has the potential to build upon the already strong reputation of the department while at the same time attracting students with diverse career goals that are not being served by existing PhD programs. There is an opportunity here as well to be innovative in terms of the teaching specialization by requiring these students to teach or team-teach their own course as part of their formalized teaching training.

- For research-focused graduate programs, is there a clear indication of the nature and suitability of the major research requirements for degree completion?

Yes, the program requirements are conventional: coursework, comprehensive exams, professional development modules, thesis proposal and thesis. Offering additional training in

qualitative methodology within the department and providing opportunities for students to find more advanced quantitative training outside of the department (such as at neighbouring universities or at the ICPSR, the Essex summer school, and LISPOP) would be beneficial.

- For graduate programs, are there sufficient graduate level courses that students will be able to meet the requirement that two-thirds of their course requirements be met through courses at the graduate level?

Yes.

## 2.5 Mode of Delivery

*For the following Yes/No question, if 'No', please explain.*

- Is the proposed mode(s) of delivery appropriate to meet the intended program learning outcomes and Degree Level Expectations?

Yes.

## 2.6 Assessment of Teaching and Learning

*For the following Yes/No questions, if 'No', please explain.*

*All programs are expected to map the courses and related academic elements to the program learning outcomes and Degree Level Expectations ([UDLEs](#) or [GDLEs](#)). This section intends to evaluate these relationships.*

- Is there a clear relationship between diverse academic elements: core courses, electives, and other program elements?

Yes.

- Are the proposed assessment methods appropriate to effectively show student achievement of program learning outcomes and Degree Level Expectations?

Yes.

- Is there a clear articulation of the plans for documenting and demonstrating the level of performance of students, consistent with the University of Waterloo's [Undergraduate](#) or [Graduate](#) Degree Level Expectations?

Yes.

## 2.7 Resources

*For the following Yes/No questions, if 'No', please explain.*

- Is the academic unit's (or units') planned use of existing resources (e.g., human,

physical) appropriate and effective for delivering the program? (*NOTE: Reviewers are encouraged to articulate and demonstrate the value added of any additional resources - e.g., new academic elements such as offering a new degree, or improved delivery of existing offerings, etc.*)

Yes. The faculty complement within the department is highly committed to the new PhD program. Political science is a research-intensive department and have the expertise and experience to offer a research, teaching, and experiential PhD in political science. Adding the proposed PhD program should attract strong students and increase the already strong research profile and productivity of the professors in the department. The program will also benefit the existing MA program by replacing cross-listed undergraduate-Masters classes with exclusive graduate classes.

We are, however, concerned that the department does not seem to have enough physical space to house all of its graduate students, and especially its PhD students, within the department itself. A necessary condition for this program to succeed is to ensure that the PhD students have office space on the same floor and ideally embedded within the area where faculty have their offices. Not only is this important for cohort building among the students, but it is also important for socializing the students into the norms of the discipline. Students and faculty need to be able to informally and formally meet in offices, hallways, and common spaces. These kinds of interactions allow for informal exchanges of research ideas and the building of research partnerships that may lead to co-authored publications. Our discipline is moving towards a co-authorship model and ensuring that the PhD students have the opportunity to interact with each other and faculty on a daily basis is necessary for the PhD program to succeed in terms of student training and placement.

In terms of other considerations, the staff are well-equipped and ready to administer the new program. We think it is absolutely essential that the department have a full time graduate program coordinator/administrator to manage existing graduate programs and the new PhD program, and we wholeheartedly support the department's request for a full time administrator.

- If necessary, is there sufficient evidence of the plans and commitment to provide the necessary resources in step with the implementation of the program?

The department has made it clear it will devote as many resources as possible to implement the new program. Our meetings with the associate dean of grad studies and the acting dean of the faculty of arts suggest they will support the department's desire for sufficient office space for their graduate students and will provide the necessary funding to ensure teaching stream students are able to teach or team-teach their own course.

On the other hand, there seem to be less enthusiasm from senior level leaders in terms of providing:

1) Fully-funded spots for international students. The Provost stated this is a faculty-level decision while the Dean's office indicated they simply can't address this issue given budgetary constraints. Coordination between the dean's office and upper administration is necessary to solve this issue since the proposed new program would be attractive to international students. Equally important, having international students in the program would benefit domestic students and faculty in numerous ways.

2) Five years of funding. As a new PhD program in a field with many political science PhD programs, one way that the university can ensure this program succeeds is to offer a funding package that is more competitive than the ones offered by the more established PhD programs in Canada. If five years of funding is not possible, then the university should consider providing the program with additional funding that allows it to offer more money beyond the minimum amount of 4 years at \$25,000 per year — at least for the first five years of the program's existence.

- Is there a sufficient number and quality of faculty and staff to achieve the goals of the program?

Absolutely. The faculty complement is strong, research oriented, and public facing. The members are active in producing first rate, policy oriented research and knowledge mobilization, all of which fit with the proposed specializations. The staff are committed, well-organized, and experienced. We have no doubt that the faculty and staff are well-prepared to implement this new program.

- Are the academic support services (e.g., library, co-op, technology, etc.), related to the program being reviewed, appropriate and effective?

Yes. The library is fully committed and able to provide the full range of support necessary for students to engage in and distribute their research. When asked whether the library could make available the reading lists for the comprehensive exam to the students electronically and by subfield/theme, for instance, the librarian agreed it was a good idea and would be happy to assist. She also was enthusiastic about providing support in the form of offering workshops and one-on-one consultations with PhD students and tracking which students took advantage of such services if doing so was helpful to the department in terms of its degree progression tracking.

Our meeting with co-op provided similar assurances that the co-op office was well-equipped and highly committed to helping the PhD program achieve its learning objectives.

**For proposed graduate programs,**

- Do faculty have adequate and recent research or professional/clinical expertise needed to sustain the program, promote innovation and foster an appropriate intellectual climate?

Yes. The department of political science has a strong mix of junior, mid-career, and senior faculty members to mount a PhD program around the three main subfields identified and to support students interested in research, teaching, and a co-op placement. Members are productive, publishing their research in good venues and winning prestigious awards and memberships in academic societies. They are adept at winning research grants and have experience in supervising graduate students.

- Where appropriate, is there adequate evidence that financial assistance for students will be sufficient to ensure the number and quality of students?

The minimum guaranteed funding package of four years at \$25,000 a year is bit below the average in Ontario. Ideally, the department would be able to offer five years of guaranteed funding for those students who wished to pursue the teaching, co-op or internship specializations and have access to money to top up offers for superior applicants. As a new program in a province in which there are many PhD programs, the success of UW's proposed program will at least partly depend on being able to offer strong financial packages to attract strong students away from more established programs.

While there is some centrally administered university funding for students to travel, it would be ideal if the department or faculty could provide funds for PhD students to cover expenses related to data collection and analysis, such as money to buy datasets or data analysis software, or to visit archives, or purchase equipment for recording and transcribing interviews, and the like.

- Is the quality and availability of graduate supervision sufficient?

Yes. The projected number of students to be admitted into the program annually (4) is modest given the size (20 tenure-stream members) and quality of the faculty members.

## 2.8 Quality Indicators

**With regards to the faculty complement,** comment on:

- Their qualifications, research and scholarly record  
(NOTE: Reviewers are urged to avoid using references to individuals. Rather, they are asked to assess the ability of the faculty as a whole to deliver the program in view of the expertise and scholarly productivity of the faculty.)

The subfields that are at the core of the proposed PhD program (e.g. Canadian politics, International Political Economy, and International Relations) are excellent choices given the faculty complement. The University of Waterloo has a strong reputation in Canada in these three fields, given their personnel and research output. Faculty members publish with the best scholarly book presses and top journals in these subfields and win major scholarly awards that recognize this expertise.

- Evidence that the program's structure and faculty research will ensure the intellectual quality of the student experience

The proposed PhD program is in many ways conventional and similar to what is offered elsewhere in terms of coursework, comprehensive exams, professional development modules, thesis proposal and dissertation. The program goes beyond these conventional requirements to add additional modules and specific required training related to research, teaching, and non-academic careers as well as offering an experiential option. As a package, the program offers more than the conventional program and should contribute to a rich intellectual student experience.

## 3. RECOMMENDATIONS

List your recommendations, in priority order.

1. Revise the language of the program to recognize “specializations” rather than “streams”. We recommend two specializations that students can complete on top of the PhD training that all students complete: “Specialization in Teaching and Learning” and “Specialization in Applied Political Science”. The applied political science specialization can be defined to include co-op and internship options.
2. Provide all PhD students with office space on the department floor.
3. Allow students engaging in experiential learning to complete the experiential placement in the term immediately prior to the final oral defence, returning afterwards for one final academic term to defend the dissertation, if this option best meets their individual circumstances.
4. Provide all students engaging in the teaching and learning specialization the opportunity to teach or co-teach a full semester class, with funding stipends for this term increased to match sessional teaching rates to match the workload.
5. Explore options to increase PhD funding packages to five years of guaranteed funding for students who take one or both of the specializations.
6. Explore options to strengthen methodological training, such as encouraging students to complete additional methods training outside of the department and offering a qualitative methods course within the department, given departmental methodological expertise.
7. Work proactively with the co-op office to ensure the success of PhD getting appropriate doctoral-level placements.
8. Work with the alumni office to track all PhD students, including students who do not complete their programs, in order to establish a strong alumni network.

**Signature:** Loleen Berdahl - email confirmation on file **Date:** \_\_\_\_\_

**Signature:** Chris Alcantara - email confirmation on file **Date:** \_\_\_\_\_

# Program Response to External Reviewers' Report Political Science (PhD) September 2020

---

## **General Commentary**

We are pleased that the reviewers agree that the proposal is of high quality and that the Department is well positioned to mount a strong and innovative program. We thank the reviewers for their thoughtful comments and helpful recommendations. As discussed below, some of the reviewers' financial/funding recommendations are beyond the Department's control and the purview of the proposal itself, as they are subject to budget constraints facing all PhD programs in the Faculty of Arts.

## **Programs Response to External Reviewers' Recommendations**

1. Revise the language of the program to recognize "specializations" rather than "streams". We recommend two specializations that students can complete on top of the PhD training that all students complete: "Specialization in Teaching and Learning" and "Specialization in Applied Political Science". The applied political science specialization can be defined to include co-op and internship options.

## **Response**

We recognize that the language of "streams" seemed to add to the reviewers' perceptions of the program's complexity. As the proposal details, all students admitted to the program will enter the regular program. Students then have the option of adding the 'teaching' and/or 'experiential' streams (the latter of which includes the co-op option, or an internship, etc.). The reviewer's preference for referring to these program options as "specializations," would, however, introduce additional confusion as specializations at the University of Waterloo describe subject-area designations that students in some graduate programs can achieve through specific course-work. The language of streams refers to student program pathway options, as reflected in the proposal. We believe it appropriate to

retain the language of 'streams,' although we will work carefully to ensure that its meaning is clear in the program website and relevant student materials.

2. Provide all PhD students with office space on the department floor.

**Response**

We welcome this recommendation. The physical presence of PhD students within the departmental space is integral to developing a sense of community, culture, and collegiality, and for the marketability of the program. The recommendation also reflects the status quo in other departments of the Faculty of Arts (for example, Philosophy). The Department recently had a number of offices within the physical area of its space re-allocated by the Faculty for other uses, and ideally these offices could be re-allocated back to the Department for use by PhD students. Because this proposal is already outlined in section 3.4 of the Volume 1 document, we simply highlight this for future consideration by the Dean's office.

3. Allow students engaging in experiential learning to complete the experiential placement in the term immediately prior to the final oral defence, returning afterwards for one final academic term to defend the dissertation, if this option best meets their individual circumstances.

**Response**

We agree that for many students conducting their placement closer to the end of their program completion will be ideal, and will help to ensure program completion. The existing proposal provides students with some flexibility in terms of the timing of co-op placements or internships, but the Department, via the graduate officer and graduate coordinator, plans to strongly advise students of this consideration when they are making decisions about placements. The Department will establish a system to track individual student progress and the completion of milestones. As part of this system, the timing of placements for students in the experiential stream will be reviewed and adjusted if problems arise.

4. Provide all students engaging in the teaching and learning specialization the opportunity to teach or co-teach a full semester class, with funding stipends for this term increased to match sessional teaching rates to match the workload.

**Response**

We welcome this recommendation as it matches our intentions. Given contemporary budget uncertainty, the Department did not feel it was in the position to provide a formal



retain the language of 'streams,' although we will work carefully to ensure that its meaning is clear in the program website and relevant student materials.

2. Provide all PhD students with office space on the department floor.

**Response**

We welcome this recommendation. The physical presence of PhD students within the departmental space is integral to developing a sense of community, culture, and collegiality, and for the marketability of the program. The recommendation also reflects the status quo in other departments of the Faculty of Arts (for example, Philosophy). The Department recently had a number of offices within the physical area of its space re-allocated by the Faculty for other uses, and ideally these offices could be re-allocated back to the Department for use by PhD students. Because this proposal is already outlined in section 3.4 of the Volume 1 document, we simply highlight this for future consideration by the Dean's office.

3. Allow students engaging in experiential learning to complete the experiential placement in the term immediately prior to the final oral defence, returning afterwards for one final academic term to defend the dissertation, if this option best meets their individual circumstances.

**Response**

We agree that for many students conducting their placement closer to the end of their program completion will be ideal, and will help to ensure program completion. The existing proposal provides students with some flexibility in terms of the timing of co-op placements or internships, but the Department, via the graduate officer and graduate coordinator, plans to strongly advise students of this consideration when they are making decisions about placements. The Department will establish a system to track individual student progress and the completion of milestones. As part of this system, the timing of placements for students in the experiential stream will be reviewed and adjusted if problems arise.

4. Provide all students engaging in the teaching and learning specialization the opportunity to teach or co-teach a full semester class, with funding stipends for this term increased to match sessional teaching rates to match the workload.

**Response**

We welcome this recommendation as it matches our intentions. Given contemporary budget uncertainty, the Department did not feel it was in the position to provide a formal

guarantee in the proposal or academic calendar that every student will have the opportunity to teach a full course, or regarding increased stipends. However, the Department plans to prioritize PhD students in the allocation of teaching opportunities, and believes that most if not all students in the teaching stream will get the opportunity to teach. Consistent with the university's Strategic Plan, which outlines a commitment "to create more flexible learning pathways aligned with the future of work and learning," the Department believes PhD students can provide novel programming and unique course offerings to student in undergraduate programs.

5. Explore options to increase PhD funding packages to five years of guaranteed funding for students who take one or both of the specializations.

#### **Response**

We welcome this recommendation in principle, while recognizing the decision remains at the Faculty and university level. The University and the Faculty of Arts guarantees a minimum of four years of funding to PhD students. In practice, many students are funded beyond four years, largely as a result of faculty research grants, scholarships, etc. The Department's excellent track record in securing external funding suggests that this will be the case with Political Science PhD students as well.

6. Explore options to strengthen methodological training, such as encouraging students to complete additional methods training outside of the department and offering a qualitative methods course within the department, given departmental methodological expertise.

#### **Response**

The proposal's course requirements as it relates to methodological training matches the standard at most PhD-granting political science programs in Canada. Political science research entails a wide variety methodological approaches, and the required methods course will give students a grounding in these pluralistic approaches. The proposal notes that we will be encouraging students to gain additional methods training, more specifically tailored to the needs of the individuals, as part of the broader professional development requirements all students in the program will be required to complete. Students will also receive advice about methods training offered outside of the program, such as courses and events in the MPS program, and at neighbouring institutions and programs (like LISPOP at Wilfrid Laurier University). As part of its tracking of student progress and milestone completion, the Department will monitor student satisfaction with established methods instruction and ensure access to the enhanced training opportunities provided by the

professional development requirements. This will also be formally evaluated two years after the first intake within the Two-Year Progress Report.

7. Work proactively with the co-op office to ensure the success of PhD students securing appropriate doctoral-level placements.

**Response**

We welcome this recommendation and it is reflected in our plans and in the co-op feasibility report attached as an appendix to the Volume 1 report.

8. Work with the alumni office to track all PhD students, including students who do not complete their programs, in order to establish a strong alumni network.

**Response**

We welcome this recommendation and it is our plan to maintain strong connections to program alumni. We have recently made similar efforts at the MA level, and can replicate those efforts in collaboration with the alumni office at the PhD level.

**Recommendations Not Selected for Implementation**

For reasons described above, we are not revising the proposal to change the language of 'streams' to 'specializations'. Generally, the recommendations relating to finances/funding are beyond the Department's purview, and thus do not result in revisions either.

**Signature of Approval**



21 September 2020

---

Chair/Director  
John Ravenhill

Date

# Dean's Response to External Reviewers' Report Political Science (PhD) October 2020

---

## General Commentary

This program has the full support and endorsement of the Faculty of Arts.

## Dean's Response to External Reviewers' Recommendations

1. Revise the language of the program to recognize "specializations" rather than "streams". We recommend two specializations that students can complete on top of the PhD training that all students complete: "Specialization in Teaching and Learning" and "Specialization in Applied Political Science". The applied political science specialization can be defined to include co-op and internship options.

### Response

Terminology can sometimes be confusing when referring to specializations or streams. At the University of Waterloo, specializations usually mean additional designations that come with added or customized course work. "Streams" or "pathways" are more often employed to describe options for students within a degree. I therefore support the original language in this respect.

2. Provide all PhD students with office space on the department floor.

### Response

Space in the Faculty of Arts is always at a premium. However, I recognize the need for new doctoral students to feel part of the department culture, to develop networks and support structures, and to be close to faculty instructors, supervisors, and committee members. The Department of Political Science does have office space on the floor that can be dedicated to PhD students for the first two years of the program at least, and I am committed to working with the Department on its space needs after that.

3. Allow students engaging in experiential learning to complete the experiential placement in the term immediately prior to the final oral defence, returning afterwards for one final

academic term to defend the dissertation, if this option best meets their individual circumstances.

**Response**

I am supportive of this recommendation, but also note that the department will be carefully advising students regarding the timing of any experiential/co-op placements. As per UW regulations, all students must end their degree on a full academic term if they are part of a co-op/experiential stream.

4. Provide all students engaging in the teaching and learning specialization the opportunity to teach or co-teach a full semester class, with funding stipends for this term increased to match sessional teaching rates to match the workload.

**Response**

I am supportive of the recommendation to have doctoral candidates in the teaching and learning stream to have the opportunity to teach or co-teach a full semester class. This would be managed by the department, according to their teaching needs. Any doctoral candidate who bears responsibility for teaching a full semester class is paid the sessional teaching rate, although the scholarship portion of their funding package from Arts is reduced in the following term. The Department will make this clear to students, so that they can make financial plans accordingly.

5. Explore options to increase PhD funding packages to five years of guaranteed funding for students who take one or both of the specializations.

**Response**

The University will not agree to a five-year funding package.

6. Explore options to strengthen methodological training, such as encouraging students to complete additional methods training outside of the department and offering a qualitative methods course within the department, given departmental methodological expertise.

**Response**

The Department has noted that the methods training it will require as part of the curriculum is the norm for many Political Science PhD programs in Canada. I am supportive of the Department encouraging students to complete additional methodological training if instructors/supervisors/committee members suggest that it would be valuable to the student's dissertation project, in particular.

7. Work proactively with the co-op office to ensure the success of PhD getting appropriate doctoral-level placements.

**Response**

I am supportive of this recommendation. The PSCI department oversees UW's largest graduate co-op program (Master of Public Service), and so these doctoral students will be well-supported by both co-op and the department to be competitively placed for appropriate-level co-op positions.

8. Work with the alumni office to track all PhD students, including students who do not complete their programs, in order to establish a strong alumni network.

**Response**

I am supportive of this recommendation in part, though any work with alumni must take place within the parameters determined by the University and the Faculty. However, I do not consider it advisable to treat those who do not complete the program (whether voluntarily or involuntarily) as if they were alumni, and I do not support this part of the recommendation.

**Recommendations Not Selected for Implementation**

- Changing the language from streams to specializations.
- Five year funding package.
- Tracking individuals who leave the program as if they were alumni.

**Signature of Approval**



11 October 2020

---

Faculty Dean

Date

**Note:** AFIW programs fall under the Faculty of ARTS; however, the Dean does not have fiscal control nor authority over staffing and administration of the program.

---

AFIW Administrative Dean/Head (*For AFIW programs only*)

Date

## University of Waterloo

### Guidelines for the Review of Centres/Institutes

- A. All Centres/Institutes will be reviewed at least once during the five-year period of existence. Notice of the review will be communicated to the Director of the Centre/Institute by the Vice-President, University Research at least nine months prior to the end of the mandate of the Centre/Institute. In the first instance and at the discretion of the Vice-President, University Research, an initial evaluation of each Centre/Institute shall be conducted.
- B. As a Centre/Institute comes up for review, its Director will be asked to prepare a report along the guidelines outlined in C.2. below; the report is to also include a reflection of the opinions of the members of the respective Centre/Institute concerning its operation. In addition, reports should include a summary of: (a) faculty involved in the Centre's activities; (b) numbers of graduate students involved in the Centre's activities (over the duration of the Centre and since the last review); (c) a list of publications from the Centre's activities (or other, appropriate, academic measures of research activity). The report is then to be submitted to the Senate Graduate Research Council, by a date established by the Vice-President, University Research, for consideration and determination as to whether a formal, independent review committee should be struck to conduct a full review of the Centre/Institute.
- C. In the event that a more thorough examination is required, the following process will be observed:
1. The Review Committee will be appointed by the Vice-President, University Research in consultation with the Senate Graduate Research Council at least six months prior to the end of the mandate of the Centre/Institute; the membership of the Committee will include:
    - A senior researcher with administrative experience and no direct involvement in the Centre/Institute (preferably a former Dean or Department Chair), who shall chair the Committee;
    - The Director of another Centre/Institute;
    - An academic who is not a member of the Centre/Institute but is knowledgeable in the field of its research activity;
    - The Vice-President, University Research or her/his delegate to assess financial and corporate concerns;
    - Other appointments as may be deemed appropriate.
  2. The Director of the Centre/Institute is required to provide the Chair of the Review Committee with the following information:
    - A progress report which includes a statement describing how and why the Centre/Institute has achieved or revised its original objectives; a detailed listing of research accomplishments, a current membership list and a detailed financial statement;
    - A five-year plan which identifies future research directions and development strategies;



- Statements from appropriate Department Chairs and Faculty Deans indicating continued support for the Centre/Institute;
  - Names of individuals who could provide external assessments of the Centre/Institute.
3. The mechanism by which the Review Committee elects to conduct the review shall be at the discretion of the Committee in consultation with the Vice-President, University Research. It is recommended that the primary thrust of the review process involve meetings with the Director and members, and an assessment of activities, achievements and progress that has been made towards the fostering and promotion of the given field. In addition, it is suggested that the review process include solicitation of external assessments and discussion with non-members of the Centre/Institute from related departments.
  4. The Review Committee is required to submit a written report to the Vice-President, University Research, normally within four months of being established. Before submission to the Vice-President, the Chair of the Review Committee will have provided a copy of the report to the Director of the Centre/Institute under review to ensure that the report contains no factual errors. The Director may submit a written commentary on the report to the Vice-President, University Research.
  5. The Senate Graduate Research Council will consider the report of the Review Committee, consulting with the Committee and Director of the Centre/Institute as necessary before making a recommendation to Senate concerning the future of the Centre/Institute. The recommendation may be:
    - Continuation with review in 5 years
    - Continuation with review in 1, 2 or 3 years
    - Termination

Approved by the Senate Research Council 890914.  
Revised by the Senate Research Council 920228.

## Centres and Institutes Renewal Checklist

As per Policy 44, all centres and institutes will be reviewed at least once during the five-year period of existence. In order to renew your centre/institute, you must prepare a package with all of the below information by the deadline issued by the Office of Research. Please prepare the documentation in the order indicated, and submit the completed checklist as the first document.

Your Completed Report is due at the Office of Research by: **[insert date]**

<input type="checkbox"/> Cover Letter Indicating Request for Renewal
<input type="checkbox"/> Progress Report that covers: <ol style="list-style-type: none"> <li>1) Statement describing how and why the Centre/Institute has achieved or revised its original objectives</li> <li>2) Detailed listing of Research Accomplishments</li> <li>3) Current membership list</li> <li>4) Reflection of opinions of the members of the respective Institute concerning its operation</li> <li>5) Summary of:             <ol style="list-style-type: none"> <li>a) Faculty Involved in the Centre’s Activities</li> <li>b) Numbers of Graduate Students Involved in the Centre’s activities (over the duration of the Centre and since the last review)</li> <li>c) A list of publications from the Centre’s activities (or other appropriate, academic measures of research activity)</li> </ol> </li> </ol>
<input type="checkbox"/> Organizational Chart
<input type="checkbox"/> Detailed Financial Statement with an Itemized Budget (2 pages)
<input type="checkbox"/> 5 year plan that includes: <ol style="list-style-type: none"> <li>1) Projected Budget</li> <li>2) Future Research Directions and Development Strategies</li> </ol>
<input type="checkbox"/> Support Letters from appropriate Department Chairs and Faculty Deans indicating continued support for the Centre/institute
<input type="checkbox"/> Presentation File on Centre/Institute – <b>[insert date]</b>

You will then present at the Research Leader’s Council. Once Research Leaders Council approves your centre, the Vice-President of Research and International will send a support letter with your centre to Senate Graduate and Research Council (SGRC) for approval. If it passes SGRC, it will go on to Senate. After Senate, you will receive a memo from the Office of Research indicating official renewal of your centre.

Your Research Leaders Council Date is: **[insert date]**

Your Senate Graduate and Research Date is: **[insert date]**

Your Senate Date is: **[insert date]**


# MEMORANDUM

TO: Senate Graduate and Research Council

CC: Kathy Winter  
Secretariat

Hans De Sterck  
Director, Centre for Computational Mathematics in Industry & Commerce (CCMIC))

Bernard Duncker  
Associate Vice-President, Interdisciplinary Research

FROM: Charmaine B. Dean  
Vice-President, Research and International 

DATE: Thursday October 29, 2020

SUBJECT: Support for the Centre for Computational Mathematics in Industry & Commerce

**- For information -**

---

I am pleased to inform you that, following the presentation from Hans De Sterck, Director of the Math-based Centre for Computational Mathematics in Industry & Commerce (CCMIC), at the Research Leaders Council meeting of October 28, 2020, and based on discussions and recommendations of Research Leaders Council, I recommend that Senate Graduate and Research Council support the renewal of the Centre for Computational Mathematics in Industry & Commerce for another five-year term.

## Centres and Institutes Renewal Checklist – 2020/2021

As per Policy 44, all centres and institutes will be reviewed at least once during the five year period of existence. In order to renew your centre/institute, you must prepare a package with all of the below information by the deadline issued by the Office of Research. Please prepare the documentation in the order indicated, and submit the completed checklist as the first document.

Your Completed Report is due at the Office of Research by: **Thursday October 1st, 2020 at 4pm**

<input checked="" type="checkbox"/>	Cover Letter Indicating Request for Renewal
<input checked="" type="checkbox"/>	Progress Report that covers: <ol style="list-style-type: none"> <li>1) Statement describing how and why the Centre/Institute has achieved or revised its original objectives</li> <li>2) Detailed listing of Research Accomplishments</li> <li>3) Current membership list</li> <li>4) Reflection of opinions of the members of the respective Institute concerning its operation</li> <li>5) Summary of:                 <ol style="list-style-type: none"> <li>a) Faculty Involved in the Centre’s Activities</li> <li>b) Numbers of Graduate Students Involved in the Centre’s activities (over the duration of the Centre and since the last review)</li> <li>c) A list of publications from the Centre’s activities (or other appropriate, academic measures of research activity)</li> </ol> </li> </ol>
<input checked="" type="checkbox"/>	Organizational Chart
<input checked="" type="checkbox"/>	Detailed Financial Statement with an Itemized Budget (2 pages)
<input checked="" type="checkbox"/>	5 year plan that includes: <ol style="list-style-type: none"> <li>1) Projected Budget</li> <li>2) Future Research Directions and Development Strategies</li> </ol>
<input checked="" type="checkbox"/>	Support Letters from appropriate Department Chairs and Faculty Deans indicating continued support for the Centre/institute
<input type="checkbox"/>	Presentation File on Centre/Institute – <b>Due Friday November 6<sup>th</sup>, 2020</b>

You will then present at the Research Leader’s Council. Once Research Leaders Council approves your centre, the Vice-President of Research and International will send a support letter with your centre to Senate Graduate and Research Council (SGRC) for approval. If it passes SGRC, it will go on to Senate. After Senate, you will receive a memo from the Office of Research indicating official renewal of your centre.

Your Research Leaders Council Date is: **November 11, 2021**

Your Senate Graduate and Research Date is: **December 2020** (date pending)

Your Senate Date is: **January 2021** (date pending)

28 September 2020

TO: Charmaine B. Dean, Vice-President, Research and International

Dear Dr. Dean,

I am writing to submit our request for the five-year Senate renewal of the Centre for Computational Mathematics in Industry and Commerce (CCMIC).

The CCMIC was established in 2005 within the Faculty of Mathematics to promote interdisciplinary research and education in Computational Mathematics across the Faculty's five academic units and the University. During the past five years, the Centre has maintained a high level of activity, attracting 20 new faculty affiliates, graduating 59 students in the Mathematics Faculty's Computational Mathematics Master's program it facilitates, and promoting Computational Mathematics research through an active Colloquium series and research interactions with the public and private sector.

Please find attached the requested renewal package, including progress report, organizational chart, financial statement, five-year plan, and letters supporting the renewal request from the Dean of Mathematics and Department Chairs.

Please let me know if any additional information or clarification is required during the review process.

Sincerely,



Hans De Sterck  
Director, Centre for Computational Mathematics in Industry and Commerce  
Professor, Department of Applied Mathematics, University of Waterloo, Canada

# 2015-2020 Progress Report

## Centre For Computational Mathematics in Industry and Commerce (CCMIC)

### (1) Statement describing how and why the Centre has achieved or revised its original objectives:

The Centre For Computational Mathematics in Industry and Commerce (CCMIC) was established in 2005 within the Faculty of Mathematics as a collaborative effort between the five academic units of the Faculty to serve *two main objectives*:

- (1) To promote research in all areas of the interdisciplinary field of Computational Mathematics (CM), across the five academic units of the Faculty and across the University, and in collaboration with industry and government.
- (2) To promote education in Computational Mathematics at the undergraduate and graduate levels.

Computational Mathematics is a **vibrant area of research**: in the era of big data and ever-growing computational resources, ***Computational Mathematics methods are key drivers of progress and innovation across increasingly many application fields***, in areas that include science and engineering, data science, finance, and many other parts of industry and society. Computational Mathematics truly cuts across almost all the research areas pursued in the Faculty of Mathematics, including computer science, statistics, optimization, and pure and applied mathematics. As a result, **the CCMIC now counts 80 faculty members among its affiliates** (which is almost one third of the professors in the Faculty of Mathematics), with **20 new affiliates having joined the Centre since 2015**. The CCMIC also has a small number of affiliates from Waterloo's Faculties of Engineering and Environment. The Centre facilitates the **Master's program in Computational Mathematics**, which is formally housed in the Faculty of Mathematics. The Master's program plays an important part in the Centre's research activities and now has an **ongoing enrolment of about 25 Master's students**.

The CCMIC is **fully funded by the Faculty of Mathematics**. It has a lean administrative structure with a Centre Director, Graduate Officer, and Graduate Coordinator (0.5 FTE). A five-member **steering committee** provides oversight and planning. The steering committee consists of five faculty members representing the five academic units of the Faculty of Mathematics, including the Centre Director and the Graduate Officer.

The CCMIC's **original mission statement** identified the following four key objectives:

1. The development, promotion, and delivery of Honours ***Undergraduate Programs in Computational Mathematics***,
2. The development, promotion, and delivery of ***Graduate Programs in Computational Mathematics***,
3. ***Promoting and facilitating collaborative research activity in Computational Mathematics***, across departmental boundaries within the Faculty, and across the University, and
4. Facilitating the development of ***research relationships with government and the private sector***.

The CCMIC has achieved or revised its original objectives as follows:

1. Since its start in 2003, the ***undergraduate program in Computational Mathematics***, housed in the Faculty of Mathematics, has evolved into a mature program. The program is seeing an

increase in enrolment in recent years, reflecting the increasing importance of Computational Mathematics methods in the big data era. In particular, over the past 3 years the number of enrolled students with majors in Computational Mathematics has grown steadily from 110 to 190. While the CCMIC continues to be involved in overseeing the CM undergraduate program, the day-to-day operation of the undergraduate program is now the responsibility of the Mathematics Undergraduate Office, which has allowed the CCMIC to fully shift its focus onto facilitating the Faculty of Mathematics' Master's program in Computational Mathematics and the promotion of Computational Mathematics research.

2. The ***Master's program in CM, offered by the Faculty of Mathematics, debuted in 2008.*** Contributing to enhancing, facilitating and delivering the CM Master's program is a central part of the Centre's activities. The CM Master's was conceived as a 12-month intensive research-based Master's program in which students take six graduate courses to get exposure to a sufficiently broad and deep selection of topics from the interdisciplinary area of Computational Mathematics, followed by a one-semester research project. In 2017 two enhancements were added to the program: a co-op option, and a coursework option. The co-op option adds a semester to the program length and is proving popular with students since it gives them access to high-end co-op jobs where they can apply Computational Mathematics skills in real-world government and industry settings. The co-op option also increases interaction between CM faculty and industry, for example, through the means of research-based co-op jobs in industry. **Due to their interest focused on Computational Mathematics, CM Master's students are highly desirable to a subset of the affiliates of the CM Centre who have their core research interests in CM.** The majority of the CM Master's graduates obtain high-end jobs in government and the private sector, and a substantial part continues on to PhD studies.
  
3. The CCMIC plays a ***crucial role in the Faculty of Mathematics in promoting interaction between faculty members from a variety of mathematical research cultures and home academic units,*** centered around a broad common interest in Computational Mathematics among the 80 affiliates of the Centre. A major catalyst of these interactions is the **monthly Computational Mathematics Research Colloquium** that the CCMIC organizes. This promotes many informal research discussions and interactions in which faculty members come to appreciate the value of other areas of mathematical and computational research. Collaborative research builds on these informal relationships, on the understanding of the value of one another's expertise, and on common purpose. These interactions also take place in part through the supervision and co-supervision of research projects in the CM Master's program, and through discussions and interactions between PhD students and postdocs in the area of Computational Mathematics that are supervised or co-supervised by the affiliates of CCMIC. **Waterloo has tremendous collective expertise in Computational Mathematics, but this expertise is spread out across the five academic units of the Mathematics Faculty, and the CCMIC plays the critical role of integration and cross-fertilization of these Computational Mathematics research interests within the Faculty of Mathematics.**
  
4. The Centre is continuing to facilitate ***research relationships with government and the private sector*** in various ways. For example, over the past five years, the CM Master's students and their supervisors have regularly gotten involved with **MITACS research projects with industrial partners** such as Spotzi Inc., Besurance, and Venbridge. CM Master's students and their supervisors have also been involved in **research projects and research-based co-op jobs with industry partners**, e.g., Neuberger-Berman. In some cases this is directly contributing to industrial

research funding (e.g., with Huawei Noah's Ark Lab). Other **industry collaborations** pursued by Centre affiliates and their students and postdocs have included research projects with companies such as Nutrien, Clearpath Robotics, and SideFX (through NSERC CRD). **Research interaction with public sector and government** includes projects with SickKids hospital, and co-op jobs at the Canadian Intellectual Property Office, Ministry of Finance Ontario, and Environment and Climate Change Canada. As such, the CCMIC continues to develop research relationships with the public and private sectors through the CM Master's program and the various research support services offered by the Mathematics Faculty's Research Office (e.g., through the office of the Director of Innovation and Research Partnerships).

## (2) Research Accomplishments

Research activity in Computational Mathematics at Waterloo is distributed over the five academic units of the Faculty of Mathematics, and ***the CCMIC plays the crucial role of integrating and streamlining this research activity and making it visible to the outside world.*** The Centre's affiliates are globally leading research experts in broad areas of Computational Mathematics that include:

- Numerical Linear Algebra and Sparse Systems
- Numerical PDE Methods and Modelling
- Computational Optimization
- Statistical Computing and Data Visualization
- Monte Carlo and Stochastic Methods
- Symbolic Computing and Computer Algebra
- Computational Number Theory and Cryptography
- Computational Fractal Geometry
- Operations Research
- Statistical/Machine Learning, Data Mining, and Pattern Recognition
- Computational Finance
- Control Systems
- Parallel and GPU Computing
- Climate, Weather, Atmospheric and Ocean Modelling
- Computational Fluid Dynamics
- Computational Solid Mechanics
- Simulation of Physical and Biological Phenomena
- Computing in Biology and Medicine
- Medical Imaging

**The combined scientific output in Computational Mathematics research papers from the 80 affiliates and the students and postdocs they supervise make Waterloo a global research leader in Computational Mathematics.**

The **Master's program in Computational Mathematics** plays an important role in the CCMIC's research activities. The program has about 25 active students on an ongoing basis, and between 10 and 15 new admits every year. The Master's students in the program have completed more than 40 research projects in CM over the past five years, supervised and co-supervised by CM affiliates from the 5 academic units of the Faculty of Mathematics and from other Faculties at Waterloo. The **research projects of the CM Master's students are listed below in Appendix A.**



### **(3) Current membership list**

The CCMIC currently counts about **80 faculty members** as its affiliates. The membership of the CCMIC is truly interdisciplinary, with **26 affiliates from the Department of Statistics and Actuarial Science, 20 from the Cheriton School of Computer Science, 17 from the Department of Applied Mathematics, 2 from the Department of Pure Mathematics, and 11 from the Department of Combinatorics and Optimization, all within the Faculty of Mathematics.** The CCMIC currently has **two affiliates from the Faculty of Engineering** (one from Civil and Environmental Engineering and one from Electrical and Computer Engineering), and **one from the Faculty of Environment** (Department of Geography and Environmental Management). Among the broader group of affiliates, it is fair to say that about 30 have their core research area in Computational Mathematics (they could be part of a “Department of Computational Mathematics” if it were to exist at Waterloo), and this group is the most active in the supervision of CM Master’s students, in the governance of the Centre, and in participating in the Centre’s activities such as its monthly colloquium.

The list of CCMIC faculty affiliates and their departmental affiliation is given in Appendix B.

### **(4) Reflection of opinions of the members of the respective Institute concerning its operation**

The following (anonymized) statements represent the opinions of a representative sample of faculty affiliates of the CCMIC, about the activities of the Centre and how it benefits their research program. The sample was chosen to broadly represent affiliates from the academic units that participate in the Centre, including an opinion from a faculty member outside the Faculty of Mathematics.

#### **Professor from Department of Applied Mathematics:**

In the academic year 2018-2019 I supervised a CM Master’s student. I was very pleased with his performance in this program; in a short amount of time (two terms) he completed six demanding courses related to Computational Mathematics and, to complete his degree, he wrote a very impressive research report in his third term. I expect that my future students will refer to his research report as a crucial source of information. His exceptional performance in this program convinced me to offer him a PhD position in my group, which he accepted. Although his research paper did not result in a published paper, his one year Master’s in the Computational Mathematics program has prepared him well for a very challenging PhD project.

In addition to supervising a CM Master’s student, I have been on the CM Graduate Affairs committee (2017-2019) and on the CM Steering committee (2018-2019). As such I have seen how the program appeals to and accepts very talented students with interests in Computational Mathematics from all over Canada and abroad.

#### **Professor from Cheriton School of Computer Science:**

The UW CM program, in a (possibly only) faculty of mathematics which includes a diverse collection of academic units (school of computer science, combinatorics and optimization, pure math, applied math, and statistics and actuarial science), is indeed unique and can potentially support and impact mathematical learning and research in a manner that is not available in a traditional stand-alone mathematics academic unit.

I believe that the CM program at UW has indeed benefited students, facilitating them to shift and position their interest and learning to further their career advancement in mathematical sciences.

Given that CM students are in a one academic year (short) program, students’ research experience is, however, limited. Due to the increasing cost of funding students in this program, I do find it difficult,

more recently, in being able to financially support students in the CM program. I hope that some solution can be discovered to ensure the continuing success of the program.

**Professor from Department of Statistics and Actuarial Science:**

The CM master's program attracts students with unique backgrounds. These students are particularly suitable for research in predictive analytics, as they typically have solid backgrounds in statistics and computer programming, or are trained to acquire such backgrounds in the CM program.

I have had one CM master's student so far, which went very well. The student received a MITACS award: he worked half-time with an industry collaborator and worked half-time with me on his master's essay. At the end, this student successfully finished a prototype computer program for the company that simulates different population behaviors and lifestyles, which will be useful for insurance companies to understand the risks associated with the population. This student also completed a high quality master's essay by summarizing his findings in analyzing the simulation results.

**Professor from Department of Statistics and Actuarial Science:**

I highly value the CM Centre as a resource that benefits research in my field. I have supervised five CM master's students so far. Two of them went into industry at Microsoft and Huawei, one is a medical doctor now and two continued with Ph.D. programs.

The CM program is very well designed as an intermediate level program for training researchers. In those cases where students continued their Ph.D. with me after they graduated from CM, they were well-equipped to do so, as the CM program provides an excellent balance among statistics, mathematics, and computer science. That is exactly the right background for research in machine learning and artificial intelligence.

The CM Centre also helps students transcend the intermediate level. In some cases, my CM students have been able to conduct highly novel research for their final essay work that are under review for published in conjunction with well-regarded machine learning conferences.

Also, my CM student's research involved a MITACS grant and two internship placements in industry.

**Professor from Department of Combinatorics and Optimization:**

I have only recently started taking MMath students from the Computational Mathematics program and I was pleased with the overall outcome. The students in that program are strong and able to do well in a research environment. In particular for my research area, computational optimization, I sometimes struggle to find students that are interested in the computational aspects of the field, as my home department is a bit more theoretical. Therefore, the MMath students are a natural fit and allow me to fill in the gap in research with students who are interested and naturally inclined to such aspects of research. I believe the program would benefit from having a PhD program, where students could go deeper into research issues in the area. I know I would be interested in PhD students doing Computational Mathematics.

From the faculty's perspective, I also believe that the CM Centre serves a good role in integrating several different departments inside the faculty. Due to the massive size of the faculty, such interdisciplinary Centres are of great importance to create a bigger interaction between their members.

**Professor from Department of Geography and Environmental Management:**

The CM Centre has been beneficial to my teaching and research program in a few ways. I have taught several students from the CM program in my graduate course on climate modelling, and they are always energetic, curious, and provide a different set of backgrounds and skill sets than the typical students in my class. In other words, they are really great students to teach, and they add tremendous value to the course. I have also enjoyed several of the research seminars given by the invited speakers, and was happy

that CM provided funding to host Prof. Tim Merlis from McGill University, who spoke about his world-leading research on numerical modeling of the projected response of tropical cyclones to climate change. I would hope that the CM Centre can continue to expand its connections to research involving numerical modelling in problems related to environmental change, which would align closely with the efforts in many Faculties on campus, and the activities of other University Centres like the Water Institute, and IC3.

**Professor from Cheriton School of Computer Science:**

The CM Centre has provided a source of excellent graduate students through their master's degree program. On the average, I supervised one to two CM students in the past many years. Despite the program is normally one year in length, the research work of many of my CM students resulted in research papers published in international conferences and journals. After their graduation, some of my CM students continued to PhD and some found a job in industry.

The talks organized by the CM Colloquium series are mostly computational math in nature. Although not many are related to my research area, they seem interesting. Either my student or myself attended the talks occasionally.

**Professor from Department of Applied Mathematics:**

I think the CM Master's program is a really unique and great program. I've been involved as a member of the grad committee (2013-2016) and as a supervisor. From my time on the grad committee, I know that the program attracts really strong students. Unfortunately, most of these students aren't interested in my research area, so I have only supervised 1 student in the last 5 years. I think this was a very good experience for the student - he took a good set of courses, got some job experience through co-op, and wrote a nice research report for me. It didn't make a significant impact on my research program, mainly the project was too short to lead to publications. It would have made a good basis for a PhD but the student decided to go to industry. The CM colloquia are great, and are a valuable resource for me and my AMATH grad students.

**Professor from Cheriton School of Computer Science:**

My primary involvement with the CCMIC is with the Master's program. In my experience, many CM Master's applicants have a strong academic background in mathematics, and, while typically not having a complete undergraduate degree in CS, they are interested in computational aspects. Students with such a background and interest fit well with my research area.

I have supervised five CM Master's students. One of these former students went on to complete a PhD. The other four took up positions in industry. One co-authored a journal paper. As a CS faculty member who is a CM affiliate, I like the flexibility of being able to supervise master's students in the CM program in addition to the CS program. For students without a CS degree, the CM program can be a better fit: they can make valuable contributions to my research program, are not required to take remedial courses, and can complete their degree in one year.

**(5a) Summary of Faculty Involved in the Centre's Activities**

At the inception of the Centre, the Faculty of Mathematics had hired a **dedicated faculty complement of 11 new faculty members for Computational Mathematics** to support the new initiative and to promote more computationally-oriented research and interests across the academic units. In addition to the CM complement, **membership of the Centre is open to any Faculty members on campus who have interests and expertise in Computational Mathematics**. The Centre now has 80 faculty affiliates (which is almost one third of the professors in the Faculty of Mathematics), with **20 new affiliates having joined the Centre since 2015**.

The **list of faculty members involved as affiliates of the CCMIC is provided in Appendix B** (as was already specified in Section (3) above).

The **Centre Directors** over the past 5 years have been: Kevin Hare, Pure Mathematics (PM), 2015-2018; Jeff Orchard, Computer Science (CS), 2018-2020; Hans De Sterck, Applied Mathematics (AM), 2020-2023. The **Graduate Officers**: Arne Storjohann, CS; Jeff Orchard, CS; Henry Wolkowicz, Combinatorics and Optimization (CO); Ryan Browne, Statistics and Actuarial Science (SAS). In addition to these, the following faculty members have served on the **CM Steering Committee**: Ali Ghodsi (SAS), Pascal Poupart (CS), Kirsten Morris (AM), Steve Vavasis (CO) (2015-2018); Sander Rhebergen (AM), Ben Feng (SAS), Michael Rubinstein (PM) (2018-2020); Ricardo Fukasawa (CO), Michael Rubinstein (PM), Arne Storjohann (CS) (2020-2023).

### **(5b) Summary of Numbers of Graduate Students Involved in the Centre's activities (over the duration of the Centre and since the last review)**

The CCMIC facilitates the Faculty of Mathematics' CM Master's program, which is central to the activities of the Centre. The **CM Master's program has graduated 59 Master's students over the past 5 years, and 116 Master's students since the inception of the Master's program in 2008**. Most of these Master's students were research-based (92 out of 116), and were supervised or co-supervised by the faculty affiliates of the Centre. The **research projects and research supervisors of these Master's students over the past 5 years are listed in Appendix A**.

In addition to the CM Master's students, the affiliates of the Centre also perform research in Computational Mathematics with **a large number of PhD students and postdocs (some co-supervised across the boundaries of academic units), which are not formally part of the Centre**, but participate in its activities such as the CM Colloquium series and the informal interactions that the Centre facilitates.

### **(5c) Summary of research activity**

The research conducted at the CCMIC centres around the following four activities.

First, the **research activities related to the CM Master's program** are a central point in the activities of the CCMIC. As already mentioned above, **Appendix A** lists the research projects of the CM Master's students over the past 5 years, who were supervised or co-supervised by faculty affiliates of the Centre. Overall, the CM Master's program has graduated 59 Master's students over the past 5 years.

The second major research-related activity facilitated by the Centre is the monthly **Computational Mathematics Colloquium**. The Colloquium series brings prominent researchers from local, national, and international institutions as well as from industry. The seminars are well attended by graduate students and faculty members. **Appendix C** lists the approximately 40 CM Colloquia that have taken place over the past 5 years.

Third, the informal research interactions on Computational Mathematics that the Centre facilitates across the boundaries of the academic units in the Faculty of Mathematics and across the University, e.g., through the Master's program and the Colloquium series, play an important role in **catalyzing and enhancing Computational Mathematics research within the Faculty of Mathematics and the University**. These interactions are facilitated through co-supervision of graduate students and postdocs, joint

publications, and research discussions. The **combined scientific output** in Computational Mathematics research papers from the 80 affiliates and the HQP they supervise make Waterloo **a global research leader in Computational Mathematics**.

Fourth, the Computational Mathematics research facilitated by the Centre also involves a substantial amount of **research interaction and collaboration with government and industry**. Over the past five years, this has included Computational Mathematics research interactions with companies such as Spotzi Inc., Besurance, Venbridge, Neuberger-Berman, Huawei Noah's Ark Lab, Nutrien, Clearpath Robotics, and SideFX, and with public sector and government services that in SickKids hospital and Environment and Climate Change Canada. These interactions take part through various means, including MITACS fellowships for CM Master's students, research-based co-op jobs, government funding such as NSERC CRD, etc. The CCMIC continues to develop research relationships with the public and private sectors through the CM Master's program and the various research support services offered by the Mathematics Faculty's Research Office (e.g., through the office of the Director of Innovation and Research Partnerships).

## Appendix A: Research projects by CM Master's students over the past 5 years

Graduate Students in Computational Mathematics Class of 2015-2016

<i>Student</i>	<i>Supervisor</i>	<i>Title of Research Report</i>
Brantiff, Nathan	Justin Wan / Serge D'Alessio	The Level Set Method for Simulating Gravity Currents
Gosal, Gurpreet	Justin Wan / Serge D'Alessio	THE LEVEL SET METHOD FOR SIMULATING THIN FLOW DOWN AN INCLINE
He, Yeshan (Sunny)	Ken Seng Tan	Cyber Risk Insurance Pricing Based on Optimized Insured Strategy
Liao, Zhenyu (Allister)	Henry Wolkowicz	Branch and Bound via ADMM for the Quadratic Assignment Problem
Yan, Su	Tom Coleman	A Graduated Smoothing Method for the Portfolio Allocation Problem with Transaction Costs
Ye, Xinghang Guge	Henry Wolkowicz	Low Rank Matrix Completion through Semi-definite Programming with Facial Reduction
Yuan, Zhongheng (Leo)	Tom Coleman	The Structured Automatic Differentiation Approach
Yu, Olina	Tom Coleman	Efficient Computation of Hessian Matrices in a Monte Carlo Setting using Automatic Differentiation

Graduate students in Computational Mathematics Class of 2016-2017

<i>Student</i>	<i>Supervisor</i>	<i>Title of Research Report</i>
Chan, Helsa	Justin Wan	Numerical Study of a Partial Differential Equation Approach to Deep Neural Networks
Cho, Chanheum (Sean)	Jesse Hoey	Exploring Emotion Embedding and the Dimensional Model of Emotion's Predictive Power in Sentiment
Gu, Weixi	Justin Wan	Adaptive Grid Generation based on Monge-Kantorovich Optimization in Two and Three Dimensions

<b>Student</b>	<b>Supervisor</b>	<b>Title of Research Report</b>
Liu, Xiaoyu (Summer)	Arne Storjohann	A Heuristic Algorithm for Integer Hermite Normal Form
Manevannan, Varuna	Tom Coleman	A Technique for Choosing an Effective Hedging Portfolio with Few Instruments
Mohiuddin, Khadeejah	Justin Wan	Automated Segmentation of Cellular Images using an Effective Region Force
Sinha, Purushottam	Kirsten Morris	H-infinity Optimal Actuator Location for Generalized Plants with Full Information
St. Jules, Michael	Steven Vavasis	Experiments With Scalable Gradient-based Hyperparameter Optimization for Deep Neural Networks
Wong, Kathleen	Tom Coleman	Efficient Gradient Computation of Exotic Options using Automatic Differentiation
Xu, Zehao	Marius Hofert & Wayne Oldford	Size Proportional Venn Diagrams in Two and Three Dimensions: Vennplot (...) in R

Graduate students in Computational Mathematics Class of 2017-2018

<b>Student</b>	<b>Supervisor</b>	<b>Title of Research Report</b>
Selby, Kira	Pascal Poupart	Incorporating Memory into Deep Generative Dialogue Models using a Scalable Attention Mechanism
Shao, Linqi	Serge D'Alessio & Justin Wan	Modeling a Square Vibrating Plate
Xia, Fan	Ken Seng Tan	Knowledge and Perception based Decision-making Simulation and Segmentation Analysis
Xu, Bangyao	George Labahn & Peter Forsyth	Options Pricing under Shared-jump Diffusion Model by Fourier Space Time-stepping Method

Graduate students in Computational Mathematics Class of 2018-2019

<b>Student</b>	<b>Supervisor</b>	<b>Title of Research Report</b>
Dumont, Nicole	Thomas Coleman	The Optimal Social Cost of Carbon & The Cost of Inaction
Fan, Beini	Yuying Li	Total Risk Minimization with Spline Kernel Functions
Fitzpatrick, Luke	Michael Waite	Subgrid Modelling for Large-Scale Atmospheric Flow

<b>Student</b>	<b>Supervisor</b>	<b>Title of Research Report</b>
Hughes, Ryan	Henry Wolkowicz	An Updated Stable Primal-Dual Interior-Point Algorithm for Linear Programming
Khan, Sakif	Ali Ghodsi	Variational Inference and Stochastic Optimization for Document Modelling
Li, Xuanrui	Kirsten Morris	Solution of Algebraic Riccati Equations using Schur Method and Newton-Kleinman Method
Liu, Wenqing	Wayne Oldford	TREC: tree reduced ensemble clustering
Mai, Qi	Justin Wan	Metal Artifacts Reduction in CT Scans using CNN with Ground Truth Elimination
Na, Bo	Peter Forsyth & Yuying Li	Neural Network Optimal Asset Allocation: Put Writing and Trent Following
Petrie, James	Katerina Papoulia & Stephen Vavasis	ADMM Energy Minimization for Quasistatic Cohesive Fracture
Schneider, Jason	Chris Fletcher	Parameter Sensitivity and Tuning of Piekduk-D
Thompson, Timothy	Katerina Papoulia	Simulating Failure of Cortical Bone with an Energy Based Discrete Fracture Model
Yang, Mingyu	Henry Wolkowicz	Uncertainty Set Sizes, Sensitivity Analysis in Robust Portfolio Optimization
Zhang, Jiayue	Ken Seng Tan	Investment Strategy Based on Machine Learning Models
Zhou, Meiyu	Ken Seng Tan	Comparison of Machine Learning Methods for Insurance Premium Prediction

Graduate Students in Computational Mathematics Class of 2019-2020

<b>Student</b>	<b>Supervisor</b>	<b>Title of Research Report</b>
Becker, Riley	Ricardo Fukasawa	Stochastic Vehicle Routing - a 2 Stage Approach
Chen, Lidan	Jun Liu	Comparison Between Different Numerical Methods in the Applications of Option Pricing
Guo, Yaxuan	Peter Forsyth & Yuying Li	Bootstrap resampling analysis of



## Appendix B: CCMIC faculty affiliates and their departmental affiliation

Name	Department
Anita T. Layton	Applied Mathematics
Brian Ingalls	Applied Mathematics
Chris Bauch	Applied Mathematics
Francis Poulin	Applied Mathematics
Giang Tran	Applied Mathematics
Hans De Sterck	Applied Mathematics
Henry Shum	Applied Mathematics
Jun Liu	Applied Mathematics
Katerina Papoulia	Applied Mathematics
Kevin Lamb	Applied Mathematics
Kirsten Morris	Applied Mathematics
Lilia Krivodonova	Applied Mathematics
Marek Stastna	Applied Mathematics
Michael Waite	Applied Mathematics
Sander Rhebergen	Applied Mathematics
Serge D'Alessio	Applied Mathematics
Sue Ann Campbell	Applied Mathematics
Robert Gracie	Civil and Environmental Engineering
Chaitanya Swamy	Combinatorics and Optimization
Chris Godsil	Combinatorics and Optimization
David Gosset	Combinatorics and Optimization
Henry Wolkowicz	Combinatorics and Optimization
Jochen Koenemann	Combinatorics and Optimization
Levent Tunçel	Combinatorics and Optimization
Michelle Delcourt	Combinatorics and Optimization
Ricardo Fukasawa	Combinatorics and Optimization
Stephen Vavasis	Combinatorics and Optimization
Tom Coleman	Combinatorics and Optimization
William J. Cook	Combinatorics and Optimization
Arne Storjohann	Computer Science
Christopher Batty	Computer Science
Dan Brown	Computer Science
Eric Schost	Computer Science
George Labahn	Computer Science
Gladimir Baranoski	Computer Science
Jeff Orchard	Computer Science
Jesse Hoey	Computer Science
Justin Wan	Computer Science
Kimon Fountoulakis	Computer Science

Mark Giesbrecht	Computer Science
Olga Veksler	Computer Science
Pascal Poupart	Computer Science
Peter Forsyth	Computer Science
Shai Ben-David	Computer Science
Stephen Watt	Computer Science
Toshiya Hachisuka	Computer Science
Yaoliang Yu	Computer Science
Yuri Boykov	Computer Science
Yuying Li	Computer Science
Vijay Ganesh	Electrical and Computer Engineering
Chris Fletcher	Geography and Environmental Management
Soroosh Yazdani	Google
Kevin Hare	Pure Mathematics
Michael Rubinstein	Pure Mathematics
Adam Kolkiewicz	Statistics and Actuarial Science
Alexander Schied	Statistics and Actuarial Science
Ali Ghodsi	Statistics and Actuarial Science
Ben Feng	Statistics and Actuarial Science
Bin Li	Statistics and Actuarial Science
Christiane Lemieux	Statistics and Actuarial Science
Greg Rice	Statistics and Actuarial Science
Ken Seng Tan	Statistics and Actuarial Science
Mario Ghossoub	Statistics and Actuarial Science
Marius Hofert	Statistics and Actuarial Science
Martin Lysy	Statistics and Actuarial Science
Matthias Schonlau	Statistics and Actuarial Science
Michael Wallace	Statistics and Actuarial Science
Mu Zhu	Statistics and Actuarial Science
Paul Marriott	Statistics and Actuarial Science
Ruodu Wang	Statistics and Actuarial Science
Samuel Wong	Statistics and Actuarial Science
Stefan Steiner	Statistics and Actuarial Science
Tony Wirjanto	Statistics and Actuarial Science
Wayne Oldford	Statistics and Actuarial Science
Yeying Zhu	Statistics and Actuarial Science
Yingli Qin	Statistics and Actuarial Science
Yulia Gel	Statistics and Actuarial Science
Chengguo Weng	Statistics and Actuarial Science
Ryan Browne	Statistics and Actuarial Science
Ilias Kotsireas	Wilfrid Laurier University, Physics and Computer Science

## Appendix C: CM Colloquia over the past 5 years

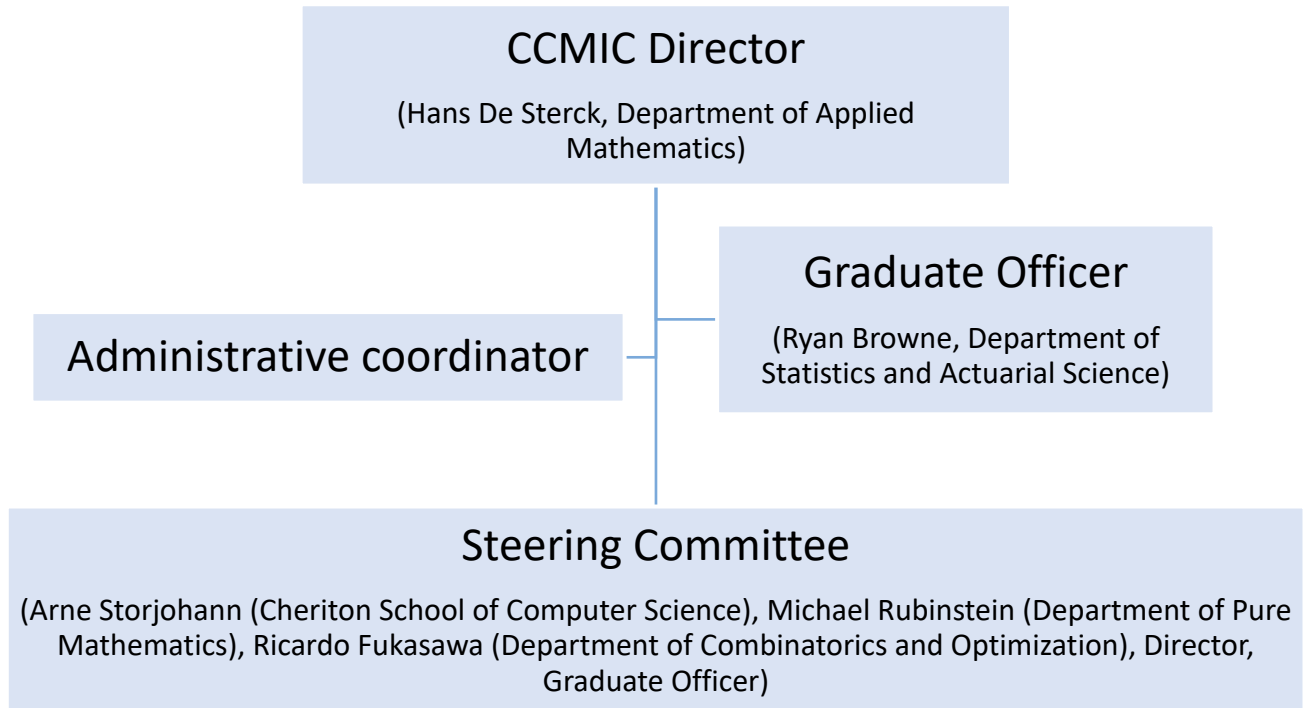
2015/2016 Colloquia			
Name	Date	Affiliation	Title of Talk
Joachim von zur Gathen	10 <sup>th</sup> Sep, 2015	Bonn-Aachen International Centre for Information Technology	Polynomial equations usually describe nice varieties
Warren Hare	1 <sup>st</sup> Oct, 2015	University of British Columbia	Proximal Thresholds of PLQ Functions
Jacques Carette	29 <sup>th</sup> Oct, 2015	McMaster University	Beyond graphics – More mathematics of building video games
E. Bruce Pitman	27 <sup>th</sup> Nov, 2015	State University of New York	Where are you going to go when the volcano blows?
Varvara Roubtsova	4 <sup>th</sup> Dec, 2015	Institut de recherche d'Hydro-Québec	SiGran: A 3D virtual laboratory for mechanics of granular media
Chen Greif	11 <sup>th</sup> Jan, 2016	University of British Columbia	The (Numerical) Linear Algebra Behind Solving Problems with Constraints
Evelyne Hubert	14 <sup>th</sup> Jan, 2016	Inria Méditerranée	A moment matrix approach to computing symmetric cubatures
Elissa Ross	25 <sup>th</sup> Feb, 2016	MESH Consultants Inc.	Geometric Challenges in Digital Design
Christiane Jablonowski	3 <sup>rd</sup> Mar, 2016	University of Michigan	High-Order Adaptive Mesh Refinement (AMR) and Variable-Resolution Techniques for Atmospheric Weather and Climate Models
Mark Schmidt	11 <sup>th</sup> Mar, 2016	University of British Columbia	Minimizing finite Sums with the Stochastic Average Gradient
Dick Peltier	11 <sup>th</sup> May, 2016	University of Toronto	Ocean turbulence and global climate variability in the ice-age

Yuri Matiyasevich	16 <sup>th</sup> May, 2016	Steklov Institute of Mathematics at St. Petersburg	Computer experiments for approximating Riemann's zeta function by Dirichlet series
Michael Mossinghoff	1 <sup>st</sup> June, 2016	Davidson College	FIFA Foe Fun!
2016/2017 Colloquia			
Name	Date	Affiliation	Title of Talk
Neil J. A. Sloane	17 <sup>th</sup> Nov, 2016	Rutgers University	What comes next after 2,4,6,3,9,12,8,10? Confessions of a sequence addict
Michael Littman	1 <sup>st</sup> Dec, 2016	Brown University	Reinforcement Learning from Users: New Algorithms and Frameworks
David Duvenaud	20 <sup>th</sup> Jan, 2017	University of Toronto	Composing graphical models with neural networks for structured representations and fast inference
Yaoliang Yu	8 <sup>th</sup> Feb, 2017	University of Waterloo	Fast gradient algorithms for structured sparsity
David Correa	22 <sup>nd</sup> Mar, 2017	University of Waterloo	Material Informed Computational Design in Architecture
Bruno Salvy	16 <sup>th</sup> June, 2017	École Normale Supérieure De Lyon	Explicit Continued Fractions for Riccati-type Equations
Jingbo Wang	28 <sup>th</sup> June, 2017	University of Western Australia	Efficient Decomposition of Quantum Walk Operators
2017/2018 Colloquia			
Name	Date	Affiliation	Title of Talk
David Richter	19 <sup>th</sup> October, 2017	University of Notre Dame	Droplets and dust in atmospheric turbulence: Insight from numerical simulations
Yang Cao	9 <sup>th</sup> Nov, 2017	Virginia Tech	Hybrid stochastic modeling of the budding yeast cell cycle control mechanism

Roger Melko	30 <sup>th</sup> Nov, 2017	University of Waterloo	Machine Learning the Many-Body Problem
Shawn Wang	8 <sup>th</sup> Dec, 2017	University of British Columbia	Linear convergence of gradient descent methods in the framework of Bregman distance
Chee Yap	12 <sup>th</sup> Dec, 2017	New York University	On Soft Geometric Computation
Jean-Christophe Nave	6 <sup>th</sup> Feb, 2018	McGill University	Simulating fluid flows with large and small scales without having to pay (too much) for it
Larry Smith	2 <sup>nd</sup> Apr, 2018	University of Waterloo	Computational Mathematics and Its Billion Dollar Problems
2018/2019 Colloquia			
Name	Date	Affiliation	Title of Talk
Mauro Maggioni	25 <sup>th</sup> Oct, 2018	Johns Hopkins University	Learning and Geometry for Stochastic Dynamical Systems in High Dimensions
Cody Hyndman	22 <sup>nd</sup> Nov, 2018	Concordia University	Arbitrage-free regularization, geometric learning, and non-Euclidean filtering in finance
Tim Merlis	25 <sup>th</sup> Feb, 2019	McGill University	High-resolution climate simulations to understand how global warming affects hurricanes
Leland McInnes	21 <sup>st</sup> Mar, 2019	Tutte Institute	Topological Methods for Unsupervised Learning
2019/2020 Colloquia			
Name	Date	Affiliation	Title of Talk
Anita Layton	24 <sup>th</sup> Sep, 2019	University of Waterloo	Mathematical Models and Their Applications in Diabetes, Hypertension and Autism
Lin Wang	28 <sup>th</sup> Oct, 2019	University of Jinan	Evolutionary Computation and Evolving Reverse

			Engineering-based Scientific Modeling
Andrew Sutherland	7 <sup>th</sup> Nov, 2019	Massachusetts Institute of Technology	Sum of Three Cubes
Ricardo Fukasawa	13 <sup>th</sup> Jan, 2020	University of Waterloo	Solving the Vehicle Routing Problem
Henry Lam	11 <sup>th</sup> Feb, 2020	Columbia University	Efficient Uncertainty Quantification in Simulation Analysis
Bartosz Protas	27 <sup>th</sup> Feb, 2020	McMaster University	Searching for Singularities in Navier-Stokes Flows Using Variational Optimization Methods
Eldad Haber	1 <sup>st</sup> Oct, 2020	University of British Columbia	A Computational Mathematics View of Deep Learning with Applications

# CCMIC Organizational Chart



## CCMIC Financial Statement 2015-2020 - Itemized Budgets

2015/2016	
Item	Amount
Scholarship/Bursary Undergrad	15,000
Scholarship/Bursary Graduate	30,000
Colloquium Series	25,000
Graduate Events	8,288
Graduate Visit Day	3,534
Software	1,285
Equipment	0
Supplies	2,789
TA Awards	0
<b>Total</b>	<b>85,897</b>

2016/2017	
Item	Amount
Scholarship/Bursary Undergrad	6,000
Scholarship/Bursary Graduate	30,000
Colloquium Series	15,000
Graduate Events	7,700
Graduate Visit Day	3,000
Software	1,650
Equipment	22,000
Supplies	3,725
TA Awards	0
<b>Total</b>	<b>89,075</b>

2017/2018	
Item	Amount
Scholarship/Bursary Undergrad	6,000
Scholarship/Bursary Graduate	30,000
Colloquium Series	18,000
Graduate Events	6,700
Graduate Visit Day	2,000
Software	1,950
Equipment	11,500
Supplies	5,425
TA Awards	0
<b>Total</b>	<b>81,575</b>



2018/2019	
Item	Amount
Scholarship/Bursary Undergrad	6,000
Scholarship/Bursary Graduate	30,000
Colloquium Series	28,000
Graduate Events	4,700
Graduate Visit Day	1,000
Software	1,950
Equipment	11,600
Supplies	5,725
TA Awards	750
<b>Total</b>	<b>89,725</b>

2019/2020	
Item	Amount
Scholarship/Bursary Undergrad	6,000
Scholarship/Bursary Graduate	36,000
Colloquium Series	8,000
Graduate Events	5,000
Graduate Visit Day	6,500
Software	1,500
Equipment*	0
Supplies*	0
TA Awards	0
<b>Total</b>	<b>63,000</b>

\*These costs have moved to the budget of the Applied Mathematics Department in 2019.

# CCMIC 5-Year Plan

## (1) Projected Budget

The CCMIC operating budget is fully funded by the Faculty of Mathematics. Major items in the budget involve costs for facilitating the Mathematics Faculty's CM Master's program, and there are smaller items for the CM Colloquium and undergraduate scholarships. Since the CCMIC budget for these activities has been quite stable over the past five years, we do not expect substantial changes in this budget over the next five years. In the budget projections below, we have taken the 2020/2021 budget numbers augmented with a 3% annual increase to reflect an average increase in cost roughly in line with inflation.

	Projected					
	2020/2021	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026
Scholarship/Bursary Undergrad	6000	6180	6365	6556	6753	6956
Scholarship/Bursary Graduate	36000	37080	38192	39338	40518	41734
Colloquium Series	8000	8240	8487	8742	9004	9274
Graduate Events	5400	5562	5729	5901	6078	6260
Graduate Visit Day	6500	6695	6896	7103	7316	7535
Software	1500	1545	1591	1639	1688	1739
TA Awards	600	618	637	656	675	696
<b>Total</b>	<b>64000</b>	<b>65920</b>	<b>67898</b>	<b>69935</b>	<b>72033</b>	<b>74194</b>

## (2) Future Research Directions and Development Strategies

### (A) Development, Promotion, and Management of Graduate Programs

The Mathematics Faculty's **CM Master's program** is a mature program and **will continue to play a central role in the activities of the CCMIC over the next five years**. Affiliates of CCMIC with core research interests in Computational Mathematics rely on this program to bring in strong students with adequate backgrounds and interests for the type of interdisciplinary Computational Mathematics research they pursue, bridging the boundaries of the academic units that participate in the CCMIC. Supervision and co-supervision by CM affiliates contributes to stimulating CM research across the Faculty of Mathematics and the University. Through MITACS projects and other funding mechanisms the CM Master's program will also continue to promote research interactions with industry and the public and government sectors.

**One specific issue that is currently substantially hurting the CM Master's program is the University's abolition of the International Master's Student Award (IMSA).** In the past, a large fraction of the strongest students in the CM Master's program were international students. These students would often go on to become excellent PhD students. Since the IMSA was abolished, these students have mostly become unaffordable for supervisors. In general, there is a strong belief among faculty members that **the abolition of the IMSA is really hurting research at the University, since it created a stifling bottleneck for attracting the kind of strong international PhD students that drive much of the research excellence**

**at Waterloo** (it is a bottleneck since students need to first do a Master's before starting a PhD, and attracting strong foreign Master's students is now almost out of reach). Clearly, the IMEA is not a useful replacement (since there are much fewer IMEA awards than needed to remove the bottleneck that was created). In our opinion, **abolishing the IMSA was an ill-advised measure that needs to be reverted with great urgency.**

While the CM Master's program is mature, a subset of the Centre's affiliates has indicated a desire to **increase the research impact of the current CM graduate program. Directions to realize this will be explored, which includes the possibility of enhancing the Master's program with a thesis option, and a possible PhD program.** New methods and applications of Computational Mathematics continue to surface at a rapid pace, so we plan to continue adding **new graduate courses** as the field advances. Initial discussions have been conducted to pursue some of this **in conjunction with the Master's programs in Data Science** that were recently initiated in the Faculty of Mathematics, since there is a close synergy between Computational Mathematics and Data Science.

#### ***(B) Promoting and Facilitating Collaborative Research in Computational Mathematics within the Faculty of Mathematics***

The CCMIC will continue to focus on its important role within the Faculty of Mathematics to **promote research interactions in Computational Mathematics across the boundaries of the five academic units of the Faculty**, including applications of computational mathematics techniques to areas such as finance, health, fluid mechanics, machine learning and data science. The CCMIC will continue to use its **Colloquium series** to bring in leading researchers in the field and to promote informal research interactions within the broad group of CM affiliates and their graduate students and postdocs. The Centre will continue its work to **position Waterloo as a global research leader in Computational Mathematics.**

#### ***(C) Facilitating Research Relationships with the Public and Private Sectors***

The CCMIC will continue efforts to **develop research relationships with the public and private sectors** through research collaborations within the framework of the CM Master's program (through MITACS fellowships, research-based coops, and industry-sponsored research projects) and through other Computational-Mathematics focused research projects pursued by the CM affiliates. **We will tap into the various research support services offered by the Mathematics Faculty's Research Office to promote these interactions (including the office of the Math Director of Innovation and Research Partnerships).** In particular, the Centre will **explore options to organize research relation-building workshops with government and industry**, which may be pursued jointly with the Data Science initiative in the Faculty of Mathematics and other groups such as the Waterloo Research Institute in Insurance, Securities and Quantitative Finance (WatRISQ).

#### ***(D) Building Interdisciplinary Computational Mathematics Research Links between the Faculty of Mathematics and Researchers and Centres across the University***

Since its inception in 2005, the CCMIC has mostly focused on building interdisciplinary research bridges in Computational Mathematics across the five academic units of the Faculty of Mathematics, and it has arguably achieved this with substantial success (e.g., drawing in 80 affiliated faculty members, which is almost one third of the professors in the Faculty of Mathematics). Despite this success, **there is a realization of a large untapped potential of applying Computational Mathematics methods and research to important research problems in other Faculties at the University of Waterloo.** Indeed,

**Computational Mathematics is a key enabling technology for innovation in many areas of science, engineering, technology, and society, especially in the current era of big data and ever-growing computational resources. Therefore, CCMIC would like to further broaden its activities and appeal across the University. These efforts will include:**

- Inviting researchers from across the University who use large-scale and advanced computation as **speakers in the CM Colloquium**;
- **Pursuing more CM affiliates from the Faculties of Engineering, Science, Environment, and beyond, with opportunities to supervise or co-supervise CM Master's students; *this will require a careful look at (modest) funding streams across faculty boundaries (e.g., graduate funding provided by TA positions, graduate growth subsidies, etc.); also, dedicated university support to partially fund cross-faculty co-supervised CM Master's students may be very useful to help kickstart this effort;***
- Considering joint **"research matching" workshops between our Computational Mathematics specialists and researchers from other interdisciplinary research Centres/Institutes at the University (this could include, e.g., *Water Institute, Interdisciplinary Centre on Climate Change, Waterloo Institute for Nanotechnology, Centre for Theoretical Neuroscience, etc.*).**

Indeed, high-end numerical computing at large scales plays a key role for many innovations in numerous application areas, and enormous progress can be made by inventing and employing new advanced Computational Mathematics techniques for various application areas. **New cross-faculty interdisciplinary research projects may be pursued of the type "Computational Mathematics + Application X"**. Such projects may, for example, be suitable for funding programs like the ***University of Waterloo Interdisciplinary Trailblazer Fund***, and the ***Tri-Agency New Frontiers in Research Fund (NFRF)*** (the Exploration and Transformation competitions), focusing on high-risk, high-reward and transformative interdisciplinary research, in which Computational Mathematics can play a transformative role. **Such transformative cross-faculty interdisciplinary research projects of the form "Computational Mathematics + Application X" have been highly successful in many leading universities around the world, but have so far not been substantially pursued yet at the University of Waterloo.** Indeed, large research centres have been built on this paradigm at many leading universities, for example, the ***Oden Institute for Computational Engineering and Sciences at the University of Texas at Austin*** (see [www.oden.utexas.edu](http://www.oden.utexas.edu)), the ***Scientific Computing and Imaging Institute at the University of Utah*** (see [www.sci.utah.edu](http://www.sci.utah.edu)), or the ***Georgia Tech School of Computational Science and Engineering*** (see [cse.gatech.edu](http://cse.gatech.edu)). There is **substantial untapped potential at Waterloo for cross-faculty interdisciplinary projects of the kind "Computational Mathematics + Application X"**, in line with what is being pursued by the Waterloo Task Force on Interdisciplinary, Inter-Faculty Research.

Dr. Mark Giesbrecht  
Dean, Faculty of Mathematics  
University of Waterloo  
Email: [deanmath@uwaterloo.ca](mailto:deanmath@uwaterloo.ca)

Professor Hans De Sterck  
Director, CCMIC  
University of Waterloo

Dear Professor De Sterck,

This letter is to express my support for the Centre for Computational Mathematics in Industry and Commerce (CCMIC) at the University of Waterloo. The CCMIC was established as an initiative in the Dean of Mathematics office in 2005. Started as an administrative structure to coordinate the undergraduate Computational Mathematics program between the academic units in the Faculty, it was also mandated to promote Computational Mathematics at the graduate and research levels. In 2008, a new master's degree program in Computational Mathematics was created. The graduate program has been highly successful, bringing in students with broad computational background in all disciplines of computer science and mathematics.

The Centre has been highly successful in bringing together computational researchers from across campus – with more than 80 faculty affiliates, as well as postdoctoral fellows, research staff and graduate students – and attracting world-class researchers at events such as the CM organized colloquia and symposia of graduate student presentations. These activities greatly benefit faculty members, researchers and students to discuss current topics in mathematical computing, and in some cases, these events have served as the initial interactions that further developed into new research collaborations. CCMIC's support of interdepartmental research is essential in our faculty to reducing siloing and encouraging collaboration. Moreover, the active Master's and undergraduate program help develop future talent and researchers in cross-cutting areas.

I will also speak to this as the previous Director of the Cheriton School of Computer Science (July 2014 – June 2020). Computer Science faculty members have been actively involved in the Centre since its beginning. Three of the eleven Computational Mathematics faculty complement are in the School of Computer Science and eleven additional CS faculty members are affiliated members of the Centre. These people have been involved with the administration of the Centre. CS Professor Justin Wan served as the Director of the Centre from 2010–2015, and Jeff Orchard from 2018-2020. CS Professor Arne Storjohann was the CM Graduate Officer and professors George Labahn, Jeff Orchard, Pascal Poupart and Arne Storjohann have served on the CM Steering Committee.

CS (and Mathematics) faculty, students, and visitors regularly participated and gave presentations at the CM Colloquium series, which has hosted more than 50 colloquia since 2010. A number of the CM graduates have continued their graduate studies to a PhD here at UW.

For all these reasons, I enthusiastically support the renewal of the CCMIC. As a focus for computation and mathematics it has been very effective at promoting research and education in this crucial area, and leads to many opportunities for new collaborations, educational opportunities, and funding initiatives.

Yours truly,

A handwritten signature in blue ink, appearing to read 'Mark Giesbrecht', with a large, stylized flourish above the name.

Mark Giesbrecht  
Professor and Dean  
Faculty of Mathematics

11 September, 2020

Dear Review Committee,

This is a letter of support for renewal of the five year term for the Centre for Computational Mathematics in Industry & Commerce (CCMIC). Since its establishment in 2005, CCMIC has consistently and successfully pursued two primary goals: the first of promoting and facilitating collaborative research activity in Computational Mathematics, and the second of development, promotion and management of a Masters and undergraduate program in Computational Mathematics. CCMIC currently has eighty affiliated members (primarily from the five academic units), with research interests in computational mathematics. With respect to the Department of Applied Mathematics, there are currently seventeen faculty members who are affiliated with CCMIC. Since 2015, CCMIC has welcomed seventeen new affiliates, three of these from the Department of Applied Mathematics. Enrolment in the Masters Program currently stands at around 25 students. CCMIC runs regular interdisciplinary research colloquia where many of the speakers are renowned researchers in Computational Mathematics. Since 2015, the Centre has hosted roughly 45 such colloquia.

Over the last five years, a number of Applied Mathematics professors have been involved administratively with the CCMIC. Most recently, Hans De Sterck has taken on the role of Director of the Centre (2020-2023). Both Kirsten Morris and Sander Rhebergen have been members of the CCMIC Steering Committee at various times over the past five years.

In short, the Centre has been playing an important and vital role in connecting researchers in the Math Faculty (across academic units) who have research interests in Computational Mathematics. Thus, in conclusion, I would like to reiterate my strong support for renewal of the five-year term for the Centre.

Yours sincerely,



Siv Sivaloganathan

===

Chair, Department of Applied Math,  
University of Waterloo.

September 16, 2020

Professor Hans De Sterck  
Director  
Centre for Computational Mathematics in Industry & Commerce

**Re: Renewal of the Centre for Computational Mathematics in Industry & Commerce**

Dear Professor De Sterck,

I am supplying a letter in strong support of renewing the mandate of the Centre for Computational Mathematics in Industry & Commerce (CCMIC) on campus.

Computation in Mathematics is a subject that has a long history in Waterloo, in various departments across the faculty. Former Computer Science Professor Wes Graham (1932-1999) was known as the “father of computing” and is one of the most prominent examples for deep-rooted computing interest in the faculty of Mathematics. Another example is the symbolic Algebra system Maple that has its origins in Mathematics in Waterloo; the Maple corporation was first incorporated by Waterloo Professors Geddes and Gonnet in 1988. This interest in computation was also present in research work on large scale scientific computing undertaken by Professor Allan George (Computer Science) who, as Dean of the faculty of Mathematics contributed substantially to the founding of the CCMIC in 2005.

The CCMIC was created with idea in mind to connect various units in the faculty that share a common interest in computational aspects in Mathematics. First and foremost, the centre’s goal is to connect researchers, and to facilitate collaborative efforts. The centre also strives to link researchers with industrial and governmental partners outside the university.

The centre is running undergraduate as well as graduate programs that distill the core aspects of the discipline into an attractive and valuable learning experience for top students in the discipline. Currently the centre has about 80 affiliated faculty members with research interest in Computational Mathematics, and of these 20 new members have joined since 2015.

The C&O department has been greatly enriched by the CCMIC and its interdisciplinary nature. Currently 11 of the faculty members in C&O are affiliated with the CCMIC, and of these, two are new since 2015. The masters program in CCMIC has 25 students at steady state. Many of my colleagues regularly supervise these students with great success. One of my own current students in my work with Sick Kids hospital is a CCMIC Masters student. The CCMIC runs a colloquium series that attracts top computational researchers to Waterloo regularly, and thereby it greatly increases the visibility of research in computational mathematics in the faculty. Since 2015, we had about 45 high profile research colloquia in the faculty. During the time since 2015, several C&O faculty served in key roles in the centre; e.g., Stephen Vavasis and Ricardo Fukasawa served as members of the CCMIC steering committee, and Henry Wolkowicz served as the centre’s Graduate Chair.

The Centre for Computational Mathematics certainly has played a valuable role in connecting researchers across the faculty and beyond. The centre has helped bringing talented students to Waterloo, both at the undergraduate and graduate levels. For the above reasons, the case for supporting the renewal of the CCMIC’s mandate is a clear and easy one.



Sincerely,

A handwritten signature in black ink, appearing to read 'J. Koenemann', with a stylized, flowing script.

Jochen Koenemann  
Professor and Chair, C&O



Department of Pure Mathematics  
University of Waterloo  
200 University Avenue West  
Waterloo, Ontario, Canada  
N2L 3G1

14 September 2020

To whom it may concern

It is my pleasure to write this letter of support for the renewal for the Centre of computational mathematics in industry and commerce (CCMIC). I have been involved with the CCMIC since I was hired here in 2004. I am a past associate director undergrad for the CCMIC, as well as the past director.

The CCMIC helps to administer a strong undergraduate program in computational mathematics, as well as a very interesting and demanding co-op Masters program. I have, over the years, supervised a number of undergraduate researchers and graduate students in these programs. One advantage of these programs, is that I am able to have students do research into computational aspects of mathematical research. Many of these research questions would be of a too computational nature to be appropriate in a Pure Mathematics student, and at the same time, too theoretical a nature to be appropriate for Computer Science student. This program offers a nice hybrid model that allows cross disciplinary research that doesn't fit the more traditional model.

In addition to the undergraduate and graduate programs, the CCMIC offers many different research opportunities. The most notable of these, is the Computational Math colloquia. These are very interesting, and well attended research colloquia about a wide variety of research topics at the intersection of mathematics and computation. A number of these research colloquia have been the starting place for interesting cross discipline research.

The CCMIC has close to 100 affiliated members, across all five department and schools within the Faculty of math, as well as members from the Faculty of environment and the Faculty of engineering. This is truly a multidisciplinary centre.

Sincerely

A handwritten signature in black ink, appearing to read "Kevin Hare".

Dr. Kevin Hare, Professor  
Associate Dean Operations and  
Academics  
Department of Pure Mathematics  
University of Waterloo

## MEMORANDUM

TO: Hans De Sterck, Director  
Centre of Computational Mathematics in Industry & Commerce

FROM: Stefan Steiner, Chair  
Statistics and Actuarial Science

DATE: Sept. 14, 2020

RE: Support for the Centre of Computational Mathematics in Industry & Commerce

---

I strongly support the renewal of the Centre of Computational Mathematics in Industry & Commerce (CCMIC). Since its founding in 2005, the CCMIC has provided a needed venue for cross departmental research collaboration in the Faculty of Mathematics in the important area of computational mathematics.

There is a well-established and strong relationship between the CCMIC and the Department of Statistics and Actuarial Science (SAS). At present, 25 faculty members in SAS (8 are new since 2015) are CCMIC affiliates, which represents roughly half the research active faculty members. Faculty members from SAS have also been active in the administrative activities of the CCMIC. Currently, the CCMIC graduate officer and 2 steering committee members are from SAS. In addition, SAS is responsible for teaching 6 courses that can be taken by undergraduate computational mathematics students towards their degree. Every year some CCMIC Masters students are supported and supervised by faculty members in SAS. This has been an overwhelmingly positive experience for faculty in SAS. One SAS faculty member summed up the prevailing view, saying “CM students are very motivated, determined, and result oriented.”

The computational mathematics programs at both the undergraduate and Masters level attract strong students with varied interests that often cross departmental boundaries. Without these programs such students may fall between the cracks. For the most part, the CCMIC students develop skills that fit particularly well in the current job market. Specifically, statistics + computer science/programming + optimization are at the core of the trendy "machine learning" umbrella, and the CCMIC programs cover all these topics, with both breadth and depth.



---

Stefan Steiner


## MEMORANDUM

TO: Senate Graduate and Research Council

CC: Kathy Winter  
Secretariat

Hassan Baaj  
Director, Centre for Pavement Advancement and Transportation Technology (CPATT)

Bernard Duncker  
Associate Vice-President, Interdisciplinary Research

FROM: Charmaine B. Dean  
Vice-President, Research and International 

DATE: Thursday October 29, 2020

SUBJECT: Support for the Centre for Pavement Advancement and Transportation Technology

**- For information -**

---

I am pleased to inform you that, following a presentation from Hassan Baaj, Director of the Engineering-based Centre for Pavement Advancement and Transportation Technology (CPATT), at the Research Leaders Council meeting of September 30, 2020, and a follow-up discussion of October 28, 2020, and based on discussions and recommendations of Research Leaders Council, I recommend that Senate Graduate and Research Council support the renewal of Centre for Pavement Advancement and Transportation Technology (CPATT) for another five-year term.



## CENTRE FOR PAVEMENT AND TRANSPORTATION TECHNOLOGY

Waterloo, September 11, 2020

Senate, University of Waterloo  
Research Leaders Council

### **Subject: Renewal of the Centre for Pavement and Transportation Technology (CPATT)**

The Centre for the Pavement and Transportation Technology (CPATT) is pleased to submit the attached report that highlights CPATT's mandate, structure, financials, and activities from 2015 to 2020. These activities were in accordance with the 2015-2020 Vision Plan presented in our renewal package to the Senate in October 2015. Also provided in Appendices are the several letters of support from active full-time and adjunct faculty members who were involved in CPATT's research in the last five years. The Dean of Engineering's letter is also attached to this report.

The report shows that CPATT has met and exceeded its 2015-2020 Vision Plan objectives and is financially self-sustainable with no institutional or external funding thus far. Key highlights of the CPATT activities and achievements include:

1. Over \$5.5 million in research grants that has been used to support Ph.D., Master and Undergraduate students training;
2. An additional \$6.5 million in expected research grants, in which CPATT is a major partner, is currently under review by the sponsoring agencies.
3. Organized, contributed to and hosted several national and international symposiums and workshops which attracted professionals from industry, municipalities, transportation agencies, academia, associations, and students from across Canada and over 17 countries;
4. Dissemination of research results through 244 publications over the course of past five years, including 100 refereed journal articles;
5. Training of 103 HQP including 34 Ph.D. and 21 Masters as well as 22 PDF and Visiting Scholars, many of whom are currently working as faculty members, professional engineers, managers, and as postdoctoral researchers in Canada and internationally;
6. CPATT is financially self-sustaining without financial support from UW or external operating grants. Thus, CPATT is a full cost recovery Centre;
7. At today's date, CPATT has a positive balance of \$15,000. It should be noted that due to the pandemic interruptions, CPATT decided to suspend the annual Research User Fee and use some funds to support HQPs to protect them from the adverse effects of the lockdown and losing some highly experienced personnel. This indicates that the centre is not only self-sustainable but resilient to support the department goals during unexpected impacts.
8. Increased faculty involvement that includes UW engineering departments (CIVIL, MECH), Earth Science, Geography and Environmental Management, and other universities (Ecole de Technologie Supérieure, Manhattan College, Chang'An University, Polytechnico di Torino and others)



## CENTRE FOR PAVEMENT AND TRANSPORTATION TECHNOLOGY

9. Active leadership in national and international communities by CPATT members such as Chairing committees at Transportation Association Canada (TAC), recognition of the CPATT director as one of the 15 global experts at the International Union of Laboratories and Experts in Construction Materials, Systems and Structures (RILEM), as well as chairing technical committees at RILEM.
10. CPATT continues to increase education and research activities, utilizing multidisciplinary collaboration within and outside UW; and
11. CPATT has established a strong foundation for continued growth over the next five years.

These accomplishments are the result of efforts from CPATT's dedicated and hardworking staff. The presence of CPATT provides a unique opportunity to bring stakeholders from a wide spectrum together (i.e., academia, government, associations, public and private sectors) which is crucial not only to fostering innovation in the pavement and transportation technology area, but also to maximize the research impact by facilitating implementation of the results of high-quality research conducted at CPATT. The centre also creates a synergy for collaborative research both nationally and internationally, which is well received by the scientific and professional community. The CPATT missions and its brand name help attracting highly talented graduate students, researchers, and scholars to UW which reinforces all of the three main themes of the University's strategic plan for 2020-2025: i.e., 1) Developing talent for a complex future, 2) Advancing research for global impact, and 3) Strengthening Waterloo's diverse communities.

CPATT is requesting renewal until 2025 (five years) so we can continue to expand our research, professional education, and training of highly qualified personnel in the area of pavement and transportation engineering and sustain our reputation as one of the leading research centres in the field of pavement engineering both in Canada and internationally .

Respectfully submitted

A handwritten signature in blue ink, appearing to read 'Hassan Baaj', is written over a horizontal line.

Hassan Baaj, PhD, DEA, MBET, PEng.  
Professor - Associate Chair for Research  
Director - Centre For Pavement and Transportation Technology  
Norman W. McLeod Professor in Pavement Materials  
Civil and Environmental Engineering, Faculty of Engineering, University of Waterloo



## CENTRE FOR PAVEMENT AND TRANSPORTATION TECHNOLOGY

### Attachments

- Centre for Pavement and Transportation Technology (CPATT) Activities 2015 to 2020.
- Letter of Support, Dean of Engineering, UW
- Letters of Support from active members of CPATT
- The announcement poster for the GRINCH 2019 Symposium - April 2019
- The announcement poster for Rilem Symposium on High Performance Asphalt Materials - October 2019
- The announcement poster for CPATT's Graduate Students Symposium – October 2016
- *Asphalt Research Fund Delivers Bankable Results*, Asphalt Magazine, Spring 2020
- ~~Example of past BOA Meeting Minutes~~
- Samples of CPATT's newsletters



CENTRE FOR PAVEMENT  
AND TRANSPORTATION  
TECHNOLOGY (CPATT) –  
UNIVERSITY OF WATERLOO

PROGRESS REPORT 2015-2020

**Hassan Baaj, Ph.D, P.Eng**  
Professor, Director of CPATT

Updated Sep. 11<sup>th</sup>, 2020



## Table of Contents

<i>Background</i> .....	2
<i>The Mission</i> .....	2
<i>The Values</i> .....	3
<i>Research Accomplishments</i> .....	3
List of research projects (2015-2020).....	3
Refereed Journal Papers .....	7
Peer-Reviewed Conference Papers .....	14
Conference Papers with Abstract Selection.....	23
Awards and Recognitions .....	24
Event Organization.....	25
<i>Training of Highly Qualified Personnel</i> .....	26
<i>Governance and Administrative Structure</i> .....	26
CPATT Board of Advisors (BOA) .....	27
CPATT Director .....	28
Senior Research Associate .....	29
Associate Director.....	29
Administrative/Financial Assistant.....	29
Support Staff.....	30
Adjunct Professors: .....	30
Other Active UW Members and other key contributors .....	30
<i>Budget and Financial Information</i> .....	31
<i>Five-Year Research Plan</i> .....	34
Future Research Plans: Rethinking the Road of the Future .....	34
The Action Plan .....	36
<i>Conclusion</i> .....	37
<i>Attachments</i> .....	37

## Background

The University of Waterloo's long-term track record of research, education and training in pavement materials, engineering and design and transportation led to the formation in 2002 and senate approval in 2005 of the Centre for Pavement and Transportation Technology, CPATT. This initiative started with a funding package of \$9 million from the Canada Foundation for Innovation, CFI, Ontario Innovation Trust, OIT, Ontario Research and Development Challenge Fund, ORDCF and various private and public sector partners. Since the original commitment, funding in excess of \$23 million dollars from these sources and other partners has continued and resulted in significant growth in research funds since that time.

CPATT's initiative involves an integrated program of field and laboratory research, with the following key objectives: concentrated focus on emerging and innovative technologies, state-of-the-art research infrastructure, increase in the talent pool of HQP and sustained partnerships. CPATT is at the forefront of exceptional research, training and professional activities and is recognized as the leading research centre in pavement and transportation research in Canada. This success is rooted in both the experienced and highly skilled faculty members, as well as the state-of-the-art facilities such as the John J. Carrick Pavement Laboratory at the University of Waterloo, the CPATT Test Track at the Waterloo Region's Waste Management Facility and several satellite test sites located across Canada. CPATT researchers have also advised on various international test sites.

## The Mission

CPATT's mission is to accept and meet the extraordinary technical and economic challenges and provide leadership in promoting and encouraging research, education and research activities in the pavement and transportation field. CPATT advances critical partnerships between universities, government, and the private sector. It also helps to nurture future leaders for this industry both in Canada and internationally. In conjunction with CPATT, fundraising for the Norman W. McLeod Endowed Chair initiated in 2008 to further assist with this Mission. One main objective of the Chair is to provide the specialized training needed to meet the challenges of transportation engineering in the 21st century. With the assistance of the Dean of Engineering Development office, over \$ 1.5 million dollars was raised for this endowment through the generous contributions of the 15 sponsors. Based on this initiative, Prof. Susan Tighe was named the Senior Chair holder, The Norman W. McLeod Chair in Sustainable Pavement Engineering in January 2011 and with the support of the Civil and Environmental Engineering Chair and Dean of Engineering, Prof. Hassan Baaj was hired September 1, 2014 as the Norman W. McLeod Associate Chair in Pavement Materials in support of the Centre for Pavement and Transportation Technology (CPATT). This additional capacity has had a substantial impact on productivity of CPATT. Prof. Tighe has recently stepped down from her position as Norman W. McLeod Senior Chair as she resigned from her position as Professor at UW but she will continue to be involved in the research activities of CPATT and the Chair as Adjunct Professor. The process for the appointment of the new Norman W. McLeod Chair is currently in progress.

The Norman W. McLeod Chair in Sustainable Pavement Engineering and the Norman W. McLeod Chair in Pavement Materials involves a partnership with 15 partners interested in sustainable pavement research and education. Many of these partners were original sponsors of CPATT while others are new members. All of the CPATT facilities support the state-of-the-art research program. The current and future research will continue to advance key research needs but will also provide strategic training for the industrial partners and the broader community at large. Development of national and international partnerships will also facilitate technology transfer.

It also focuses on facilitating interdisciplinary approaches for research areas by establishing links within and outside the University, and solicit funds by sustaining membership and partnerships as well as by affiliate programs.

### The Values

- To maintain a commitment to high quality research that advances theory and contributes to management practice or policy development
- To foster a community that promotes the research and personal development of graduate students and faculty
- To support multidisciplinary and interdisciplinary research
- To facilitate commitment to making research findings and their implications available in formats that targets the needs of different audiences
- To achieve responsiveness to the research needs of partners within the University and local community.

### Research Accomplishments

Over the past five years, there have been several research collaborations and accomplishments by several of the key CPATT researchers. Several new collaborations were created and increases in research were noted through increased laboratory activity and publications. Part of these new projects and collaborations resulted from the hiring of Prof. Hassan Baaj who joined CPATT in September 2014. Technology transfer and increased productivity was facilitated through interactions with the Board of Advisors, Graduate Student Poster Symposium, national and international venues, faculty interactions, interactions with research partners and various meetings. It is also notable that CPATT hosted three national and international events in 2019. The following is a list of some of the research projects, publications, oral presentations and other research contributions and achievements between 2015 and 2020. The list includes only the contribution of the two principal researchers, Prof. Baaj and Prof. Tighe, that are fully related to CPATT’s activities.

#### *List of research projects (2015-2020)*

<b>Granting Agency – Program &amp; Role</b>	<b>Total Cash Amount</b>	<b>Period</b>	<b>Project Title</b>
<b>New Frontiers in Research Fund – Transformation</b> (H. Baaj - CO-PI)	~\$6,000,000	2021-2026	3-Dimensional Printing and Robotics for Construction

PI: A. Khajepour, Mech. Eng. <b>LOI Submitted</b>			
<b>NSERC Alliance Grant</b> Titan Environmental Containment (S. Tighe – CO-PI) PI – Shunde Yin	\$115,384	2020-2023	Evaluation of Geosynthetic Reinforced Pavements by Field and Laboratory Testing Integrated with Thermo-hydro-mechanical Modeling
<b>National Research Council – AI for Logistics</b> (H. Baaj - PI) <b>Under review</b>	\$249,838	2020-2022	Towards Smart and Sustainable Pavement Structures in Canada
<b>NSERC Alliance Grant</b> Peel Plastics, Steed & Evans and Yellowline (H. Baaj - PI) <b>Ongoing - Alliance under preparation</b>	\$165,000	2020-2022	Optimization of the use of Recycled Plastic Waste Materials in Asphalt Mixes and Binders
<b>Mitacs Accelerate</b> 3Dimesnional Housing Corp. (H. Baaj - CO-PI)	\$494,100	2019-2021	Investigation on 3D Wall Printing: Materials, Patterns, Insulation, and Deposition System.
<b>NSERC CRD</b> Imperial Oil, Steed & Evans and Capital Paving (H. Baaj - PI)	\$165,000	2019-2022	Sustainable Asphalt Mixes with High RAP Contents and Rejuvenating Agents: Laboratory Evaluation and Plant Validation
<b>Industry Project</b> Sidewalk Labs (S. Tighe - PI)	\$247,910	2019-2021	Developing an Urban Interlocking Concrete Paver
<b>NSERC Research Tools and Instruments Grant</b> (H. Baaj - PI)	\$ 130,000	2019	Hydraulic Controller and Environmental Chamber for Characterization of Smart Construction Materials and High-Performance Asphalt Concrete Mixes
<b>Industry Project</b> PSI (S. Tighe - PI)	\$99,840	2019-2021	Comparison of Various Pavement Design Methodologies
<b>NTAI</b> (S. Tighe - PI)	\$49,979	2019-2020	Evaluation of Climate Change Impacts on Northern Pavement
<b>NSERC CRD</b> Porous Pave (S. Tighe - PI)	\$168,400	2019-2021	Developing A New Permeable Pavement Type
<b>Industry Project</b> Porous Pave (S. Tighe - PI)	\$84,200	2019-2021	Developing A New Permeable Pavement Type
<b>Industry Project</b> Department of Transportation & Infrastructure Renewal (H. Baaj - PI)	\$50,500	2019	Impact of Aggregates Properties on Rutting Performance of Warm Asphalt Mixes
<b>NSERC – CRD</b> Ontario Asphalt Pavement Council (S. Tighe - PI)	\$86,956	2018-2021	Evaluation of Asphalt Properties in Plant Produced Asphalt Mixes
<b>NSERC CRD</b> Heat Design Equipment (S. Tighe - PI)	\$165,000	2018-2020	Exploring A Premium Asphalt Patching Mixes by Using 100% RAP Recycler

<b>NSERC CRD</b> OAPC (S. Tighe - PI)	\$85,000	2018-2020	Evaluation of Asphalt Cement Quality
<b>OAPC</b> (S. Tighe - PI)	\$50,000	2018-2020	Evaluation of Asphalt Cement Quality
<b>MTO – HIIFF</b> (S. Tighe - PI)	\$110,000	2018-2020	Performance Evaluation of Pre-cast Concrete Panels over Asphalt
<b>MTO – HIIFF</b> (S. Tighe - PI)	\$93,500	2018-2020	Evaluation of Testing Variability of Semi-Circular Bend (SCB) and Disc-Shaped Compact Tension (DCT) Fracture Tests
<b>OCE VIP I</b> Alternative Runway (S. Tighe - PI)	\$25,000	2018-2019	Development of Alternate Runway Material Test Program
<b>MTO – HIIFF</b> (H. Baaj - PI)	\$52,875	2018-2019	Pilot Project of High Modulus Asphalt for use on Ontario's highways
<b>OCE VIP I - NSERC Engage</b> MultiSolv (H. Baaj - PI)	\$50,000	2018-2019	Development of Biodegradable Asphalt Release Agents
<b>MTO – HIIFF</b> (S. Tighe - PI)	\$23,938	2018-2019	Greenhouse Gas Mitigation in Highway Design, Construction and Maintenance - Jurisdictional Scan
<b>OCE VIP I</b> Acrocy (H. Baaj - PI)	\$25,000	2018-2019	Development of High-Performance Asphalt Mixes using Nano-fibres
<b>Industry Project</b> Lafarge Research Centre (H. Baaj - PI)	\$10,000	2018	State of the Art Review on full Depth Reclamation with Hydraulic Road Binders
<b>NSERC Engage</b> Bombardier (S. Tighe - PI)	\$22,500	2018	
<b>NSERC CRD</b> Lafarge Canada (H. Baaj - PI)	\$165,000	2017-2019	Use of Hydraulic Road Binders for In-Place Soil Stabilization and Full-Depth Reclamation of Low Volume Roads
<b>MTO – HIIFF</b> (S. Tighe - PI)	\$82,250	2017–2019	Impact of Additives on the Performance of In-Place Recycled Pavements
<b>NSERC CRD</b> Cement Association of Canada (S. Tighe - PI)	\$450,000	2017-2022	Sustainable Long-Life Concrete Pavements
<b>NSERC – CRD</b> Cematrix (S. Tighe - PI)	\$304,659	2017-2020	Evaluating Pavement Structural Benefits of Lightweight Cellular Concrete
<b>OCE VIP I</b> Kersol (H. Baaj - PI)	\$25,000	2017-2018	Development of New Solvent(s) for Extraction of Asphalt Binder
<b>Greater Toronto Airports Authority</b> (S. Tighe - PI)	\$25,000	2017	Examining High Performance Asphalt Mixes
<b>NSERC Discovery Grant</b> (H. Baaj - PI)	\$135,000	2016-2021	Innovation in High-Performance Asphalt Mixes (HPAM) to increase the service life of flexible pavements in Canada

<b>Ministry of Transportation Ontario</b> (S. Tighe - PI) PI – Brenda McCabe, UofT	\$84,250	2016-2019	Examining Work Zone Throughput to Improve Safety, Workzone Efficiency and Cost Effectiveness
<b>NSERC CRD</b> Imperial Oil, Steed & Evans and Miller Paving (H. Baaj - PI)	\$190,000	2016-2018	Experimental Study on Blending of Aged and Virgin Binders in Asphalt Mixtures Incorporating RAP to Improve Mix Performance
<b>MTO – HIIFP</b> (H. Baaj - PI)	\$105,000	2016-2018	Development of a New Asphalt Mixture Aging/Conditioning Procedure to be used for Performance Testing of Asphalt Mixtures
<b>Embassy of the Republic of Iraq in Canada</b> (S. Tighe - PI)	\$21,000	2016	Academic Bench Fee Program for Funded Graduate Student
<b>NSERC Discovery Grant</b> (S. Tighe - PI)	\$170,000	2015-2020	Sustainable Long-Life Pavements
<b>Saudi Arabian Cultural Bureau</b> (S. Tighe - PI)	\$50,000	2015-2018	Academic Bench Fee Program for Funded Graduate Student
<b>MTO – HIIFP</b> (S. Tighe - PI)	\$110,000	2015-2017	Performance Evaluation of Pre-cast Concrete Panels over Asphalt
<b>MTO – HIIFP</b> (H. Baaj - PI)	\$83,750	2015-2017	Development of High Modulus Asphalt mix design technology for use on Ontario's highways
<b>MTO – HIIFP</b> (S. Tighe – CO PI) PI - Prof. Yuan Ryerson University	\$38,550	2015-2017	Local Calibration of the MEPDG Prediction Models
<b>MTO – HIIFP</b> (S. Tighe – CO PI) PI – Prof. H. Baaj	\$77,500	2015-2017	Development of High Modulus Asphalt Mix Design Technology in Ontario
<b>MTO – HIIFP</b> (H. Baaj - PI)	\$75,000	2015-2017	Effect of Oxidation Products of Iron Sulphide Minerals in Aggregate on Asphalt Cement
<b>Ontario Centre of Excellence VIP1 &amp; Talent Edge</b> Foamyna Canada (H. Baaj - PI)	\$80,000	2015-2016	Optimization of the Use of Recycled Glass-Base Artificial Lightweight Aggregates in the Pavement Structure
<b>MTO – HIIFP</b> (H. Baaj - PI)	\$25,000	2015-2016	Effect of Extraction and Recovery Method and Solvent Type on Properties of Recovered Binder
<b>MTO - HIIFP</b> Partnership with Aggregate Recycling Ontario (H. Baaj - PI)	\$31,250	2015-2016	Evaluation of Reclaimed Concrete Materials as Aggregate for OPSS Granular B Type II
<b>Industry Project</b> Imperial Oil (S. Tighe - PI)	\$75,000	2014-2017	Improvement Strategies for Upstream Heavy Oil Mining Roadways (2 renewals approved)
<b>MTO – HIIFP</b> (S. Tighe - PI)	\$80,000	2014-2016	Effect of Warm Mix Additives on Tensile Strength of Compacted Asphalt Mix

<b>York Region</b> (S. Tighe - PI)	\$100,000	2014-2016	Performance Evaluation of Coloured Asphalt Pavements and Surface Treatments for BRT Lanes in York Region
<b>NSERC – CRD</b> McAsphalt Industries Ltd. (S. Tighe - PI)	\$153,308	2013-2015	Comparing Cold In-place Recycling (CIR) and Cold In-place Recycling with Expanded Asphalt Mixture (CIREAM)
<b>MTO – HIIFP</b> (S. Tighe - PI)	\$70,200	2013-2015	Development of Acceptance Test Methods Related to Performance and Durability of Pervious Concrete
<b>NSERC CRD</b> Cement Association of Canada (S. Tighe - PI)	\$500,000	2012-2016	Sustainable Long-Life Concrete Pavements

### *Refereed Journal Papers*

- J1. S. Raschia, T. M. Baghaee\*\*, D. Perraton, H. Baaj, A. Carter, A. Graziani, “Effect of RAP source on compactability and behaviour of cold recycled mixtures in the small strain domain”, Revision submitted to Journal of Materials in Civil Engineering, Submission ID: MTENG-10934R1, Resubmission Date: July 13, 2020.
- J2. S. Wang\*, H. Baaj, “Impact of Supplementary Cementitious Materials on the Hydration and Strength Properties of Hydraulic Road Binders”, Road Materials and Pavement Design, Submission ID: RMPD-20-04-20, Submission date: April 20th, 2020.
- J3. A. Hamid\*, H. Alfaidi\*, H. Baaj, M. El-Hakim, “Effects of Geopolymer on Rheological and Microstructural Properties of Asphalt Binder”, Advances in Materials Science and Engineering Journal, Special Issue: Novel Bituminous Materials for Sustainable Pavements, Vol. 2020, 11p.
- J4. H. Kadhim\*, H. Baaj, “Evaluating the Performance of the Asphalt Mixes Containing Reclaimed Asphalt Pavement by Considering the Effect of Silo Storage Time”, Journal of Testing and Evaluation 48, no. 1 (2020): 18-34. <https://doi.org/10.1520/JTE20180957>
- J5. S. Saliani\*, A. Carter, H. Baaj, P. Tavassoti\*\*, “Characterization of Asphalt Mixtures Produced with Coarse and Fine Recycled Asphalt Particles”, Journal of Infrastructures 4 (67), 2019
- J6. E. Melese\*, H. Baaj, S. L. Tighe, S. Zupko, and T. Smith. “Characterisation of Full-Depth Reclaimed Pavement Materials Treated with Hydraulic Road Binders.” Construction & Building Materials, Volume 226, 30 November 2019, Pages 778-792
- J7. S. Wang\*, H. Baaj. "Treatment of weak subgrade materials with cement and hydraulic road binder (HRB)." Road Materials and Pavement Design (2020): 1-24
- J8. S. Saliani\*, A. Carter, H. Baaj, P. Mikhailenko, “Characterization of Recovered Bitumen from Coarse and Fine Reclaimed Asphalt Pavement Particles”, Infrastructures 2019, 4(2), 24
- J9. D. Wang, A. Cannone Falchetto, C. Riccardi, L. Poulikakos, B. Hofko, L. Porot, M. Wistuba, H. Baaj, P. Mikhailenko, K. Hoon Moon, “Investigation on the combined effect of aging temperatures and cooling medium on rheological properties of asphalt binder based on DSR and BBR”, Road Materials and Pavement Design, Vol. 20 (sup1), S409-S433, 2019
- J10. Y. Azimi Alamdary\*, S. Singh, H. Baaj, “Laboratory simulation of the impact of solar radiation and moisture on long-term age conditioning of asphalt mixes”, Road Materials and Pavement Design, Vol. 20 (sup1), S521-S532, 2019
- J11. Y. Azimi Alamdary\*, S. Singh, H. Baaj, “Effect of aggregates containing iron sulphide on asphalt ageing”, Road Materials and Pavement Design, Published online, DOI: 10.1080/14680629.2019.1610477, 2019

- J12. P. Mikhailenko\*\*, H. Baaj, “Comparison of Chemical and Microstructural Properties of Virgin and RAP Binders and their SARA Fractions”, *Energy & Fuels*, DOI: 10.1021/acs.energyfuels.8b03414., 2019
- J13. P. Mikhailenko\*\*, C. Kou \*, H. Baaj, et al., “Comparison of ESEM and physical properties of virgin and laboratory aged asphalt binders”, *Fuel*, Volume 235, Pages 627-638, Elsevier, Jan. 2019
- J14. T. M. Baghaee\*, H. Baaj, “Rheological Characterization of High-Modulus Asphalt Mix with Modified Asphalt Binders.” *Construction and Building Materials* 193, pp.142–152, 2019
- J15. G. Ferrotti, H. Baaj, J. Besamusca, M. Bocci, A. C. Falchetto, J. Grenfell, B. Hofko, L. Porot, L. D. Poulidakos, & Z. You, “Comparison between bitumen aged in laboratory and recovered from HMA and WMA lab mixtures” *Materials and Structures*, Springer, (2018) 51: 150, <https://doi.org/10.1617/s11527-018-1270-4>
- J16. T. M. Baghaee\*, H. Baaj, “The Use of Compressible Packing Model and Modified Asphalt Binders in High-Modulus Asphalt Mix Design.” *Road Materials and Pavement Design*, <https://doi.org/10.1080/14680629.2018.1536611>, 2018
- J17. C. Kou\*, A. Kang, P. Xiao, P. Mikhailenko\*, H. Baaj, L. Sun, & Z. Wu, “A Source Pollution Control Measure Based on Spatial-Temporal Distribution Characteristic of the Runoff Pollutants at Urban Pavement” Sites. *Journal Appl. Sci.* 8:1802, DOI: 10.3390/app8101802, 2018
- J18. T. M. Baghaee\*, H. Baaj, “Application of Compressible Packing Model for Optimization of Asphalt Concrete Mix Design”, *Construction and Building Materials*, Elsevier, Vol. 159, p. 530-539, 2018
- J19. H. Baaj, P. Mikhailenko\*\*, H. Almutairi\*, H. Di Benedetto, “Recovery of Asphalt Mixture Stiffness During Fatigue Loading Rest Periods”, *Construction and Building Materials*, Volume 158, Pages 591-600, 2018
- J20. P. Mikhailenko\*\*, H. Khadim\*, H. Baaj, S. L. Tighe “Observation of Asphalt Binder Microstructure with ESEM”, *Journal of Microscopy*, 2017 May 4., doi: 10.1111/jmi.12574., 267(3):347-355, 2017
- J21. C. Kou\*, Peng Xiao, A. Kang, P. Mikhailenko\*\*, H. Baaj, Z. Wu, “Methods to Evaluate the Aging Grades of Reclaimed Asphalt Binder”, *Applied Sciences*, 7(12), 1209; doi: 10.3390/app7121209, 2017
- J22. P. Mikhailenko\*\*, H. Khadim\*, H. Baaj, “Observation of Bitumen Microstructure Oxidation and Blending with ESEM”, *Road Materials and Pavement Design*, Taylor & Francis, Vol. 18 (sup 2), p. 216-225, 2017
- J23. C. Kou\*, P. Xiao, A. Kang, P. Mikhailenko\*\*, H., Baaj, Z. Wu, “Protocol for the Morphology Analysis of SBS Polymer Modified Bitumen Images Obtained by Using Fluorescent Microscopy”, *International Journal of Pavement Engineering*, Volume 20, - Issue 5, p. 585-591, 2019
- J24. S. Wang\*, Q. Lv, H. Baaj, X. Li, Y. Zhao, “Volume Change Behaviour and Microstructure of Stabilized Loess under Cyclic Freeze-Thaw Conditions”, *Canadian Journal of Civil Engineering*, NRC Research Press, 43(10), p. 865-874, 2016
- J25. N. Tapsoba\*\*, H. Baaj, C. Sauzeat, H. Di Benedetto, M. Ech “3D Analysis and Modelling of Thermal Stress Restrained Specimen Tests (TSRST) on Asphalt Mixes with RAP and Shingles”, *Construction and Building Materials*, Elsevier, Vol. 120, p. 393-402, 2016
- J26. T. M. Baghaee\*, H. Baaj, “The Use of Rejuvenating Agents in Production of Recycled Hot Mix Asphalt: A Systematic Review”, *Construction and Building Materials*, Elsevier, Vol. 114, p. 805-816, 2016



- J27. H. Al-Bayati\*, P. K. Das\*\*, S. L. Tighe, H. Baaj, “Evaluation of Various Treatment Methods for Enhancing the Physical and Morphological Properties of Coarse Recycled Concrete Aggregate”, *Construction and Building Materials*, Elsevier, Vol. 112, p. 284-298, 2016
- J28. J. Tierrie, H. Baaj, P. Darmedru, “Modelling the Relationship between the Shape and Flowing Characteristics of Processed Sands”, *Construction and Building Materials*, Elsevier, Vol. 104, p. 235-246, 2016
- J29. D. Pickel\*, S. Tighe, H. Baaj, R. Fung and E. Saunderson, “Innovative Design, Traffic Management and Construction of Concrete Overlay Technology: A Canadian Municipal Application”, *Transportation Research Record*, 16-2265, 19pp., 2016
- J30. P. K. Das\*\*, H. Baaj, S. Tighe, N. Kringos, N., “Atomic Force Microscopy (AFM) to Investigate Asphalt Binders: A State-of-the-Art Review”, *Road Materials and Pavement Design*, Taylor & Francis, Volume 17- Issue 3, p. 693-718, 2016
- J31. M. Soltani, T. M. Baghaee\*, M. R. Karim, H. Baaj, “Analysis of Fatigue Properties of Unmodified and Polyethylene Terephthalate Modified Asphalt Mixtures Using Response Surface Methodology”, *Engineering Failure Analysis*, Elsevier, Vol. 58, 238-248, 2015
- J32. T. M. Baghaee\*, M. Soltani, M. R. Karim, H. Baaj, “Optimization of Asphalt and Modifier Contents for Polyethylene Terephthalate Modified Asphalt Mixtures Using Response Surface Methodology”, *Measurement*, Vol. 74, p. 159-169, 2015
- J33. T. M. Baghaee\*, M. Soltani, M.R. Karim, S. Shamshirband, D. Petkovic, H. Baaj, “Estimation of the Rutting Performance of Polyethylene Terephthalate Modified Asphalt Mixtures by Adaptive Neuro-Fuzzy Methodology”, *Construction and Building Materials*, Elsevier, Vol. 96, p. 550-555, 2015
- J34. N. Tapsoba\*\*, C. Sauzeat, H. Di Benedetto, H. Baaj, M. Ech, “Three-Dimensional Analysis of Fatigue Tests on Bituminous Mixtures”, *Fatigue & Fracture of Engineering Materials & Structures*, Wiley Publishing Ltd., Vol. 38, N° 6, p. 730-741, 2015
- J35. P. K. Das\*, H. Baaj, N. Kringos, S. Tighe “Coupling of Oxidative Ageing and Moisture Damage in Asphalt Mixtures”, *Road Materials and Pavement Design (RMPD)*, Taylor & Francis, Vol. 16:sup1, p. 265-279, 2015
- J36. S. J. Cooke, V. M. Nguyen, D., Anastakis, S. D. Scott, M. R. Turetsky, A. Amirfazli, A. Hearn, C. E. Milton, L. Loewen, E. E. Smith, D. R. Norris. “Diverse perspectives on interdisciplinarity from Members of the College of the Royal Society of Canada”, *FACETS* 5, no. 1: 138-165, 2020
- J37. Y. Liu\*, H. Wang, S. Tighe, D. Pickel, Z. You. “Study on impact of variables to pavement preheating operation in HIR by using FEM”. *Construction and Building Materials*, 243, 118304, 2020
- J38. L. Brescia-Norambuena, D. Pickel\*, M. González, S. Tighe, G. Azúa. “Accelerated construction as a new approach for underground-mining pavement: Productivity, cost and environmental study through stochastic modeling”, *Journal of Cleaner Production* 251: 119605, 2020
- J39. X. Zhou, G. Zhao\*, S. Tighe, M. Chen, S. Wu, S. Adhikari, Y. Gao “Quantitative comparison of surface and interface adhesive properties of fine aggregate asphalt mixtures composed of basalt, steel slag, and andesite”, *Construction and Building Materials*, 246, 118507, 2020
- J40. X. Zhou, G. Zhao\*, S. Wu, S. Tighe, D. Pickel, M. Chen, S. Adhikari, Y. Gao. “Effects of biochar on the chemical changes and phase separation of bio-asphalt under different aging conditions.” *Journal of Cleaner Production*: 121532, 2020
- J41. J. Huyan\*, W. Li, S. Tighe, Z. Xu, J. Zhai. “CrackU-net: A novel deep convolutional neural network for pixelwise pavement crack detection”, *Structural Control and Health Monitoring*, March 18. <https://doi.org/10.1002/stc.2551>, 2020, 2020

- J42. J. Huyan\*, W. Li, S. Tighe, Y. Zhang, B. Yue. "Image-Based Coarse-Aggregate Angularity Analysis and Evaluation", *Journal of Materials in Civil Engineering* 32, no. 6: 04020140, 2020
- J43. J. Huyan\*, W. Li, S. Tighe, R. Deng, S. Yan. "Illumination Compensation Model with k-Means Algorithm for Detection of Pavement Surface Cracks with Shadow", *Journal of Computing in Civil Engineering* 34, no. 1: 04019049, 2020
- J44. J. Huyan\*, W. Li, S. Tighe, Z. Sun, H. Sun. "Quantitative Analysis of Macrotexture of Asphalt Concrete Pavement Surface Based on 3D Data". *Transportation Research Record*, 0361198120920269, 2020
- J45. J. Huyan\*, W. Li, S. Tighe, L. Xiao, Z. Sun, N. Shao. "Three-dimensional pavement crack detection based on primary surface profile innovation optimized dual-phase computing." *Engineering Applications of Artificial Intelligence* 89: 103376, 2020
- J46. W. Yu\*, L. Xu, F. M. Ni, A. G. Oyeyi, S. Tighe. "Characteristics of Lightweight Cellular Concrete and Effects on Mechanical Properties." *Materials* 13, no. 12: 2678, 2020
- J47. J. Huyan\*, G. O. Abimbola, S. Tighe. "Life-Cycle Cost Analysis and Performance Comparison of Asphalt Overlays on PCC Pavements in Wet-Freeze Regions of Canada." In *Transportation Association of Canada and ITS Canada 2019 Joint Conference and Exhibition*, 2019
- J48. J. Huyan\*, W. Li, S. Tighe, J. Zhai, Z. Xu, Y. Chen. "Detection of Sealed and Unsealed Cracks with Complex Backgrounds Using Deep Convolutional Neural Network." *Automation in Construction* 107: 102946. <https://doi.org/https://doi.org/10.1016/j.autcon.2019.102946>, 2019
- J49. R. Oyediji\*, D. Lu\*, S. Tighe, "Impact of flooding and inundation on concrete pavement performance", *International Journal of Pavement Engineering*, DOI: 10.1080/10298436.2019.1685671, 2019
- J50. G. Jannat\*, S. Tighe. "Investigating Pavement Maintenance and Rehabilitation Requirement Based on Material Types and Traffic Levels through an Application of Probabilistic Approach for Ontario Highways." *Transportation Research Record*, June 16, 0361198119852355. <https://doi.org/10.1177/0361198119852355>, 2019
- J51. G. Jannat\*, S. Varamini\*, S. Tighe. "Investigating Performance of Superpave through Mechanistic-Empirical (ME) Approach, Field Evaluated Performance, and Laboratory Test Results: A Case Study on Ontario Highways", *Canadian Journal of Civil Engineering*, September 17. <https://doi.org/10.1139/cjce-2019-0090>, 2019
- J52. S. Dong\*, P. Hao, S. Tighe. "A diagnostic method for evaluating the condition index of cement-stabilised base using ts fuzzy neural network", *International Journal of Pavement Engineering* 20, no. 10: 1140-1153, 2019
- J53. H. K. A. Al-Bayati\*, S. Tighe. "Effect of Recycled Concrete Aggregate on Rutting and Stiffness Characteristics of Asphalt Mixtures" *Journal of Materials in Civil Engineering* 31, no. 10: 04019219, 2019
- J54. W. Li, J. Huyan\*, L. Xiao, S. Tighe, L. Pei. "International roughness index prediction based on multigranularity fuzzy time series and particle swarm optimization" *Expert Systems with Applications: X* 2: 100006, 2019
- J55. Y. Zhang\*, X. Yang, S. Tighe. "Evaluation of Mechanical Properties and Microscopic Structure of Coal Gangue after Aqueous Solution Treatment." *Materials* 12, no. 19: 3207, 2019
- J56. A. Chamorro\*, S. Tighe. "Development and Application of a Sustainable Management System for Unpaved Rural Road Networks", *Transportation Research Record*: 0361198119864908, 2019

- J57. Y. Liu\*, H. Wang, S. Tighe, G. Zhao, Z. You. “Effects of Preheating on the Rheological Properties of Rejuvenated Asphalt Binder”, *Transportation Research Record: Journal of the Transportation Research Board*, DOI: 10.1177/0361198119834908, 2019
- J58. M. Posavljak\*, S. Tighe, N. Larson, C. Rapp, “A different kind of partnership: an infrastructure performance stock exchange. *Infrastructure Asset Management*”. DOI: 10.1680/jinam.18.00039, 2019
- J59. D. Pickel\*, D. Malek, S. Tighe, “Using Analytic Hierarchy Process for Assessment of Precast Concrete Inlay Panel Construction: A Canadian Case Study”, accepted for publication in *Precast Concrete Institute Journal*, July 2019
- J60. W. Li, J. Huyan\*, S. Tighe, N. Shao, Z. Sun, “An innovative Primary Surface Profile-based three-dimensional pavement distress data filtering approach for optical instruments and tilted pavement model-related noise reduction”. *Road Materials and Pavement Design*. 20:1, 132-150, DOI: 10.1080/14680629.2017.1378118 Cellular Concrete and Effects on Mechanical Properties." *Materials* 13, no. 12 (2020): 2678, 2019
- J61. E. Melese\*, D. Pickel\*, D. Soon, J. Mack, S. Tighe “Analytical hierarchy process as dust palliative selection tool”, *International Journal of Pavement Engineering*, DOI: 10.1080/10298436.2018.1516040, 2018
- J62. S. Kodippily\*, J. Yeaman, T. Henning, S. Tighe “Effects of extreme climatic conditions on pavement response, *Road Materials and Pavement Design*”, DOI: 10.1080/14680629.2018.1552620, 2018
- J63. S. Kodippily\*, S. Tighe, T. Henning, J. Yeaman. “Evaluating pavement performance through smart monitoring—effects of soil moisture, temperature and traffic” *Road Materials and Pavement Design* 19, no. 1 (2018): 71-86, 2018
- J64. T. Cao\*, W. Wang, S. Tighe, S. Wang. “Crack Image Detection Based on Fractional Differential and Fractal Dimension.” *IET Computer Vision* 13, no. 1: 79–85. <https://doi.org/10.1049/iet-cvi.2018.5337>, 2019
- J65. D. Pickel\*, S. Tighe “Joint performance evaluation for a Canadian precast concrete inlay panel trial”. *International Journal of Pavement Engineering*, DOI: 10.1080/10298436.2018.1547384, 2018
- J66. D. Lu\*, S. Tighe, W. Xie (2018) “Impact of flood hazards on pavement performance”, *International Journal of Pavement Engineering*, DOI: 10.1080/10298436.2018.1508844, 2018
- J67. Q. Liu\*, M. Gonzalez, S. Tighe, A. Shalaby “Three-dimensional surface texture of Portland cement concrete pavements containing nanosilica”, *International Journal of Pavement Engineering*, 19:11, 999-1006, DOI: 10.1080/10298436.2016.1231520, 2018
- J68. A. Osorio-Lird, A. Chamorro, C. Videla, S. Tighe, C. Torres-Machi\*, “Application of Markov chains and Monte Carlo simulations for developing pavement performance models for urban network management”, *Structure and Infrastructure Engineering*, 14:9, 1169-1181, DOI: 10.1080/15732479.2017.1402064, 2018
- J69. J. D. van der Walt, E. Scheepbouwer, S. Tighe “Differential rutting in Canterbury New Zealand, and its relation to road camber, *International Journal of Pavement Engineering*”, 19:9, 798-804, DOI: 10.1080/10298436.2016.1208198, 2018
- J70. D. Pickel\*, S. Tighe, W. Lee, R. Fung. “Highway 400 precast concrete inlay panel project: Instrumentation plan, installation, and preliminary results”. *Canadian Journal of Civil Engineering*, 45 (10), 889-898, 2018

- J71. T. Younes\*, F. M. Ni\*, S. Tighe, “Risk analysis in paving operations using discrete event simulation: a case study of Taiwan permeable asphalt concrete pavement pilot road project”, *International Journal of Pavement Engineering*, DOI: 10.1080/10298436.2018.1511785, 2018
- J72. S. Dong\*, J. Zhong, S. Tighe, P. Hao, D. Pickel, “Approaches for local calibration of mechanistic-empirical pavement design guide joint faulting model: A case study of Ontario”. *International Journal of Pavement Engineering*, DOI: 1080/10298436.2018.1545093, 2018
- J73. W. Li, J. Huyan\*, S. Tighe, “Pavement Cracking Detection Based on Three-Dimensional Data Using Improved Active Contour Model.” *Journal of Transportation Engineering, Part B: Pavements*, 144(2), 04018006, 2018
- J74. C. Torres-Machi\*, A. Osorio-Lird, A. Chamorro, C. Videla, S. Tighe, C. Mourgues “Impact of environmental assessment and budgetary restrictions in pavement maintenance decisions: Application to an urban network”. *Transportation Research Part D: Transport and Environment*. Volume 59, Pages 192-204, 2018
- J75. X. Sanchez\*, S. Tighe, “Steps towards the detection of reclaimed asphalt pavement in superpave mixtures”. *Road Materials and Pavement Design*. 20:5, 1201-1214, DOI: 10.1080/14680629.2018.1428218, 2018
- J76. C. Torres-Machi\*, F. Nasir, J. Achebe, R. Saari, S. Tighe. “Sustainability Evaluation of Pavement Technologies Through Multicriteria Decision Techniques” for *Journal of Infrastructure Systems*, 2018
- J77. H. K. Al-Bayati\*, J. Achebe, S. Tighe. “Influence of recycled concrete aggregate on volumetric properties of hot mix asphalt. Resources”, *Conservation and Recycling*, 130, 200-21, 2018
- J78. D. Lu\*, W. Xie, S. Tighe. “Pavement Risk Assessment for Future Extreme Precipitations under Climate Change”. *Transportation Research Record: Journal of the Transportation Research Board*, 2018
- J79. S. Kodippily\*, S. Tighe, T. F. P. Henning, J. Yeaman, “Evaluating pavement performance through smart monitoring – effects of soil moisture, temperature and traffic, *Road Materials and Pavement Design*”, 19:1, 71-86, DOI: 10.1080/14680629.2016.1235507, 2018
- J80. Q. Liu\*, S. Varamini, S. Tighe. “Field Evaluation of Red-Coloured Hot Mix Asphalt Pavements for Bus Rapid Transit Lanes in Ontario, Canada” *Coatings* 7, no. 5: 58, 2017
- J81. W. Li, J. Huyan\*, S. Tighe, Q. Ren, Z. Sun. “Three-Dimensional Pavement Crack Detection Algorithm Based on Two-Dimensional Empirical Mode Decomposition” *Journal of Transportation Engineering, Part B: Pavements*, 6, 143(2), DOI: 10.1061/JPEODX.0000006, 2017
- J82. W. Li, J. Huyan\*, S. Tighe, N. Shao, Z. Sun. “An innovative Primary Surface Profile-based three-dimensional pavement distress data filtering approach for optical instruments and tilted pavement model-related noise reduction.” *Road Materials and Pavement Design*, 1-19, DOI: 10.1080/14680629.2017.1378118, 2017
- J83. J. Huyan\*, W. Li, S. Tighe. “Pavement Cracking Detection Based on Three-dimensional Data Using Improved Active Counter Model (ACM)”, *Journal of Transportation Engineering, Part B: Pavements*, 2016
- J84. D. Pickel\*, S. Tighe, J. West, “Assessing Benefits of Pre-Soaked Recycled Concrete Aggregate on Variably Cured Concrete”, Submitted to the *Journal of Construction and Building Materials*, 2016
- J85. M. Gonzalez\*, M. Safiuddin, J. Cao, S. Tighe, “Sound Absorption and Friction Properties of Nano-Lotus Leaf Coated Concrete for Rigid Pavement”, *Materials Science* 22(3), DOI: 10.5755/j01.ms.22.3.7638, 2016

- J86. Q. Liu\*, M. Gonzalez, S. Tighe, A. Shalaby, “Three-dimensional surface texture of Portland cement concrete pavements containing nanosilica”, *International Journal of Pavement Engineering*, DOI: 10.1080/10298436.2016.1231520, 2016
- J87. G. Jannat\*, T. Henning, C. Zhang, S. Tighe, N. Li, “Road Section Length Variability on Pavement Management Decision Making for Ontario Highway Systems”, *Transportation Research Record: Journal of the Transportation Research Board*, No. 2589, pp. 87-96, 2016
- J88. M. Gonzalez\*, S. Tighe, K. Hui, S. Rahman, A. de Oliveira, “Evaluation of freeze/thaw and scaling response of nanoconcrete for Portland Cement Concrete (PCC) Pavements”, *Construction and Building Materials*, Vol. 120, pp. 465-472, 2016
- J89. G. White, S. Tighe, S. Emery, J. Yeaman, “Developing a framework for diagnosis of shear distress in asphalt surfaces”, *International Journal of Pavement Engineering*, DOI: 10.1080/10298436.2016.1141413, 2016
- J90. M. Shaheen\*, A. Al-Mayah, S. Tighe. “A Novel Method for Evaluating Hot Mix Asphalt Fatigue Damage: X-Ray Computed Tomography”, *Journal of Building and Construction Materials*, Vol. 113, pp. 121-133, 2015
- J91. M. Shaheen\*, A. Al-Mayah, Susan Tighe, “Effects of High Friction Aggregate and PG Plus Binder on Rutting Resistance of Hot Mix Asphalt Mixtures”, *International Journal of Pavement Engineering*, Vol 17(4), pp. 1-11, 2015
- J92. M. Shaheen\*, A. Al-Mayah, S. Tighe, “Optimization of Hot Mix Asphalt Surface Course Mix Design for Fatigue Resistance: PG Plus and High Friction Aggregate”, *American Society of Civil Engineering, Journal of Material in Civil Engineering*, Vol 28(1) , 2015
- J93. F. Irali, A. Kivi, S. Tighe, C. Sangiorgi, “Tire-pavement noise and wearing course surface characteristics of experimental Canadian road pavement sections”, *Canadian Journal of Civil Engineering*, 42(10): 818-825, 2015
- J94. S. Rahman\*, A. Northmore, V. Henderson, S. Tighe, “Developing a Framework for Low-Volume Road Implementation of Pervious Concrete Pavements” *International Journal of Transportation Science and Technology*.4(1): 77-92, 2015
- J95. X. Sanchez\*, S. Tighe, “Improving the Selection of Virgin Binders for Recycled Hot Mixtures in Ontario.” *International Journal of Transportation Science and Technology*, 4(1), 47-60, 2015
- J96. S. Rahman, A. Northmore, V. Henderson\*, S. Tighe. “Developing a Framework for Low-Volume Road Implementation of Pervious Concrete Pavements”, *International Journal for Transportation Science and Technology (IJTST)* , 2015
- J97. L. Butler, J. West, S. Tighe, “Closure to Bond of Reinforcement in Concrete Incorporating Recycled Concrete Aggregates”, *American Society of Civil Engineering, Journal of Structural Engineering*, ASCE, STENG-3911, 2015
- J98. A. Chamorro\*, S. Tighe, “Optimized Maintenance Standards for Unpaved Road Networks Based on Cost-Effectiveness Analysis”, *Transportation Research Record: Journal of the Transportation Research Board*, Vol. 2084, pp. 3-10, 2015
- J99. G. Jannat\*, S. Tighe, 2015. “An Experimental Design Based Evaluation of Sensitivities of Mechanistic-Empirical Pavement Design Guide (MEPDG): Investigating Main and Interaction Effects of Input Factors”, *International Journal of Pavement Engineering*, DOI: 10.1080-10298436.205.10-07238, 2015

J100. I. Picketts\*, J. Andrey, L. Matthews, S. Dery, S. Tighe. "Climate Change Adaptation Strategies for Transportation Infrastructure Management", *Regional Environment Change Journal* 16: 1109. <https://doi.org/10.1007/s10113-015-0828-8>, 2015

### *Peer-Reviewed Conference Papers*

C1. M. Aurilio\* and H. Baaj, "Examining the effects of a Self-Healing Elastomer on the Properties of Bitumen", Accepted for publication at the RILEM International Symposium on Bituminous Materials, December 14-16, Lyon, France, 2020.

C2. T. M. Baghaee\*\*, H. Baaj, "Effects of Aggregate Shape Parameters and Gradation on High-Modulus Asphalt Mix Performance", Accepted for publication at the RILEM International Symposium on Bituminous Materials, December 14-16, Lyon, France, 2020.

C3. R. Aurilio\*, M. Aurilio\*, H. Baaj. "The Effect of a Chemical Warm Mix Additive on the Self-Healing Capability of Bitumen." Accepted for publication at the RILEM International Symposium on Bituminous Materials, December 14-16, Lyon, France, 2020.

C4. P. Tavassoti\*\*, R. Aurilio\*, D. Zhao\*, H. Baaj, "Investigating the Nonlinear Behavior of Neat and Modified Binders through Large Amplitude Oscillatory Shear (LAOS) Testing." Accepted for publication at the RILEM International Symposium on Bituminous Materials, December 14-16, Lyon, France, 2020.

C5. P. Tavassoti\*\*, T.H. Ameen, G. Cascante, H. Baaj, "Improving the Predictive Master Curve of Bituminous Mixtures Using Ultrasonic Measurements", Accepted for publication at the RILEM International Symposium on Bituminous Materials, December 14-16, Lyon, France, 2020.

C6. P. Tavassoti\*\*, H. Baaj, "Moisture Damage in Asphalt Concrete Mixtures: State of the Art and Critical Review of the Test Methods", Transportation Association of Canada (TAC) Conference, Soils and Materials Session, Vancouver, B.C., 2020.

C7. M. Aurilio\*, P. Mikhailenko\*\*, H. Baaj and L. Polikakos, "Properties of Asphalt Binders with Increasing SBS Polymer Modification", 5th International Symposium on Asphalt Pavement and Environment (APE), Padua, Italy, Sep. 2019

C8. Aurilio, M.\*, Qabur, A.\*, Mikhailenko\*\*, P., Baaj, H., "Analysis of Double Edge Notched Tension Test and Multiple Stress Creep Recovery Test Ability to Predict HMA Fatigue Performance." 2019 Association of Asphalt Paving Technologists Conference March 3-6, Fort Worth, United States (2019).

C9. A. Hamid\*, H. Baaj, M. El-Hakim. "Enhancing Asphalt Cement Properties Using Geopolymer- Based on Fly Ash and Glass Powder." Proceedings and Oral Presentation at the 7th CSCE International Specialty Conference on Engineering Mechanics and Materials, Laval, Montreal, Canada, June 12 - 15, 2019.

C10. M.C. Liu\*, C. Van Niejenhuis\*, R. Aurilio\*, H. Baaj, H. "Impact of Cementitious Material Type and Complex Mineralizer on the Compressive Strength of Hempcrete." Proceedings and Oral Presentation at the 7th CSCE International Specialty Conference on Engineering Mechanics and Materials, Laval, Montreal, Canada, June 12 - 15, 2019.

C11. G. Ferrotti, H. Baaj, J. Besamusca. et al. "Comparison of Short-Term Laboratory Ageing on Virgin and Recovered Binder from HMA/WMA Mixtures." RILEM 252-CMB Symposium. RILEM Book series, Vol. 20, Springer, Cham. (2019).

C12. P. Mikhailenko\*\*, H. Baaj, "ESEM Microstructural and Physical Properties of Virgin and Laboratory Aged Bitumen", RILEM 252-CMB Symposium. RILEM Book series, Vol. 20, Springer, Cham. (2019).

- C13. E. Melese\*, H. Baaj, S. L. Tighe, T. Smith, and S. Zupko. “Mechanical Properties of Full-Depth Reclaimed Pavement Materials Treated with Hydraulic Road Binders.” In TRB Annual Meeting Online 2019 & Archived Meeting Content. Washington D.C., 2019.
- C14. E. Melese\*, H. Baaj, S. L. Tighe, T. Smith, and S. Zupko. “Laboratory Assessment on Effects of Blended Cements on Strength and Durability of Full-Depth Reclaimed Pavement Materials | Tac-Atc.Ca.” Saskatoon, Saskatchewan, 2018.
- C15. S. Wang\*, H. Baaj, S. Zupko, and T. Smith. “Field and lab assessment for cement-stabilized subgrade in Chatham, Ontario.” Conference of the Transportation Association of Canada Saskatoon, SK, 2018.
- C16. S. Wang\*, H. Baaj, 2018. “Restrained Shrinkage Test and Lab Simulation of Micro-Cracking Technology for Cement-Stabilized Soils”. Proceedings of the Canadian Society for Civil Engineering Conference, Fredericton, Canada, June 13-June 16, 2018
- C17. H. Kadhim\*, H. Baaj, and P. Pirzadeh. “Evaluating Permanent Deformation in Asphalt Mixes Containing Reclaimed Asphalt Pavement by Considering the Effect of Silo Storage Time” the 13th ISAP Conference on Asphalt Pavements. Fortaleza, Ceará, Brazil, 2018
- C18. E. Melese\*, H. Baaj, S. L. Tighe, “Effects of Blended Cements on Strength and Durability of Full-Depth Reclaimed Pavement Materials”, Testing and Modelling of Road and Embankment Materials Session, Transportation Association of Canada, Saskatoon, SK, 2018
- C19. E. Melese\*, H. Baaj, S. L. Tighe, T. Smith, & S. Zupko. “Mechanical Properties of Full-Depth Reclaimed Pavement Materials Treated with Hydraulic Road Binders.” Poster Presented at the TRB, Washington D.C., 2018
- C20. T. Smith, D. Race, S. Wang\*, E. Melese\*, H. Baaj, S. L. Tighe, “Engineered Soils: What are they and how are they used in Canada?” Conference of the Canadian Geotechnical Society, Ottawa, Canada, October 2-4, 2017
- C21. P. Mikhailenko\*\*, H. Baaj, “Overview of Current Asphalt Binder Extraction and Recovery Practices” Transportation Association of Canada Conference, St. John’s, Canada, September 24-27, 2017
- C22. P. Mikhailenko\*\*, C. Kou\*, H. Baaj, S. L. Tighe. 2017, “Observation of Polymer Modified Asphalt Microstructure by ESEM” Canadian Society for Civil Engineering Conference, Vancouver, Canada, May 31-June 3, 2017
- C23. H. Kadhim\*, P. Mikhailenko\*\*, H. Baaj, S. L. Tighe. 2017, “The Effect of the Silo-Storage on the Rheological Behavior of a Surface Course Asphalt Mix Containing Reclaimed Asphalt Pavement (RAP)”, Canadian Society for Civil Engineering Conference, Vancouver, Canada, May 31-June 3, 2017
- C24. Q. Liu, S. M. Hossain\*\*, H. Baaj, S. L. Tighe, A. Shalaby, “Field Assessment of Three-Dimensional Surface Texture and Frictional Properties of Experimental Canadian Road Pavements”, World Conference of Pavement and Asset Management, Baveno, Italy, June 12-16, 2017
- C25. P. Mikhailenko\*\*, H. Kadhim\*, Y. Azimi Alamdary\*, H. Baaj “Observation of asphalt binder microstructure with ESEM”, Conference of the Transportation Association of Canada, Toronto, ON. 26-29 September, 2016
- C26. H. Al-Bayati\*, S. L. Tighe, H. Baaj, “Effect of different treatment methods on the interfacial transition zone microstructure to coarse recycled concrete aggregate”, Conference of the Transportation Association of Canada, Toronto, ON. 26-29 September, 2016

- C27. A. Schneider\*, H. Baaj, P. Lum, S. Senior, “Testing and evaluation of reclaimed materials as aggregate for OPSS granular B type II”, Conference of the Transportation Association of Canada, Toronto, ON. 26-29 September, 2016
- C28. T. M. Baghaee\*, S. M. Hossain\*\*, H. Baaj “Adoption of statistical analysis to evaluate the permanent deformation of polyethylene Terephthalate (PET) modified SMA mixtures”, Conference of the Transportation Association of Canada, Toronto, ON. 26-29 September, 2016
- C29. S. L. Tighe, H. Baaj, “Evaluation of Innovative Recycling Techniques: a Canadian case study”, 8th International Conference on Maintenance and Rehabilitation of Pavements (MAIREPAV-8), Singapore 27-29 July 2016
- C30. A. Schneider\*, H. Baaj, P. Lum, S. Senior, “Field Testing and Evaluation of Reclaimed Materials as Aggregate for OPSS Granular B type II”, Conference of the Canadian Society of Civil Engineering, London, ON. 1-4 June, 2016
- C31. S. Salianni\*, A. Carter, H. Baaj, “Investigation of the Impact of RAP Gradation on The Effective Binder Content in Hot Mix Asphalt”, Conference of the Canadian Society of Civil Engineering, London, ON. 1-4 June, 2016
- C32. Y. Yousefi\*, A. Schneider\*, H. Baaj, S. L. Tighe, A. Yousefi, “Foamglass Lightweight Aggregate: The New Approach”, Conference of the Canadian Society of Civil Engineering, London, ON. 1-4 June, 2016
- C33. P. K. Das\*, H. Baaj, B. Birgisson, S. L. Tighe, “Moisture Susceptibility of Warm-Mix-Asphalt in A Changing Climate: Incorporating Top-Down Cracking and Fracture Mechanics Approach”, Conference of the Transportation Association of Canada, Charlottetown, PEI. 27-30 September, 2015
- C34. R. Wafa\*, S. Tighe, G. Moore, R. Fung, 2019. “Development of innovative asset management solutions for a large Canadian city”, World Conference on Pavement and Asset Management (WCPAM 2017), June 12-16, 2017, Baveno, Italy, 2019
- C35. G. Zhao\*, J. Huyen\*, S. Tighe, W. Li, “Implementing Unsupervised Machine Learning To Gain A Better Understanding of the Asphalt Pavement Conditions of Ontario Provincial Highways”. In CSCE Annual Conference (pp. 1-10) , 2019
- C36. F. M. Ni\*, A. G. Oyeyi\*, S. Averyanov, S. Tighe, B. Dolton, J. Li. “Properties of ultra-low density lightweight cellular concrete containing slag”. Transportation Research Board 98th Annual Meeting Transportation Research Board, January, Washington D.C., 2019
- C37. D. Lu, S\*. Tighe, W. Xie, H. Kadhim. “Flooding Induced Performance Change of Hot Mix Asphalt Pavement.” 2018 Canadian Society of Civil Engineers Annual Conference (CSCE), 2018
- C38. D. Lu, S\*. Tighe, W. Xie. “Adapting to Pavement flooding risk under climate change.” 2018 Canadian Society of Civil Engineers Annual Conference (CSCE), 2018
- C39. S. Nahidi\*, S. Rahman, S. Tighe. “Throughput Evaluation of Workzones On High-Volume Highways of Ontario, Canada”. Canadian Society of Civil Engineers Annual Conference (CSCE), 2018
- C40. Z. Alyami\*, S. Tighe “Incorporating Asset Value in Life Cycle Cost Analysis for Transportation Infrastructure Assets”. Canadian Society of Civil Engineers Annual Conference (CSCE), 2018
- C41. S. Averyanov\*, F. M. Ni\*, E. Melese\*, S. Tighe, “Construction Experience Analysis of using CEMATRIX Lightweight Cellular Concrete as a Subbase material”. Canadian Society of Civil Engineers Annual Conference (CSCE), 2018
- C42. A. Wakefield\*, M. R. Anderson, Z. McKay, S. Tighe. “A Review of solvent extraction-recovery procedures and their effect on recovered asphalt binder properties.” Can. Tech. Asp. Assoc., 2018



- C43. J. Achebe\*, S. Tighe. “Towards Developing Environmental Sustainability Performance Measures for Pavement Asset Management Practice”. Conference and Exhibition of the Transportation Association of Canada, 2018
- C44. L. Uzarowski\*, R. Rizvi, V. Henderson, S. Tighe “Developing Shear Resistant Asphalt Mixes for Roundabout Pavements”. Conference and Exhibition of the Transportation Association of Canada, 2018
- C45. H. K. A. Al-Bayati\*, S. Tighe “Influence of Coarse Recycled Concrete Aggregates on the Dynamic Modulus of Asphalt Concrete Mixtures”. Transportation Association of Canada (TAC), Saskatoon, Saskatoon, 2018
- C46. H. K. A. Al-Bayati\*, S. Tighe, “Effect of Recycled Aggregate on the Permanent Deformation of Asphalt Mixtures”. Canadian Technical Asphalt Association Conference, 2018
- C47. S. Varamini\*, S. S. Ashani, S. Tighe. “Comprehensive Evaluation of Warm-Mix Asphalt Moisture Susceptibility”. No. 18-03082. Transportation Research Board (TRB) Annual Meeting, January, Washington D.C., 2018
- C48. R. Wafa\*, S. L. Tighe, G. Moore, D. Perusin. “Construction and Preliminary Results of Concrete Overlay in Residential Neighborhoods: A Canadian Case Study”. No. 18-05828. 2018. Transportation Research Board (TRB) Annual Meeting, January, Washington D.C., 2018
- C49. G. Jannat\*, S. Tighe. “Investigating Cost-Effective Pavement Maintenance and Rehabilitation Strategies Through Life-Cycle Cost Analysis (LCCA) by Incorporating Variation in Performance Based on Material Types and Traffic Levels for Ontario Highways”. No. 18-05807. Transportation Research Board (TRB) Annual Meeting, January, Washington D.C., 2018
- C50. D. Malek\*, D. Pickel\*, S. Tighe, “Methodology for Performance Evaluation of Precast Concrete Inlay Panels as a Pavement Repair Technique”, CSCE Annual Conference, Fredericton, NB, Canada, 2018
- C51. F. Mi-Way Ni\*, S. Averyanov\*, E. Abebaw Melese\*, S. Tighe, “Characterization of Light Weight Cellular Concrete”, CSCE Annual Conference, Fredericton, NB, Canada, 2018
- C52. D. Malek\*, V. Speller\*, S. Tighe, “The Role of Fast-track Pavement Repair Methods in Infrastructure Management”, CSCE Annual Conference, Fredericton, NB, Canada (BEST PAPER AWARD), 2018
- C53. H. K. A. Al-Bayati\*, S. Tighe, “Investigation of Treated CRCA in HMA Mixtures through Evaluation Low Temperature Cracking”, CSCE Annual Conference, Fredericton, NB, Canada, 2018
- C54. D. Lu\*, S. Tighe, W. Xie, “Adapting Pavement Infrastructure to Flood Risk under Climate Change – A Review of Adaptation Strategies”, CSCE Annual Conference, Fredericton, NB, Canada, 2018
- C55. H. K. A. Al-Bayati\*, S. Tighe, “Evaluating the Effects of Mineral Filler on the Volumetric Properties of HMA Mixtures based on Superpave Mix Design Specifications”, CSCE Annual Conference, Fredericton, NB, Canada, 2018
- C56. S. Kodippily\*, J. Yeaman, T. F. P Henning, S. Tighe, “Effects of variation in moisture and temperature on pavement response”. 28th Australian Road Research Board International Conference, Brisbane, Australia. ARRB Group, 2018
- C57. S. Kodippily\*, J. Yeaman, T. F. P. Henning, S. Tighe, “Moisture Sensitivity of Pavement Basecourses”. 28th Australian Road Research Board International Conference, Brisbane, Australia. ARRB Group, 2018

- C58. D. Lu\*, S. Tighe, W. Xie. "Pavement Risk Assessment for Future Extreme Precipitations under Climate Change." Transportation Research Board (TRB) Annual Meeting, January, Washington D.C., 2018
- C59. Z. Alyami\*, S. Tighe, "Asset Value Index for Infrastructure Asset Management", Transportation Research Board (TRB) Annual Meeting, January, Washington D.C., 2018
- C60. R. Wafa\*, S. Tighe, G. Moore, D. Perusin, "Construction and Preliminary Results Of Concrete Overlay In Residential Neighbourhoods - A Hamilton Case Study". Transportation Research Board. Transportation Research Board (TRB) Annual Meeting, January, Washington D.C., 2018
- C61. D. Pickel\*, S. Tighe, W. Lee, R. Fung. "Highway 400 Precast Concrete Inlay Panel Project: Instrumentation Plan, Installation, and Preliminary Results", Transportation Research Board (TRB) Annual Meeting, January, Washington D.C., 2018
- C62. G. Jannat\*, S. Tighe, "Investigating Cost-Effective Pavement Maintenance & Rehabilitation Strategies through Life Cycle Cost Analysis (LCCA) by Incorporating Variation in Performance based on Material Types and Traffic Levels for Ontario Highways", Transportation Research Board (TRB) Annual Meeting, January, Washington D.C., 2018
- C63. D. Lu\*, S. Tighe, W. Xie. "Pavement Fragility Modeling Framework and Build-in Resilience Strategies for Flood Hazard." Transportation Research Board (TRB) Annual Meeting (No. 17-01735), January, Washington D.C., 2017
- C64. D. Lu\*, S. Tighe, W. Xie. "Impacts of flooding on Asphalt Pavements under Climate Change". Canadian Technical Asphalt Association (CTAA) Annual Conference, November 12-15, Halifax, Canada, 2017
- C65. Z. Alyami\*, S. Tighe, "A methodological framework for implementation of asset management in PPP projects". Proceedings of the World Conference on Pavement and Asset Management (WCPAM 2017), June 12-16, Baveno, Italy, 2017
- C66. Z. Alyami\*, D. Mizutani, K. Kaito, S. Tighe. "A dynamic optimal model for pavement asset management and PPP projects". Proceedings of the World Conference on Pavement and Asset Management (WCPAM 2017), June 12-16, Baveno, Italy, 2017
- C67. R. S. Wafa\*, S. Tighe. "Feasibility of Concrete Overlays as a Rehabilitation Strategy on Municipal Roads – City of Hamilton". Transportation Association of Canada. St.John's: Transportation Association of Canada, 2017
- C68. D. Pickel\*, S. Tighe, R. Fung, S. Lee, P. Smith, T. Kazmierowski, M. Snyder, "Precast Concrete Inlay Panel Installation Method Evaluation", Transportation Association of Canada Annual Meeting, St. Johns, NFLD, CAN, 2017
- C69. D. Pickel\*, Q. Liu\*, R. Wafa\*, S. Tighe, R. Fung, "Field Evaluation of Portland Cement Concrete Pavement Surface Texture and Frictional Properties", Transportation Association of Canada Annual Meeting, St. Johns, NFLD, CAN, 2017
- C70. Z. Alyami\*, S. Tighe. "Project Asset Management for Pavement Assets under Performance-Based Contracts." In *Advances in Public-Private Partnerships*, pp. 211-224. Reston, VA: American Society of Civil Engineers, 2017
- C71. B. McWade\*, M. Navarra, S. Tighe. "Harwood Avenue and Bayly Street (Reg. Rd. 22) A Concrete Pavement Urban Intersection Pilot Project." In *TAC: Investing in Transportation: Building Canada's Economy--Conference and Exhibition of the Transportation Association of Canada*, 2017
- C72. G. Jannat\*, S. Varamini, S. Tighe. "Investigation of Performance of Superpave Through Mechanistic-Empirical Approach, Field Evaluated Performance, and Laboratory Test Results: A Case

Study for Ontario Highways (Poster).” In TAC: Investing in Transportation: Building Canada's Economy--Conference and Exhibition of the Transportation Association of Canada, 2017

C73. G. Jannat\*, S. Tighe. “Developing Performance Prediction Models Based on Traffic and Materials by Incorporating Mechanistic-Empirical Approach for Ontario Highways.” No. 17-06054. Transportation Research Board (TRB) Annual Meeting (No. 17-01735), January, Washington D.C., 2017

C74. X. Sanchez\*, T. Somers, M. Sweezie, Paving Engineer Construction Branch. “Investigating the Effect of Warm Mix Additive on the Performance of Asphalt Mixtures.” In TAC: Investing in Transportation: Building Canada's Economy--Conference and Exhibition of the Transportation Association of Canada, 2017

C75. G. Jannat\*, S. Tighe. “Application of Probabilistic Approach for Predicting Pavement Maintenance Requirement: A Case Study on Ontario Highways.” In TAC: Investing in Transportation: Building Canada's Economy--Conference and Exhibition of the Transportation Association of Canada, 2017

C76. S. Kodippily\*, J. Yeaman, T. Henning, S. Tighe. “Moisture Sensitivity of Pavement Basecourses using Site Data and Soil 2 Water Characteristic Curves 3.”, 2017

C77. Q. Liu\*, S. Tighe, A. Shalaby. “Assessment of Airfield Runway Macrotecture and Friction Using Three-Dimensional Laser-Based Measurements”. No. 17-01393. Transportation Research Board (TRB) Annual Meeting (No. 17-01735), January, Washington DC., 2017

C78. G. Jannat\*, S. Tighe. “Investigation of Pavement Performance Index Through Application of a Seemingly Unrelated Regression Model: Case Study on Highways in Ontario, Canada”. No. 17-02534. Transportation Research Board (TRB) Annual Meeting (No. 17-01735), January, Washington D.C., 2017

C79. S. Varamini\*, M. Esenwa, S. Tighe, M.K. Farashah, T. Moore. “Mixture Design and Field Experience: Coloured Hot Mix Asphalt on Bus Rapid Transit (BRT) Lanes in Ontario.” In Proceedings of the Sixth-Second Annual Conference of the Canadian Technical Asphalt Association (CTAA): Halifax, Nova Scotia, 2017

C80. D. Pickel\*, S. Tighe, R. Fung, S. Lee, P. Smith, T. Kazmierowski, M. B. Snyder, “Using Precast Concrete Inlay Panels for Rut Repair on High Volume Flexible Pavements”, 11th International Conference on Concrete Pavements (ICCP), San Antonio, TX, USA, 2016

C81. Z. Alyami\*, S. Tighe, “Integrating Asset Valuation in Transportation Asset Management”, Efficient Transportation - Managing The Maintenance Demand, Transportation Association of Canada (TAC), Toronto, Ontario, September 2016

C82. S. Varamini\*, M. Kafi, M. El-Hakim, S. Tighe, “Coloured Asphalt Bus Rapid Transit Lanes in The Regional Municipality of York: Integrating Laboratory Performance Testing into Sustainable Pavement Asset Management”, Transportation Association of Canada, Toronto, Ontario, 2016

C83. D. Pickel\*, S. Tighe, “Development of Precast Concrete Inlay Panel Rehabilitation Strategy for High Volume Asphalt Highways”, 11th International Transportation Speciality Conference at the Canadian Society of Civil Engineers (CSCE), London, ON, 2016

C84. A. Kivi\*, S. Tighe, R. Fung, J. Grajek. “Long Term Evaluation of Unbonded Concrete Overlay Technology: A Municipal Case Study,” 11th International Conference on Concrete Pavements (ICCP), San Antonio, Texas, August 28 - September 1, 2016

C85. S. Varamini\*, S. Tighe, “Coloured Asphalt Bus Rapid Transit Lanes in The Regional Municipality of York: Integrating Laboratory Performance Testing into Sustainable Pavement Asset

Management”, 11th International Transportation Speciality Conference at the Canadian Society of Civil Engineers (CSCE), London, ON, 2016

C86. S. Varamini\*, S. Tighe, “Mechanistic Evaluation of the Effect of Warm mix Additives on the Strength and Durability of Typical Ontario Superpave Surface Mixtures”, Canadian Technical Asphalt Association, Banff, Alberta, 2016

C87. J. Bhavsar, M. El-Hakim\*, S. Tighe, “Comparison Between Cold –Place Recycling (CIR) and Cold In-Press Recycling with Expanded Asphalt Mixture”, Canadian Technical Asphalt Association, Banff, Alberta, 2016

C88. G. Jannat\*, T. Henning, S. Tighe, N. Li, “Future of Management Systems: Innovative Key Performance Indicators and Analysis of Data”, Eighth International Conference on Maintenance and Rehabilitation of Pavements, DOI: 10.3850/978-981-11-0449-7-049-cd, 2016

C89. A. Zaid\*, S. Tighe, P. Malin, “Transportation Asset Management for Public Private Partnership (PPP) Projects”, Transportation Association of Canada (TAC), At Toronto, Ontario, 2016

C90. M. J. Rodriguez-Roblero\*, G. Cascante, M. D. Pandey, S. Tighe, “Evaluation of the effect of nanosilica in the frosting resistance of concrete through ultrasound”, GeoVancouver, October 2-5., Vancouver, BC., 2016

C91. M. Gonzalez\*, S. Tighe, J. F. Munoz, J. Grove, “Recommendations for Quality Control of Nanomaterials and Field Construction of PCC Pavements when Nanomaterials are Incorporated”, Presentation at the 95th Transportation Research Board Annual Meetings, Paper No. 16-2956, Jan 10-14, Washington, D.C., 2016

C92. Z. Alyami\*, S. Tighe, “Asset Valuation: A Performance Measure for Comprehensive Infrastructure Asset Management”, Innovative Work in Infrastructure Management: Best Papers from AISIM, 95th Annual Transportation Research Board Annual Meetings, Jan 10-14, Washington, D.C., 2016

C93. Z. Alyami\*, S. Tighe, “A methodology for Integration Asset Valuation in Transportation Asset Management”, 11th International Transportation Speciality Conference at the Canadian Society of Civil Engineers CSCE, London, ON, June 1-4, 2016

C94. G. Jannat\*, T. Henning, C. Zhang, S. Tighe, N. Li, “Road Section Length Variability in Pavement Management Decision Making for Ontario Highway Systems”, 95th Transportation Research Board Annual Meetings, Paper No. 16-5874, Jan 10-14, 2016, Washington, D.C., 2016

C95. S. Varamini\*, S. Tighe, “Effect of Colouring Pigment on Asphalt Mixture Performance: Case for Use in Ontario”, 95th Transportation Research Board Annual Meetings, Paper No. 16-3889, Jan 10-14, Washington, D.C., 2016

C96. S. Varamini\*, S. Tighe, “Canadian Usage and Practices for Evaluating Warm-Mix Asphalt Moisture Susceptibility”, 95th Transportation Research Board Annual Meetings, Paper No. 16-3854, Jan 10-14, Washington, D.C., 2016

C97. C. Torres-Machi\*, A. Osorio, P. Godoy, A. Chamorro, C. Mourgues, C. Videla, S. Tighe, “Incorporating Sustainability into Pavement Asset Management: Application to an Urban Network”, 95th Transportation Research Board Annual Meetings, Paper No. 16-6277, Jan 10-14, Washington, D.C., 2016

C98. G. Jannat\*, S. Tighe, “Investigating Life Cycle Cost Analysis to Identify Sustainable Pavement Maintenance and Rehabilitation Strategy: A Case Study on Ontario Highways”, Transportation Association of Canada Conference, September 25-28, Toronto, 2016

- C99. G. Jannat\*, S. Tighe, “Developing new Performance Index for Assessing overall Pavement Condition by Incorporating of Mechanistic-Empirical Approach for Ontario Highways”, Transportation Association of Canada Conference, September 25-28, Toronto, 2016
- C100. G. Jannat\*, S. Tighe, “Developing Engineering Criteria and Standards for Key Performance Indicators (KPI) used in Pavement Management”, 8th International Conference on Maintenance and Rehabilitation of Pavement, Singapore, July 27-29, 2016
- C101. M. Shaheen\*, A. Al-Mayaa, S. Tighe, “Visualization and Quantification of Hot Mix Asphalt Characteristics Using X-Ray Computed Tomography”, 60th Annual Conference of the Canadian Technical Asphalt Association (CTAA), Ottawa, ON, 2015
- C102. M. Shaheen\*, S. Tighe, A. Al-Mayah, “Improvement of Hot Mix Asphalt Surface Course Mix Design for Fatigue Resistance”, 60th Annual Conference of the Canadian Technical Asphalt Association (CTAA), Ottawa, ON, 2015
- C103. D. Ambaiowei\*, S. Tighe, “Rubberized Asphalt Mixtures in RAP: A Case for Use in Ontario”, 94th Annual Transportation Research Board Annual Meetings, Paper No. 15-0960 Washington, D.C. Jan 2015
- C104. X. Sanchez\*, V. Aurilio, S. Tighe, S. Brown, F. Magisano. “Use of the Hirsch Model to Backcalculate the Performance Characteristics of Blended Binder in Superpave Hot Mix Materials”, 60th Annual Conference of the Canadian Technical Asphalt Association (CTAA), Ottawa, ON, November 15-18, 2015
- C105. L. Uzarowski\*, M. Maher, S. Tighe, “Green Pavement Technologies are Sustainable Only if they Deliver Acceptable Performance”, 60th Annual Conference of the Canadian Technical Asphalt Association (CTAA), Ottawa, ON, November 15-18, 2015
- C106. R. Rizvi\*, S. Tighe, L. Uzarowski. “Research to Identify Advanced Asphalt Technology to Address Shear Distresses on Airfield Facilities”, Conference of the Transportation Association of Canada, Charlottetown, September 2015
- C107. G. Jannat\*, S. Tighe, “Performance Based Evaluation of Overall Pavement Condition Indices for Ontario Highway Systems”, Conference of the Transportation Association of Canada, Charlottetown, September 2015
- C108. A. Ayed\*, S. Tighe, “Local Calibration for Mechanistic-Empirical Design using Genetic Algorithm”, Conference of the Transportation Association of Canada, Charlottetown, September 2015
- C109. S. Tighe, “Vulnerabilities and Design Considerations for Pavement Infrastructure in Light of Climate Change”, Conference of the Transportation Association of Canada, Charlottetown, September 2015
- C110. S. Tighe, “Braking Availability Testing Device”, 9th International Conference on Managing Pavement Assets, Washington, D.C., May 18-21, 2015
- C111. S. Tighe, “Demonstrating how Sustainability Can Effectively be Incorporated in to Pavement Management”, 9th International Conference on Managing Pavement Assets, Washington, D.C., May 18-21, 2015
- C112. X. Sanchez\*, S. Tighe, V. Aurilio, “Mechanical Response of Superpave Recycled Hot Mixtures in Ontario”, Conference of the Transportation Association of Canada/Green Technology in Pavement and Materials Engineering Session, Charlottetown, Canada, September 2015
- C113. J. Bhavsar\*, S. Tighe, “Performance Evaluation of Cold in Place Recycling (CIR) Mixes for Ontario”, Conference of the Transportation Association of Canada, Charlottetown, September 2015

- C114. S. Varamini\*, S. Tighe, “Survey on Current Practices For Evaluating Warm Asphalt Moisture Sensitivity”, Conference of the Transportation Association of Canada, Charlottetown, September 2015
- C115. C. Gray, J. Yeaman\*, S. Tighe, “Using Innovative In-Situ Measuring Tools To Better Understand Asphalt Performance”, Australian Asphalt Pavement Association International Conference, Gold Coast, Australia, September 2015
- C116. S. Tighe, J. Yeaman\*, “Developing A Framework for Innovative Research and Education Which Improves Pavement Life Cycle and Reduces Costs”, Australian Asphalt Pavement Association International Conference, Gold Coast, Australia, September 2015
- C117. C. Johnston\*, A. Wiegand, S. Tighe, J. Yeaman. “Impacts of Asphalt Laboratory Compaction Techniques: Does it really affect the Master Curve?”, Australian Asphalt Pavement Association International Conference, Gold Coast, Australia, September 2015
- C118. X. Sanchez\*, D. Ambaiowei, S. Tighe, “Low Temperature Performance of Superpave Recycled Hot Mixtures in Ontario”, International Airfield and Highway Pavements Conference: Modifications of Warm and Hot Asphalt Concrete and Performance, June 2015
- C119. Z. Alyami\*, S. Tighe, “Asset Valuation: A Performance Measure for Comprehensive Infrastructure Asset Management”, Annual Inter-University Symposium on Infrastructure Management (AISIM), University of Delaware, May 21-22, 2015 (BEST PAPER AWARD)
- C120. Z. Alyami\*, S. Tighe, D. Gransberg, M. Bianchin, “Performance Measures for Pavement Assets Under Performance Based Contracts”, 9th International Conference on Managing Pavement Assets, Washington, D.C., May 18-21, 2015
- C121. Z. Alyami\*, S. Tighe, “Pavement Maintenance on Long Term Performance Based Contracts” 9th International Conference on Managing Pavement Assets, Washington, D.C., May 18-21, 2015
- C122. Z. Alyami\*, S. Tighe, “Project Asset Management for Pavement Assets under Performance Based Contracts” Proceedings of the 2nd International Conference on Public-Private-Partnerships, Austin, TX, 26-19 May 2015
- C123. A. Hamdi, M. El-Hakim\*, S. Tighe, N. Li, “Pavement Maintenance on Long Term Performance Based Contracts” 9th International Conference on Managing Pavement Assets, Washington, D.C., May 18-21, 2015
- C124. S. Pinto\*, S. Tighe, “Improving Airport Pavement Management Using an Analytical Hierarchy Process Decision Making Tool Braking Availability Testing Device”, 9th International Conference on Managing Pavement Assets, Washington, D.C., May 18-21, 2015
- C125. S. Tighe, “Accelerated Testing and Instrumentation: A Canadian Case Study”, 9th International Conference on Managing Pavement Assets, Washington, D.C., May 18-21, 2015
- C126. D. MacLeod\*, S. Tighe, M. Juhasz, “Pavement Management Systems for Canadian Low Volume Roads”, 9th International Conference on Managing Pavement Assets, Washington, D.C., May 18-21, 2015
- C127. M. Gonzalez\*, S. Tighe. “Nanotechnology Applied in the Design of the Next Generation of Concrete Pavements Surface” Fifth International Symposium on Nanotechnology in Construction (NICOM5), Chicago, IL. May 24-26, 2015
- C128. F. Irali, M. Gonzalez\*, S. Tighe, A. Simone, “Temperature and Aging Effects on Tire/Pavement Noise Generation in Ontarian Road Pavements”, 94th Annual Meeting of the Transportation Research Board, Paper No. 15-3877, January 11-15, 2015

- C129. M. Longhi, M. Gonzalez\*, S. Rahman, S. Tighe, C. Sangiorgi, “Evaluation of the Strength and Abrasion Resistance of Pervious Concrete Mixes Using Three Types of Cement (GU, GUL, nanocement)”, 94th Annual Transportation Research Board Proceedings, Washington, D.C., Paper No. 15-3369, January 11-15, Washington, D.C (presentation), 2015
- C130. L. Jiao\*, J. Yang, Y. Huang, S. Tighe, “Development of Frost-Thaw Prediction Model on Weather Information”, 94th Annual Transportation Research Board Proceedings, Washington, D.C., January 11-15, 2015. Paper 15-2067, Washington, D.C, 2015
- C131. M. Gonzalez\*, S. Tighe, J. Medley, “Assessing Friction Response of Nanoconcrete for Rigid Pavements Using British Pendulum Tester and Tribometer”, 94th Annual Transportation Research Board Proceedings, Paper No. 15-1669, Washington, D.C., January 11-15, Washington, D.C, 2015
- C132. A. Osorio, A. Chamorro\*, S. Tighe, C. Videla, “Development of Performance Models of Urban Pavements for Network Analysis”, 94th Annual Transportation Research Board Proceedings, Washington, D.C., Paper No. 15-0427 January 11-15, Washington, D.C, 2015
- C133. A. Chamorro\*, S. Tighe, “Optimized Maintenance Standards for Unpaved Road Networks Based on Cost-Effectiveness Analysis”, 94th Annual Transportation Research Board Proceedings, Washington, D.C., No.2473. January 11-15, Washington, D.C, 2015
- C134. Z. Alyami\*, S. Tighe, “Project Asset Management for Performance Based Contracts”, Innovative Work in Infrastructure Management: Best Papers from AISIM, 94th Annual Transportation Research Board Proceedings, January 11-15, 2015

#### *Conference Papers with Abstract Selection*

- C135. M. Aurilio\*, P. Tavassoti, M. Elwardany, H. Baaj. “Comparing the Ability of Different Tests and Rheological Indices to Evaluate the Cracking Resistance of Polymer Modified Asphalt Binders.” Canadian Technical Asphalt Association Conference, November 9-20, Kelowna, Canada, 2020.
- C136. R. Aurilio\*, M. Aurilio\*, H. Baaj. “High-Performance Pavements: A focus on self-healing asphalt technologies”, Canadian Technical Asphalt Association Conference, November 15-18, Kelowna, Canada, 2020.
- C137. P. Tavassoti\*\*, H. Baaj, P. Mikhaelinko, L. Eamer, “Experimental Evaluation of Biodegradable Asphalt Release Agents in Canada”, 64th Canadian Technical Asphalt Association (CTAA) Conference, Montreal, QC, Canada, 2019.
- C138. M. Aurilio\*, A. Qabur\*, P. Mikhaïlenko\*\*, H. Baaj. “Comparing the Fatigue Performance of HMA Samples with PMA to their Multiple Stress Creep Recovery and Double Notched Tension Test Properties.” Canadian Technical Asphalt Association Conference, November 11-14, Regina, Canada, 2018.
- C139. T. M. Baghaee\*, H. Baaj. “Development of High-Modulus Asphalt Mix Designs for Ontario’s Highways.” Canadian Technical Asphalt Association Conference, November 11-14, Regina, Canada, 2018.
- C140. H. Kadhim\*, H. Baaj. “Evaluation of the Impact of Silo Storage on Thermal Cracking of the Hot Mix Asphalt with RAP.” TAC 2018: Innovation and Technology: Evolving Transportation-2018 Conference and Exhibition of the Transportation Association of Canada, 2018.
- C141. H. Almutairi\*, P. Mikhaïlenko\*\*, H. Baaj, “Rutting Performance of Asphalt Mixtures with Nanotube-fibers with Varied Addition Rates.” Canadian Technical Asphalt Association Conference, November 11-14, Regina, Canada, 2018.

C142. S. Saliyani\*, A. Carter, H. Baaj, S. Badeli, “Investigation on tensile strength of Hot Mix Asphalt with inclusion of pulp aramid fiber (PAF)”, Proceedings of the 62nd Annual Conference of the Canadian Technical Asphalt Association, Halifax, NS, November 15–15, 2017

C143. M. Aurilio, P. Mikhailenko\*\*, H. Baaj, “Predicting HMA Fatigue Using the Double Edge Notched Tension Test and Multiple Stress Creep Recovery Test”, Proceedings of the 62nd Annual Conference of the Canadian Technical Asphalt Association, Halifax, NS, November 15–15, 2017

C144. P. K. Das\*, N. Kringos, H. Baaj, S. Tighe, “Investigation of diffusion-controlled oxidative aging in asphalt mixture”, Proceedings of the 60th Annual Conference of the Canadian Technical Asphalt Association, Ottawa, ON, November 15-18, 2015.

### *Awards and Recognitions*

#### National/International Awards and Recognitions:

- **Susan Tighe**, Fellow, Engineering Institute of Canada, 2020
- **Hassan Baaj**, Expert, RILEM Association, 2020-2022
- **Hassan Baaj**, Chair, Soils and Materials Standing Committee, Transportation Association of Canada, 2018-2020
- **Susan Tighe**, International Association of Advanced Materials (IAAM) Medal Lecture, Stockholm Sweden, 2019
- **Susan Tighe**, Fellow, Canadian Society for Civil Engineering, 2019
- **Hassan Baaj**, University Research Award, Imperial Oil (\$25,000/year for three years), 2019
- **Susan Tighe**, Fellow, Canadian Academy of Engineering, 2018
- **Susan Tighe**, Canada Research Chair, Natural Science and Engineering Research Council, 2005-2015
- **Hassan Baaj**, 2015: University Research Award, Imperial Oil (\$25,000/year for three years)

#### University of Waterloo/Endowed Chair Awards:

- **Hassan Baaj**, University of Waterloo, Outstanding Performance Award (OPA), 2020
- **Hassan Baaj**, Waterloo Engineering Society, Teaching Excellence Award, Fall 2019
- **Susan Tighe**, University of Waterloo, Special Performance Award, awarded for outstanding performance, 2004, 2010, 2014, 2018
- **Susan Tighe**, Faculty of Engineering, Graduate Supervision Award, 2016
- **Susan Tighe**, University of Waterloo, Award of Excellence in Graduate Supervision, 2017
- **Hassan Baaj**, UW Faculty of Engineering Distinguished Performance Award, 2017

#### Provincial/Regional/Industry Awards:

- **Susan Tighe**, Research & Development Medal, 2016 Ontario Professional Engineers Awards (OPEA), 2016
- **Susan Tighe**, 2016 MTO Women in Engineering, Celebrating 100 years of Women in Engineering, 2016



### Best Paper/Presentation Awards:

- Hanaa Al-Bayati, **Susan Tighe**, 2019, Best Paper, TAC Conference, Halifax, NS Canada
- Dahlia Malek (MAsc Student), Victoria Speller (MAsc Student), and **Susan Tighe**, 2018, Best Paper, CSCE 2018 Annual Conference, Fredericton, NB, Canada
- Eskedel Melese (PhD Student), Hassan Baaj, Best Student Paper (paper co-authored with my student), 2018 Transportation Association of Canada Conference, Saskatoon, SK
- Adam Schneider (MAsc Student), **Hassan Baaj**, Best Student Paper, Transportation Association of Canada (TAC) Conference, 2016
- Gulfam Jannat, (PhD Student), **Susan Tighe**, Best Poster, Transportation Association of Canada (TAC) Conference, 2016
- Zaid Alyami, (PhD Student), **Susan Tighe**, Annual Inter-University Symposium on Infrastructure Management (AISIM), 2015.
- Mike Aurilio (MAsc Student), Peter Mikhailenko (PDF), **Hassan Baaj**, Best Paper Elaine Thompson Award – 62<sup>nd</sup> Canadian Technical Asphalt Association Conference, Halifax, NS, 2017
- Mike Aurilio (MAsc Student), Peter Mikhailenko (PDF), **Hassan Baaj**, Norman McLeod Award for Best Oral Presentation – 62<sup>nd</sup> Canadian Technical Asphalt Association Conference, Halifax, NS, 2017

### *Event Organization*

In the last five years, CPATT have hosted more than 30 invited talks, seminars and Lunch and Learn events Seminars by experts from across the country and internationally. Either those whom we have invited specifically to give a talk or those who gave a seminar as they were here as external Ph.D. committee members. In 2019, CPATT hosted three important national and international events.

**Pavement Engineering Research Symposium:** CPATT hosted in April 2019 the annual meeting of the (GRINCH) which is a research group originally created by the pavement engineering researchers at Laval University and the École de Technologie Supérieure in Québec. In 2019, the event has been expanded to become a Pan-Canadian event with the participation of faculty members, researchers and graduate students from eight different Canadian Institutions. The announcement poster for this event is included in the Appendix.

**Annual Meeting of Cluster F (Bituminous Materials and Polymers) of the Rilem:** Rilem (International Union of Laboratories and Experts in Construction Materials, Systems and Structures) is an internationally recognised organization that brings together researchers working on the development of the construction materials of the future. The cluster F focuses on finding innovative and sustainable solutions to make transportation infrastructure more durable and environmentally friendly. Prof. Baaj leads currently one of the 5 committees of the cluster (IC-278 CHA: Crack Healing of Asphalt). Three other committees work on recycling and energy efficient solutions and the last committee work on understanding the fundamentals of chemical and physical interactions in asphalt materials. The meeting took place on Monday Sep. 30th and Tuesday Oct 1st. Around 50 academic and industrial researchers representing 24 different universities and research institutions in 13 different countries.

**Rilem Symposium on High Performance Asphalt Materials:** We have invited some of the researchers attending the Cluster F meeting to stay for one day in order to organize an international symposium. The event was sponsored by UW Engineering, CEE and CPATT in addition to several other industrial sponsors. The event was very successful and was attended by more the 100 participants from MTO engineers, municipalities and industry in addition to graduate students and faculty members from UW. The announcement poster for this event is included in the Appendix.

## Training of Highly Qualified Personnel

Below is a summary of highly qualified personnel involvement with CPATT since 2015 including current students and others working with CPATT.

Summary of Highly Qualified People Training involved in CPATT (2015-2020)

Status	Undergraduate*	Masters	PhD	PDF, Visiting Scholars
Completed	24	17	17	16
Ongoing	2	4	17	6

\*Includes Co-op students, USRA and URA

The productivity of the HQP has been substantial. The goal is that students participate in an active research program where they interact with others. Students within the group lead the majority of publications and these students are highly employable upon completion. The following is a brief summary where some of the former HQP are currently employed:

- Several Assistant Professors (University of New Brunswick, Carlton University, Catholic University of Chile, King Aziz University Saudi Arabia, etc.)
- Post-Doctoral Positions (EMPA Switzerland)
- Several Principal Engineers (Stantec Consulting, Golder Associates, Englobe)
- Several Project Engineers and Managers (Hatch Mott MacDonald, MMM, CH2M Hill, IBI Group, SNC Lavalin, iTRANS, Applied Research Associates, Fugro-Roadware and WSP)
- Several Senior Postings in Government (Ministry of Transportation Ontario, Alberta Transportation, Manitoba Highways, Saskatchewan Highways, York Region, Region of Waterloo, City of Waterloo)
- Associations (World Bank, Ontario Good Roads Association, Ontario Asphalt Pavement Council)

In addition, several visiting professors and scholars have come to CPATT over the past five years. They have visited from Canada, United States, Chile, China, France, Italy, Oman and Germany. Several of these visitors have given seminars to CPATT but these have also been advertised university wide. Typically, there are two to three seminars per year. Attendance at seminars has been excellent and, in several cases, many working professionals have attended.

## Governance and Administrative Structure

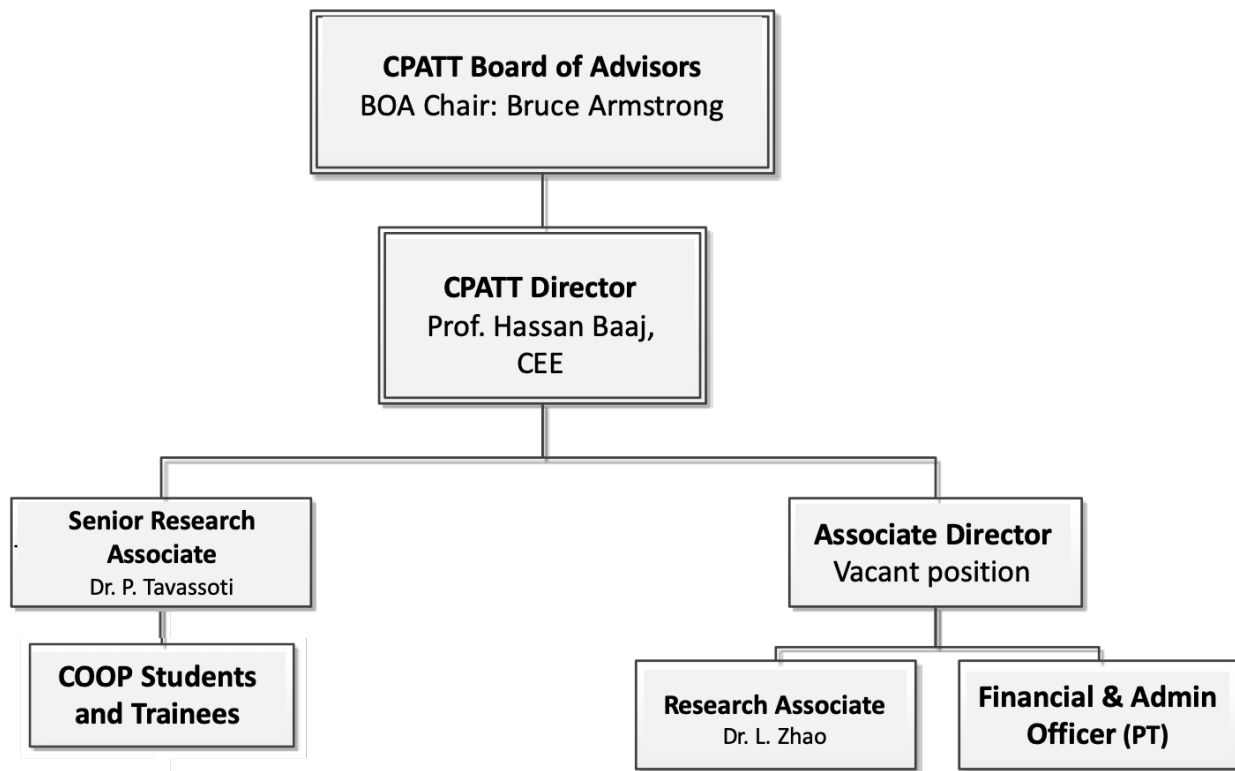
The general organizational structure for CPATT involves a three-way partnership of public sector and private sector agencies and the universities. Overall guidance is provided by a Board of Advisors, with

representation from the major funding partners. The Director and the Associate Director are responsible for the on-going management of the research programs.

Internally the Director, Associate Director and the Senior Research Associate provide leadership of the Research Team. The following members are involved with CPATT activities in an in-depth way:

- Prof. Hassan Baaj, Director (Sep. 2017 – present), Associate Director (2015 – 2017)
- Prof. Susan Tighe, Past Director (past 2015 – Sep. 2017)
- Prof. Shunde Yin, Candidate for the post of Associate Director (Starting Oct. 2020)
- Dr. Pezhouhan Tavassoti-Kheiry, Senior Research Associate
- Dr. Guangyuan Zhao, Research Associate

The following figure is a schematic presentation of the organization of CPATT.



### *CPATT Board of Advisors (BOA)*

The Board of Advisors, as identified earlier, is constituted to represent stakeholders within the University and community. The purpose of the board is to provide strategic direction and it does not have an operational or fiduciary responsibility. The role of the board is to provide input and advice to the director and research theme, champions on research directions, dissemination of results, partnerships and sources of funding. ~~Example of past BOA Meeting Minutes is included in the Appendix.~~

Currently, the following are members of the CPATT’s Board of Advisors:

1. Mr. Tim Smith, Director Technical Activities, Cement Association of Canada (Chair BOA 2012-2015)
2. Mr. Marcos Krockner, Director of Transportation, Regional Municipality of Waterloo
3. Mr. Doubra Ambaiowei, Executive Director, Ontario Hot Mix Producers Association
4. Ms. Becca Lane, Manager Materials Engineering and Research Office, Ministry of Transportation Ontario
5. Dr. Amir Halim, Principal, Infrastructure Management and Pavement Engineering, Stantec Consulting Limited (Chair BOA 2015-2017)
6. Mr. Tony Kucharek, Technical Director, McAsphalt Industries Limited
7. Mr. Bruce Armstrong, President, Canadian Asphalt Industries Inc. (Chair BOA 2017-2020)
8. Mr. Jim Kelly, Vice President, Capital Paving Limited
9. Mr. Mohammed Ahmed, Manager Quality Assurance, SNC Lavalin
10. Dr. Ludomir Uzarowski, Principal, Pavement and Materials Engineering, Golder Associates Ltd.
11. Mr. John Pontarollo, Senior Vice President Ontario & Western Canada, CRH (Canada) Inc.
12. Mr. Michael Mackay, Principal Engineer and General Manager, EnGlobe
13. Dr. James Smith, Manager Member/Technical Services, Ontario Good Roads Association
14. Mr. Alen Keri, Senior Pavement Engineer, Concrete Association of Ontario
15. Mr. Ted Arscott, President, Roto-Mill Inc.
16. Dr. John Emery, Owner, Shiloh CanConstuct
17. Mr. Malcolm Matheson, President, Steed and Evans Limited
18. Prof. Susan Tighe, Former Director of CPATT, Adjunct Professor, Former Norman W. McLeod Chair in Sustainable Pavement Engineering, University of Waterloo
19. Prof. Neil Thomson, Former Chair of Civil and Environmental Engineering, Ex-officio
20. Prof. Hassan Baaj, CPATT Director, Professor, University of Waterloo

### ***CPATT Director***

The CPATT Director is appointed by the Chair of the Department of Civil and Environmental Engineering. This is normally a tenured faculty member in the Department of Civil and Environmental Engineering. The Founding director was the late Professor Ralph Haas. Prof. Carl Haas and Prof. Susan Tighe have also both served as CPATT Directors until the appointment of the current Director, Prof. Hassan Baaj in 2017.

The primary responsibilities of the Executive Director, as established by the Board of Advisors and approved by Senate, include:

- Initiating and coordinating the research and education activities of CPATT;
- Developing strategic direction and ensuring that the strategic plan is followed;
- Establishing and maintaining linkages with associations, other research centers, and informing CPATT members about these activities;
- Assisting the Board of Advisors with on-going CPATT activities;
- Representing CPATT at industry events; and

- Report to the Board of Advisors, Dean of Engineering, and Chair of the Department of Civil and Environmental Engineering.

### *Senior Research Associate*

Dr. Pejoohan Tavassoti, joined CPATT in 2017 as Senior Research Associate. Dr. Tavassoti's position is mainly funded by research grants obtained by Prof. Baaj and partially from CPATT's operating account.

The primary responsibilities of the Senior Research Associate include:

- coordinating and conducting CPATT's research contracts in the lab and field;
- hiring, training, and managing of co-op students assisting with contract work;
- assisting with graduate students' research;
- contributing to preparing research proposals and disseminating findings by preparing reports and presentations for clients; and
- assisting CPATT committees to meet their objectives.

### *Associate Director*

The position of Associate Director has always been held by UW full-time faculty members. Prof. Baaj served as Associate Director for two years before his appointment as Director in 2017. As mentioned earlier, Prof. Shunde Yin candidature to serve as Associate Director will be discussed during the next BOA meeting.

The Associate Director is responsible for the Centre's administration, conferences, branding, marketing, customer relationship management (CRM), newsletter and web content management, staffing, and finance. The Associate Director also provides leadership and oversight to the development and management of the Centre Pavement and Transportation Technology (CPATT).

The Associate Director reports to the CPATT Director and the Board of Advisors and also works closely with the research team members.

### *Administrative/Financial Assistant*

- Ms. Jessica Rossi, Financial and Administrative Officer, (Full-time - Aug. 2016 – Sep. 2017)
- Ms. Nicole Schmidt, Interim Financial and Administrative Officer, (Part-time - Sep. 2017 – Present)

Currently the post of Financial and Administrative Officer is vacant but Nicole Schmidt, Financial Assistant Research and Contracts at CEE, is helping with the financial administration of CPATT which has been a crucial and highly appreciated support from CEE.

The Administrative/Financial Assistant and duties include:

- ensuring that the Director and Associate Director are up-to-date on CPATT's day to day activities and that University and CPATT policies are implemented in a timely manner;
- maintaining financial records of budgets, expenses and income for the Centre's accounts to reconcile with the University financial system;

- working with co-op students; hiring, training, and supervising work-study students;
- liaising with CPATT BOA members to ensure deadlines and Centre's objectives are achieved. Responsibilities include: maintaining records related to CPATT, disseminating information on Centre's activities, initiating meetings, assisting in the preparation of reports;
- acting as a liaison between Board members and Director to ensure Centre's policies are properly followed;
- arranging and organizing conferences, workshops, seminars, and other events, both on- and off-site, sometimes in conjunction with other industry organizations.
- generating invoices, and collecting and processing payments for events and services through the Accounts Receivable and Accounts Payable system;
- setting up research contracts with Office of Research, and completing payments, and managing project finances;
- responsibilities for general office administration, including maintaining confidential files, and updating membership database;
- maintaining CPATT's website and ensuring that all required updates are completed promptly;
- maintaining office inventory, and purchasing office supplies; and
- performing other duties as assigned by the Executive Director, Technical Director/Research Associate and Associate Director as needed by the Board of Directors and Committees

### *Support Staff*

Since 2015, CPATT has employed 26 students to assist with CPATT activities including Co-op students and Undergraduate Research Assistants to assist with the completion of research projects, contracts and other CPATT activities.

CPATT also promotes the involvement of engineering students in the pavement engineering field by encouraging CPATT members to hire uWaterloo co-op students, involving students in pavement projects and supporting student attendance at the annual students CPATT symposium, workshops and conferences.

### *Adjunct Professors*

- Prof. Mohab El-Hakim, Manhattan College, USA
- Dr. John Emery, Shiloh CanConstuct
- Dr. Steve Goodman, Manager, Pavements and Materials, Gemtec
- Dr. Vimy Henderson, Director of Eastern Operations, PSI Technologies Inc.
- Dr. Li Ningyuan, Consultant, Retired from MTO
- Dr. Sina Varamini, Manager, Research & Development, McAsphalt Industries Limited

### *Other Active UW Members and other key contributors*

Serval other UW researchers and faculty members have been involved in research projects in collaboration with CPATT including co-supervising graduate students, submitting joint proposals or participating in CPATT's seminars, symposia or other activities. The following is a list of some of these faculty members.

- Prof. Shunde Yin (Geotechnical)
- Prof. Giovanni Cascante (Non-Destructive Testing)
- Prof. Dipanjan Basu (Geotechnical, Soils)
- Prof. Adil Al-Mayah (Materials, Structures)
- Prof. Maria Anna Polak (Concrete Structures)
- Prof. Wei-Chau Xie (Risk and Reliability)
- Prof. Tarek Hegazy (Construction Management)
- Prof. Carl Haas (Construction Management)
- Prof. Jeff Casello (Transportation Planning)
- Prof. Scott Walbridge (Steel Structures)
- Prof. Sriram Narasimhan (Structural Dynamics)
- Prof. Bruce Hellenga (ITS and Traffic)
- Prof. Liping Fu (ITS and Traffic)
- Prof. Jean Andrey, Geography Dept., UW
- Prof. Goretty Dias, School of Environment, Enterprise and Development – SEED, UW
- Prof. Alan Carter, Ecole de Technologie Supérieure, Montreal, Qc
- Prof. Orazio Balgieri, Polytechnico di Torino, Italy

## **Budget and Financial Information**

The original financing of CPATT's activities was realized through funding from CFI/OIT/Board of Advisors Partners/Norman W. McLeod Endowment for the research infrastructure, ORDCF/Partners for the operating requirements, and various projects again for operating needs. The original CFI and ORDCF budgets have been spent and the laboratory and field equipment is in place. In 2019, Prof. Baaj, together with five other researchers, have been awarded \$130,000 for the retrofit of one of servo-hydraulic testing equipment at CPATT.

The information below presents a summary of the revenue and expenses of CPATT from May 1<sup>st</sup>, 2015 to Sep 11<sup>th</sup>, 2020.

At today's date, CPATT has a positive balance of \$15,000. It should be noted that due to the pandemic interruptions, CPATT decided to suspend the annual Research User Fee and use some funds to support HQPs to protect them from the adverse effects of the lockdown and losing some highly experienced personnel. This indicates that the centre is not only self-sustainable but resilient to support the department goals during unexpected impacts.

Also, it is important to note that the Sales and Service Revenue, corresponding to technical services provided by CPATT to external clients (industry and consulting firms), has been stable with a positive trend in the last 5 years. The objective is to increase this type of service in the future.

Account Group	Fiscal Year					Fiscal YTD May 1 - Sept 15, 2020		
	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	Commitments	Available Funds
Carryforward from Prior Year	(90,186)	(166,677)	(109,061)	(60,600)	(51,189)	(15,064)		
Budgetary Support		(17,652)	(50,789)	(50,000)	(10,000)			
Sales & Services Revenue	(54,100)	(4,000)	(15,000)	(31,317)	(93,138)	(24,429)		
Research User Fee	(105,530)	(83,275)	(91,050)	(42,503)	(11,562)			
Research account surplus resolutions		(70,989)						
<b>Total Revenue</b>	<b>(249,816)</b>	<b>(342,593)</b>	<b>(265,900)</b>	<b>(184,420)</b>	<b>(165,889)</b>	<b>(39,493)</b>	<b>0</b>	
Salaries- Faculty/Research Assoc/Post Doc	-	-	-	18,333	66,523	9,672	900	
Salaries – TA/RA	22,526	16,656	12,579	-	-			
Salaries-Staff	11,715	112,133	43,153	17,296	2,288			
Supplies & Others	9,041	30,813	30,922	37,250	43,439	4,094	8,835	
Travel & Hospitality	23,538	33,521	40,900	21,322	25,415	71		
Capital Assets Expense Accts			21,783					
Expandable Equip Purchases and Maintenance	16,318	33,909	20,053	22,829	10,661	542		
Scholarship & Bursaries		6,500	35,910	16,200	2,500			
<b>Total Expense</b>	<b>83,139</b>	<b>233,532</b>	<b>205,300</b>	<b>133,231</b>	<b>150,825</b>	<b>14,379</b>	<b>9,735</b>	
<b>Balance (- /surplus, +/deficit)</b>	<b>(166,677)</b>	<b>(109,061)</b>	<b>(60,600)</b>	<b>(51,189)</b>	<b>(15,064)</b>	<b>(25,114)</b>	<b>9,735</b>	<b>(15,380)</b>

Funding over the next five years is expected to come from the following sources:

- **Research projects user fee:** For each project conducted at CPATT, a user fee will be budgeted and collected to cover the operational cost of the lab. It is expected that this would generate a revenue of \$50,000/year in the next five years.
- **Corporate Membership:** As the initial funding for CPATT and N.W. McLeod Chair has been completed this year and all the partners have paid their committed contributions, the intent is to propose the creation of corporate membership fee that will be open to current and new CPATT members. The membership will be divided into three levels: Platinum, Gold and



Silver and the membership fees will be \$5,000, \$5,500 and \$2,000/year respectively. It is expected that the membership program will generate a yearly revenue of \$30,000/year in the first year and should increase to \$50,000 in year 5. This plan will be discussed during the next CPATT BOA meeting in October 2020.

- **Professional Training:** As recommended by several members from the BOA and other CPATT members, CPATT plans to start offering several professional training programs for pavement engineers and technicians, both in Canada and internationally. This started in 2020 with a joint training program with Ontario Hot Mix Producers Association and the Asphalt Institute, but his program has been postponed to 2021 due to Covid-19. In addition, CPATT started planning for the creation of a professional training program with China that would be extended to other countries. Dr. Li Ningyuan, adjunct professor at CPATT, has started initiating several contacts with Chinese universities and companies. The estimated revenue from training programs is expected to generate \$25,000 in the first year that should ramp up to 50,000 in year 5.
- **Technical Services:** CPATT receives frequent requests for technical services including lab testing and technical studies. Thanks to the new RTI funding received in 2019, our testing capacity will increase which would lead to an increase in the revenue. It is expected that the annual revenue will be around \$50,000/year in the next five years.
- **Other sources:** In addition to the aforementioned revenue sources, we will plan to continue to submit research proposal and applications for research tools, instruments and infrastructure through NSERC, CFI, ORF and other organizations.

CPATT's success has also resulted in the development of an endowed chair in the field of pavement engineering which led to the hiring of Prof. Hassan Baaj as the Associate Chair holder in 2014. Prof. Tighe's position is now vacant and the hope is to be able to hire a new faculty member who would join CPATT and contribute to attracting new collaborations.

Current funding sources of the Centre staff, namely the CPATT Research Associates and CPATT administrative assistant (vacant post since 2018) come from various research projects and Norman McLeod Chair. Primary funding sources include:

- NSERC
- Ontario Centre of Excellence
- Ministry of Transportation of Ontario
- Cement Association of Canada
- Ontario Hot Mix Producers Association
- McAsphalt Industries and Miller Paving
- Other industry partners

The table below summarizes the anticipated yearly budgets for CAPTT for the next five years:

**Projected Yearly Budget for CPATT 2020-2025:**

Account Group	2020/21	2021/22	2022/23	2023/24	2024/25
<b>Revenue</b>					
- Technical Services	(\$50,000)	(\$50,000)	(\$50,000)	(\$50,000)	(\$50,000)
- Research User Fee	(\$50,000)	(\$50,000)	(\$50,000)	(\$50,000)	(\$50,000)
- Corporate Membership	(\$30,000)	(\$35,000)	(\$40,000)	(\$45,000)	(\$50,000)
- Training	(\$25,000)	(\$35,000)	(\$50,000)	(\$50,000)	(\$50,000)
<b>Expenses</b>					
- Salaries-Admin staff	\$25,000	\$26,000	\$27,000	\$28,500	\$30,000
- Salaries-technical staff	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000
- Training-honorarium	\$10,000	\$14,000	\$20,000	\$20,000	\$20,000
- Operational Expenses	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000
- Travel & Hospitality	\$15,000	\$18,000	\$23,000	\$26,000	\$30,000
- Scholarship & Bursaries	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000
<b>Balance (-/surplus, +/-deficit)</b>	(\$5,000)	(\$12,000)	(\$20,000)	(\$20,500)	(\$20,000)

**Five-Year Research Plan**

The five-year plan for 2020-2025 will focus on continuing to develop and expand on external collaboration and to focus on internal collaborations amongst faculty members in CPATT. This collaboration will be facilitated through regular monthly faculty meetings and meetings with the Board of Advisors twice a year. Each meeting will involve discussing a specific research theme which is of interest to the group.

CPATT’s current research is diverse covering wide range of topics related to Pavement Engineering. In particular, our researchers were involved in research projects related to sustainability and environmental solutions in the field of transportation engineering materials and infrastructures. In addition, we were involved in several applied and R&D projects in the area of civil engineering infrastructures in general through our collaboration with several industrial partners. This allowed our researchers and students to work on multidisciplinary research projects in collaboration with several industry partners.

***Future Research Plans: Rethinking the Road of the Future***

The transportation system of a country has the same importance that the arteries, veins and nerves have to the human body. The health of this system is reflected in the development of the country. We must therefore preserve and grow the transportation systems to support the societal, economic and ecological needs in the future and to follow the technological advances in the transportation industry. A profound reflection on the road to the future is then essential.

Several organisations and international experts have started working on defining the road of the future. This road would be sustainable, resilient, connected, adaptable, self-healing, source of energy, smart and versatile. It will change its configuration according to the needs of traffic, communicate with users and lead them to their destination safely. This road would be modular, easy to build and repair. The road of the future would be depolluting and able to self-clear the snow and recover water from the rain. While all these ideas and others are very interesting, some are more urgent and important than others.

Our long-term research objective at UW is to pursue the research work that we started at CPATT on **Smart and Sustainable Transportation Engineering and take this area to a higher level**. The following paragraphs describe some research themes and topics that would feed CPATT's research roadmap in the upcoming years.

***Proactive versus Reactive Pavements:*** Pavements are built today using mainly empirical or semi-mechanistic pavement design methods based on a number of assumptions and in some advanced methods, the values of stresses and strains in the different layers are calculated theoretically. However, the behaviour of the construction materials and the response of the structure may be much more complex than what is used to model and predict them. Huge errors may happen and lead to premature failures and huge financial losses. On the other hand, data collection methods used in Pavement Management Systems (PMS) are progressing thanks to the progress of new technologies, such as the use of automated data collection vehicles using 3D laser sensors or image analysis techniques. However, these techniques remain limited as they cannot predict the damage until it is actually visible on the surface. Proactive pavements are those that will send real-time information on stresses and strains, crack initiation and deflections, moisture levels, freeze and thaw conditions and traffic loading.

These smart and connected pavements are now possible thanks to the great technological advances in many areas. Very small wireless stress, strain and moisture gauges and weigh-in-motion sensors could be embedded in the pavement structure. Real-time data can then be remotely collected and analysed to help the engineers in timely decision-making process on pavement design adjustment or rehabilitation and maintenance.

***Mechanistic Eco-design of Pavement Structures:*** Another main problem related to pavement design methods is that they do not allow adequate use of value-added products and innovative materials in pavement structures. In addition, researchers tend to generally address the two topics (Materials and Structure) separately. It is therefore important to create links and collaborate with academic and industrial peers with the aim of developing a global mechanistic structural pavement design approach that includes LCA models to allow for more economic and ecological pavement structures.

***Alternative Binders:*** The road construction industry is strongly linked to the petroleum industry through the use of bitumen. However, the price of bitumen is increasing continuously and several studies predict the depletion of petrol within a few decades. Also, petroleum products have a profound impact on global warming and greenhouse gas emission. The business model of the chemical industry and the road industry may then become incompatible with sustainable development

in our societies in the future. In addition, the consumption of fossil Carbon has an undeniable impact on global warming and the greenhouse gas emission. In this context, the business model of the chemical industry seems to be incompatible with the sustainable development of our societies.

Several companies have already developed binders from alternative sources to oil to substitute bitumen. These binders are often expensive by comparison, not optimized for performance and are often difficult to produce. Extensive multidisciplinary research seems therefore necessary in order to overcome these difficulties and to come up with a durable and environmentally friendly alternative binder at a reasonable cost.

### *The Action Plan*

Active CPATT faculty have expressed interest and serious discussion in pursuing a major research grant or centre of excellence in one of the theme areas. Discussions towards the creation of a research pole focusing on Smart and Sustainable Pavements have already started with several partners. Some of the partners have shown strong interest and Ontario Good Road Association has already accepted to commit funding towards the initiative. However, the project has been delayed due to several factors such as the freezing of research funding by MTO in 2018 and more recently Covid-19. Nevertheless, it is expected that a major collaboration grant will be prepared over the year.

In addition, there will be a concerted effort to pursue collaborations through the new NSERC Alliance Funding Program, Ontario Centres of Excellence and Mitacs. Many of the key researchers have already been involved with successful federal and provincial grants and with the collaborations under the CPATT umbrella, it is expected that several of the newer faculty members will participate with mentorship from senior faculty members within CPATT.

In addition, CPATT will continue to host national and international meetings, seminars and symposiums. The focus on research carried out by graduate students who work with CPATT faculty has been a huge success and this outreach will continue. Over the period of 2015 - 2020, 3 Graduate Student Symposiums were hosted in addition to a poster session in 2019 as part of the GRINCH Meeting. Copies of the abstract book are provided for the 2018 Graduate Student Symposium in the Appendix. These symposiums were very successful with well over 100 attendees in attendance at each symposium. They have also resulted in new collaborations with public and private sector organizations. This initiative will continue over the next five years.

Finally, technology transfer of research findings will be facilitated through a CPATT newsletter that will be published three times per year. Samples of CPATT's newsletters are contained in the Appendix. Currently there are over 1,500 subscribers from all stakeholder groups and although the majority of subscribers are in Canada and the United States, approximately 33% of the subscribers are based internationally. The newsletters highlight researchers, both faculty and students within CPATT. The website was redesigned in accordance with UW guidelines and continues to be updated on a regular basis. It is designed to highlight current research and that provides interested research sponsors with information on current competencies.

In short, the overall goal of CPATT over the next five years is to develop collaborative research partnerships and funding proposals. In addition, CPATT will work to expand the Board of Advisors

in broader technical areas including ITS, transportation, structures, and geotechnical. It is suggested that faculty members in the respective research areas would collaborate to develop those partnership in a similar manner as those in the pavement area. Finally, the goal for improved communication within CPATT will be facilitated through an up-to-date functional website and the development of a newsletter which highlights on going work by faculty members and graduate students. The goal of this communication will serve both as marketing but also as a tool for technology transfer.

## **Conclusion**

The presence of CPATT provides a unique opportunity to bring stakeholders from a wide spectrum together (i.e., academia, government, associations, public and private sectors) which is crucial not only to fostering innovation in the pavement and transportation technology area but also to maximize the research impact through facilitating implementation of the results of the high-quality research conducted at CPATT. The centre also creates a synergy for collaborative research both nationally and internationally, which is well received by the scientific and professional communities internationally. The CPATT mission and brand name help attracting highly talented graduate students, researchers, and scholars to UW which reinforces all of the three main themes of the University's strategic plan for 2020-2025: i.e., 1) Developing talent for a complex future, 2) Advancing research for global impact, and 3) Strengthening Waterloo's diverse communities.

## **Attachments**

- 1- Letter of Support Dean of Engineering
- 2- Letters of Support from active members of CPATT
- 3- The announcement poster for the GRINCH 2019 Symposium held by CPATT in April 2019
- 4- Copies of the Abstract Book of GRINCH 2019
- 5- The announcement poster for Rilem Symposium on High Performance Asphalt Materials held by CPATT in October 2019
- 6- ~~Example of past BOA Meeting Minutes~~
- 7- Asphalt Research Fund Delivers Bankable Results, Asphalt Magazine, Spring 2020
- 8- Samples of CPATT's newsletters

**Secretary Note: Items 3-8 above are found here.**

September 11, 2020

Senate Graduate and Research Council (SGRC)  
Research Leaders Council  
University of Waterloo

Subject: Letter of Support for renewal of the Centre for Pavement and Transportation Technology (CPATT)

Dear Members of the Senate Graduate and Research Council,

The Faculty of Engineering is pleased to strongly support the renewal of the Centre for Pavement and Transportation Technology (CPATT) for another five-year term.

CPATT is an international leader in pavement engineering research, implementation and education. They also serve our community of pavement engineers, academics and contractors as a critical nexus of knowledge management, networking and learning. With the leadership of the Former Director, Prof. Susan Tighe, and the current Director, Prof. Hassan Baaj, CPATT has become a significant asset to the University of Waterloo, the Faculty of Engineering and the Department of Civil and Environmental Engineering. As a research centre, CPATT provides a strong bridge between faculty members and Industry, as well as between graduate and undergraduate students and Industry. These industry linkages develop research funding opportunities, co-op positions, and assist with our goal to be recognized as an international leader in research, education and innovation. In 2019, CPATT hosted two major events; one is a national event (GRINCH Symposium) and the second is an international one (Rilem Symposium) which demonstrates the leadership role and the national and international recognition that CPATT has been able to acquire over the years.

Over the past five years CPATT has demonstrated exceptional growth in the area of pavement engineering, design and management. This impressive growth has been achieved while CPATT operated as a cost recovery Centre – it generates 100 percent of its revenue required to support the Centre operation without internal or external funds.

The Faculty of Engineering confirms its support for the renewal of the Centre for Pavement and transportation Technology for a new five-year term.

Sincerely,



Mary Wells, Dean  
Faculty of Engineering



Hassan Baaj, Ph.D., P. Eng.  
Professor - Associate Chair for Research  
Norman W. McLeod Professor in Pavement Materials  
Director - Centre For Pavement and Transportation Technology  
Civil and Environmental Engineering

September 9, 2020

**Re: Support Letter for the Centre For Pavement and Transportation  
Technology 2020 Renewal**

I am very glad to write a letter of support for the Centre for Pavement and Transportation Technology (CPATT) at the University of Waterloo. I have collaborated with CPATT members on various projects over the years. We have shared equipment and ideas and these collaborations have proven to be extremely beneficial for my research output. The most recent joint project is on 3-D printing of concrete for application in building modern infrastructure. It is a novel and exciting application of additive manufacturing (3-D printing), which will benefit construction and transportation industries.

CPATT is a unique organization at the University of Waterloo, which provides a forum for research and education for many young engineering professionals. It is well managed, very active, organizes regular meetings and seminars with academia and industry, and brings together engineering faculty and students to conduct collaborative work related to transportation engineering and pavement materials.

I strongly support the renewal of CPATT and I look forward to continued collaboration with the Centre.

Regards,



Maria Anna Polak, PhD, P. Eng., FACI, FCSCE  
Professor and University Research Chair  
Department of Civil and Environmental Engineering  
University of Waterloo  
Waterloo, Ontario, Canada, N2L 3G1  
Email: polak@uwaterloo.ca  
Tel: 1 647 500 3384



Hassan Baaj, Ph.D., P. Eng.  
Professor - Associate Chair for Research  
Norman W. McLeod Professor in Pavement Materials  
Director - Centre For Pavement and Transportation Technology  
Civil and Environmental Engineering

From: Li Ningyuan  
Adjunct Professor, and former employee of Ministry of Transportation of Ontario

Date: September 3, 2020

**RE: Experience and Suggestions in Supporting the CPATT of UW**

As an adjunct professor, my comment on past experience of involving in CPATT research and operational activities is highlighted with a few examples showing remarkable values:

- Since the CPATT was formed in 18 years ago, it has been a symbol representing one of the worldwide recognized entities flagging up advanced transportation engineering and road asset management technologies. The CPATT of UW was initiated by super high-profile Canadian academia Ralph Haas and Gerhard Kennepohl, directed by well-known professors Susan Tighe and Hassan Baaj, supported by a large number of stakeholders and research institutes, and actively operated by all CPATT team members and graduate students.
- As a former senior pavement engineer at the Ministry of Transportation of Ontario (MTO), I had a long-term collaborated working relationship with the CPATT on MTO sponsored HIIFP research projects over the past 15 years, ranging from identifying research needs to delivering high-quality research products, which have been successfully applied to help tackle some of the technical issues and challenges to conserving Ontario's economy based road transportation system. The CPATT's individually specialized research teams have acted, as a consolidated entity, to provide the MTO with most valuable and cost-effective high-tech assistance to Ontario's transport system development.
- The CPATT has presented, representing an entity of the UW and Canadian educational and research entity, at many national and international conferences (such as TAC, CSCE, TRB, AASHTO, etc.), special seminars and symposiums, training programs, to showcase UW's transportation engineering and road asset management technologies through the CPATT in terms of accomplishments and contributions to the globe's transportation engineering, including state-of-the-art research infrastructure in areas of design, materials, construction, preservation, automation, safety, and management for developing new technologies, Training skilled people, technology transfer and sustained partnerships.



- The CPATT has earned a very good and honorable reputation not only in Canada but also in many other countries that are interested in seeking transportation engineering and road asset management educations and academic researches. Every year, it attracts a wide large number of engineering students, road construction industries, visiting scholars and post graduate researchers from the world.
- Also, I should appraise the CPATT's research collaboration with its partnership stakeholders in terms of involving external specialists and road engineering experts in its graduate student research programs, including research statements, comprehensive examinations and PH.D. student thesis review comments.

A couple of suggestions for supporting continuation of the CPATT research collaboration program:

- Provide more training programs and workshops focusing on practical road condition data collection, road materials engineering, road asset management applications as needed by many road agencies and individuals in the world
- Promotion of CPATT research programs through international collaboration with other universities, research institutes and industries in the world.

Li Ningyuan, Ph.D., P.Eng.  
Professional Engineer and Adjunct Professor  
University of Waterloo, Ontario, Canada  
Tel: 416-570-6531  
Email: [NLI@uwaterloo.ca](mailto:NLI@uwaterloo.ca)





September 10, 2020

**Hassan Baaj**, Ph.D, P. Eng.

Professor - Associate Chair for Research Norman W. McLeod Professor in Pavement Materials  
Director - Centre For Pavement and Transportation Technology  
Civil and Environmental Engineering

**RE: Letter of Support for CPATT Renewal Application**

Dear Hassan,

It is with great enthusiasm that I write this letter of support for CPATT's renewal application. As an adjunct assistant professor and former graduate student at CPATT, I am proud to consider myself member of a centre representing high caliber researchers and professors on national and international platforms; who all share the same vision of "providing practical and applied innovation to the pavement industry". This vision requires tremendous effort in engaging practicality and theoretically-sound innovation throughout different stages from idea evaluation to implementation and in-service assessment, which often get neglected at university-level research projects. However, CPATT team has demonstrated repeatedly for almost 20 years how to be a leader in combining innovation and practicality in a multitude of applications pertained to the transportation engineering. Such vision has been showcased in hundreds of journal publications and conference proceedings presented on national and international levels.

CPATT also represents a unique partnership between experts from the academia, industry and transportation authorities. This partnership is an essential platform for the pavement industry in Canada, as it provides a hub to identify research needs in building more sustainable and resilient transportation infrastructure. This partnership overtime has resulted in better incorporation of sustainability into industry practices, improving recycling and material characterization, and more importantly preparing the industry and its practices to deal with climate change.

CPATT has provided tremendous benefit to the industry by training University of Waterloo students to become the skilled professionals and future leaders that the industry needs. Such training has been accomplished by allowing students work and interact with industry experts on CPATT projects. It is important to mention that majority of today's successful leaders within the industry are those who were studied and trained at CPATT. This is certainly a legacy that is hard to accomplish and requires to be maintained.

**McASPALT INDUSTRIES LIMITED**

8800 Sheppard Avenue East  
Toronto, ON M1B 5R4

T 416.281.8181  
F 416.281.8842  
TF 1.800.268.4238

info@mcasphalt.com

mcasphalt.com  
ISO 9001/14001/45001



The pavement industry is going through fundamental changes including shortage of experts due to age gap and impacts of climate change. These challenges combined with developing sustainable practices for constructing and maintaining pavements created a need for CPATT more than ever. I strongly support CPATT renewal and look forward to continuing my collaborative work with the team and feel very enthusiastic about the next five years achievements and accomplishments.

Sincerely,

A handwritten signature in black ink, appearing to read 'Sina Varamini', is written in a cursive style.

**Sina Varamini**, Ph.D, P. Eng.  
Adjunct Assistant Professor – Centre For Pavement and Transportation Technology  
Civil and Environmental Engineering  
Manager, Research and Development – McAsphalt Industries Limited

Research Centre  
8800 Sheppard Ave East  
Toronto, Ontario, M1B 5R4

[svaramini@mcasphalt.com](mailto:svaramini@mcasphalt.com)  
[svaramini@uwaterloo.ca](mailto:svaramini@uwaterloo.ca)

Office: 416-281-8181 (Ext 228)  
Cell: 416-300-1455

September 3, 2020

Hassan Baaj, Ph.D., P. Eng.  
Professor - Associate Chair for Research  
Norman W. McLeod Professor in Pavement Materials  
Director - Centre For Pavement and Transportation Technology  
Civil and Environmental Engineering

**Re: Letter of Support for the Renewal of Centre For Pavement and Transportation  
Technology (CPATT)**

It is with pleasure that I am providing a letter of support for the Centre For Pavement and Transportation Technology (CPATT) at the University of Waterloo. I have interacted with CPATT for over eight years and have had meaningful interaction regarding research and industry connections. Currently, pavement engineering and the transportation sector have significant impact in the Civil Engineering profession and CPATT stands as a premier center for generating and disseminating knowledge in this area. CPATT's initiatives in conducting workshops and seminars are commendable. I believe that CPATT is a well-managed center, plays an important role in developing novel technologies and connecting to the industry partners, and is an important part of UW.

I strongly support the CPATT's renewal and look forward to having more fruitful interactions.

Sincerely,



Dipanjan Basu, Ph.D., P.Eng.

Associate Professor  
dipanjan.basu@uwaterloo.ca



**Waterloo. Ontario**    **Phone:**    (519) 888-4567    Ext. 32098  
**Canada. N2L 3G1**    **Fax:**        (519) 888-6197  
                                 **e-mail :**     gcascant@uwaterloo.ca



September 2, 2020

Hassan Baaj, Ph.D., P. Eng.  
Professor - Associate Chair for Research  
Norman W. McLeod Professor in Pavement Materials  
Director - Centre For Pavement and Transportation Technology  
Civil and Environmental Engineering

**Re:    Support Letter for the Centre For Pavement and Transportation Technology 2020  
      Renewal**

It is my pleasure to provide a letter of support for the Centre For Pavement and Transportation Technology (CPATT) at the University of Waterloo. Over the past six years, CPATT has allowed me to connect to industry partners to obtain research funds, data, and to understand better the transportation industry needs in the area of non-destructive evaluation of pavements. CPATT regularly host industry workshops and seminars; which provide an opportunity to connect with industry and to present my research results.

CPATT has been and continues to provide unique organization at the University of Waterloo.

CPATT is a well-managed Centre; and it has been a pleasure to see it to continue to grow over the years. I strongly support the Centre renewal and to continue to take advantage of industry and research initiatives at CPATT.

Respectively submitted.  
Sincerely,

A handwritten signature in black ink, appearing to read "Giovanni Cascante".

Giovanni Cascante Ph.D., P.Eng.  
Professor,  
Civil and Environmental Engineering Department

**September 11, 2020**

Hassan Baaj, Ph.D, P. Eng.  
Professor - Associate Chair for Research  
Norman W. McLeod Professor in Pavement Materials  
Director – Centre For Pavement and Transportation Technology  
University of Waterloo  
200 University Avenue West, Waterloo, ON, Canada, N2L 3G1  
Phone #: (519) 888-4494  
E-Mail: [hbaaj@uwaterloo.ca](mailto:hbaaj@uwaterloo.ca)

Dear Dr. Baaj,

I am pleased to provide this letter to share my experiences with the Centre for Pavement and Transportation Technology (CPATT), as well as my support in its continuation. I have been involved in CPATT since its initiation in 2005. CPATT has provided a tremendous contribution to the pavement and materials industry, not only in Canada, but globally. Having developed industry members that are now in private and public sector and academic leadership roles around the world.

My involvement with CPATT started as an undergraduate co-op student. I then continued on to do graduate studies. I was fortunate to have the opportunity to use many of CPATT's resources during my doctorate degree. During the time I was involved with CPATT, I had the opportunity to meet various industry members. As a result, I received a job offer prior to even completing my studies. I have now moved into the role of Director of Eastern Operations at PSI Technologies Inc. I utilize my industry network from CPATT almost daily. CPATT has developed many highly skilled professionals while carrying out quality research. I encourage you to continue this valuable program in the future.

Should you have any questions, please contact me at [vhenderson@pavesci.com](mailto:vhenderson@pavesci.com) or 519-661-7332.

Kind regards,



Vimy Henderson, Ph.D., P.Eng.  
Director of Eastern Operations, PSI Technologies Inc.

September 2, 2020

Hassan Baaj, Ph.D., P. Eng.  
Professor - Associate Chair for Research  
Norman W. McLeod Professor in Pavement Materials  
Director - Centre For Pavement and Transportation Technology  
Civil and Environmental Engineering

**Re: Support Letter for the Centre For Pavement and Transportation Technology  
2020 Renewal**

I'm pleased to provide this letter of support for the Centre For Pavement and Transportation Technology (CPATT) at the University of Waterloo. Over the past three years, CPATT has provided me with the opportunities to access the research facilities as well as opportunities to connect to industry partners to obtain research funds, data, and. A most recent project titled "Evaluation of geosynthetic reinforced pavements by field and laboratory testing integrated with thermo-hydro-mechanical modeling" funded by NSERC Alliance Program is attributed to the connection between CPATT and TITAN Environmental Containment Inc. CPATT regularly hosts industry workshops and seminars and provides a platform for academics to communicate effectively with industry. The most recent domestic and international conferences that are hosted by CPATT and I attended are the GRINCH Pavement Engineering Research Symposium 2018 and the RELIM High Performance Asphalt Materials 2019. From these conferences I was able to interact with the researchers and engineers and discuss the most challenging problems in pavement engineering.

Based on my observation and my experience in academia in USA and Canada over the last twelve years, CPATT is the best managed and most successful Centre in a university. I strongly support the Centre renewal and to continue to take advantage of industry



support and research resources constantly initiated and generously offered by CPATT.

Please feel free to let me know if more information is needed.

Sincerely,

A handwritten signature in black ink, appearing to read 'S. Yin'.

Shunde Yin  
Associate Professor, Ph.D.  
Civil and Environmental Engineering Department  
University of Waterloo  
Tel: 519-8884567X33323  
Email: [shunde.yin@uwaterloo.ca](mailto:shunde.yin@uwaterloo.ca)





Dr. Mohab El-Hakim  
310B - 3825 Corlear Avenue  
Bronx, New York 10463  
United States of America

September 10, 2020

Hassan Baaj, Ph.D., P. Eng.  
Professor - Associate Chair for Research  
Norman W. McLeod Professor in Pavement Materials  
Director - Centre For Pavement and Transportation Technology  
Civil and Environmental Engineering  
[hassan.baaj@uwaterloo.ca](mailto:hassan.baaj@uwaterloo.ca)

**Re: Support Letter for the Centre For Pavement and Transportation Technology 2020 Renewal**

Dear Dr. Baaj,

I am delighted to write this support letter for the renewal of the Centre For Pavement and Transportation Technology (CPATT) at the University of Waterloo. CPATT represented a crucial connection between academia and industrial firms in the transportation and highway construction sector. The applied research projects performed by CPATT members are industrial-driven to meet current and future needs to maintain and improve the Canadian transportation infrastructure. The research produced by CPATT is world renowned and well recognized through publications in top scientific journals. CPATT hosted international conferences, seminars and pave-in events where it offered our Canadian industrial partners the opportunity to expand their technical knowledge by collaboration with top academic institutions in Canada and overseas.

The growth of CPATT in the past decade reflects the clear and ambitious vision of the current management. I strongly support the Centre renewal and further development of industrial-academic collaboration on applied research projects.

If you have any questions or require further information, please do not hesitate to contact me.

Sincerely yours,



---

**Mohab El-Hakim, Ph.D., P.Eng.**  
*Assistant Professor*  
*Department of Civil & Environmental Engineering*  
Riverdale, NY 10471  
Phone: 718-862-7274  
[mohab.elhakim@manhattan.edu](mailto:mohab.elhakim@manhattan.edu)  
<https://manhattan.edu/campus-directory/melhakim01>

## MEMORANDUM

TO: Senate Graduate and Research Council

CC: Kathy Winter  
Secretariat

Jean Duhamel  
Director, Institute for Polymer Research (IPR)

Bernard Duncker  
Associate Vice-President, Interdisciplinary Research

FROM: Charmaine B. Dean  
Vice-President, Research and International



DATE: Thursday October 29, 2020

SUBJECT: Support for the Institute for Polymer Research

**- For information -**

---

I am pleased to inform you that, following the presentation from Jean Duhamel, Director of the Engineering-based Institute for Polymer Research (IPR), at the Research Leaders Council meeting of September 30, 2020, and a follow-up discussion of October 28, 2020, and based on discussions and recommendations of Research Leaders Council, I recommend that Senate Graduate and Research Council support the renewal of the Institute for Polymer Research for another five-year term.

**PROGRESS REPORT (for Senate Renewal)  
INSTITUTE FOR POLYMER RESEARCH (IPR)  
2020 - 2025**

Prepared by Colleen Mechler and Jean Duhamel

Submitted by Prof. Jean Duhamel

## Table of Contents

Progress Report .....	2-12
List of Appendices .....	13
Appendix 1 – IPR Current academic members and their research interests .....	14-17
Appendix 2 – IPR current industrial membership list .....	18
Appendix 3 – IPR Annual symposium: <b>sample</b> information <a href="#">Secretary Note: Appendix 3 found here</a> .....	19-52
Appendix 4 – IPR Overview .....	53-55
Appendix 5 – Sample Newsletters (2016 and 2018) <a href="#">Secretary Note: Appendix 5 found here</a> .....	56-110
Appendix 6 – Organizational Chart .....	111-112
Appendix 7 – List of presentations for the Winter 2018 and Winter 2019 IPR Students Seminar Series .....	113
Appendix 8 – Abstracts of the 2018 and 2019 IPR Distinguished Lecturer .....	114-115
Appendix 9 – Detailed financial statement for 2018 and 2019 .....	116-119
Appendix 10 – Letters of support from IPR members .....	120-122
Appendix 11 – Letters of support from Chairs and Deans .....	123-126

# **PROGRESS REPORT (for Senate Renewal) INSTITUTE FOR POLYMER RESEARCH (IPR) 2015 - 2020**

IPR was formed in 1978, as the “copolymer group”, mainly based on the individual efforts of Professors Ken O’Driscoll (Chemical Engineering) and Alf Rudin (Chemistry). As such, it has had the same collaborative research spirit and multidisciplinary nature since its inception. In 1984, IPR was officially recognized by the Senate of the University of Waterloo (UW) as an Institute, and today, IPR is one of the longest-serving Institutes at UW (if not the longest-serving). Given its research, teaching and other activities (detailed in IPR newsletters on an annual basis, which, along with other information, are available on the IPR website <https://uwaterloo.ca/institute-polymer-research/>), IPR also qualifies as one of the most research intensive Institutes of UW. The long history of the IPR is illustrated, among other factors, by the fact that the IPR held its 41<sup>st</sup> annual symposium on May 8<sup>th</sup>, 2019, while the 42<sup>nd</sup> annual symposium, originally scheduled on May 6<sup>th</sup>, 2020, was held virtually on September 2<sup>nd</sup>, 2020 due to the Covid-19 pandemic. IPR has had “institute status” recognized by the UW Senate for 36 years.

IPR consisted initially of researchers in Chemical Engineering and Chemistry, their research groups, and industrial member companies. Research and development interests spanned almost anything in polymer science, polymer engineering and polymeric materials, ranging from monomer/polymer synthesis, polymer production technology, polymer property characterization (physico-chemical to mechanical characteristics), and polymer processing and reactive modification of polymers. The number of academic members of IPR on the UW campus has risen from seven (7) in 1986 to sixteen (16) today. The academic members currently span three departments (Chemistry, Physics and Astronomy, and Chemical Engineering), two faculties (Engineering and Science), two Universities in Canada (Waterloo and Ryerson), and two countries (Canada and Mexico). Of course, with the multiplicative factor of research collaborations and other interactions of its academic members, the overall IPR network is very extensive. The current IPR academic member list (along with members’ research interests) can be found in Appendix 1.

Essentially, the main idea for IPR was to offer improved services to the Canadian polymer industry (initially) and more graduate research training in the field of polymer science and engineering, brought about by the existence of a better infrastructure and increased research activities. These services have developed further over the years and expanded to become worldwide.

IPR delivers in the following areas: Research in synthesis, production, characterization, processing, and modification of polymeric materials; Training of graduate students in polymer science/engineering; Teaching of undergraduate and graduate courses in polymer science/engineering; Collaboration within academic units and also with industrial organizations with the above interests, both in Canada and internationally.

Two additional characteristics of IPR have been impressive over the years. An industrial membership that consistently includes several multinationals in polymer

science, engineering and technology, and that has averaged about 6 member companies per year over the past five years with very strong ties with the IPR academic members (the current IPR industrial member list can be found in Appendix 2). At the same time, IPR interacts with many other (small and medium) companies (some from the immediate Kitchener-Waterloo-Cambridge-Guelph-Stratford-Brantford-Hamilton-London locality), which are not necessarily official IPR industrial members, so again the network is very extensive.

The other impressive characteristic of IPR is the number of MASc/MSc and PhD students trained (i.e., the training of highly qualified personnel), along with post-doctoral fellows, research engineers and other associates. Over the past five years, the IPR graduate student population has numbered 250. On average, there are about 80 active students/research personnel (excluding faculty) per year, representing a considerable percentage of the research work and output of the departments of Chemistry and Chemical Engineering (15 and 40%, respectively). As a quick measure, 48 PhD students have graduated since 2015, along with more than 60 MASc/MSc students. All these students, researchers, and industrial member representatives join the IPR academic members on an annual basis (typically in the first week of May of every year) for an exchange of scientific information on the latest developments and state-of-the-art in the polymer world. The IPR May Conference is a highly anticipated event within the IPR community (sample information can be found in Appendix 3). The last 41<sup>st</sup> annual Symposium held on May 8<sup>th</sup>, 2019 was well attended with an audience of about 60 people with 22 oral presentations by graduate students and two keynote addresses by an academic colleague, Prof. Elizabeth Gillies from Western University (London, Canada) and an industry researcher, Dr. Anna Mathew from Dupont (Kingston, Canada). For its 40<sup>th</sup> symposium on May 9<sup>th</sup>, 2018, the IPR invited Prof. Marc Hillmyer from the University of Minnesota who is the Editor-in-Chief of *Macromolecules*, the top journal in macromolecular science in the world, as its first Distinguished IPR Lecturer. Marc attended the IPR Symposium on May 9<sup>th</sup> where 24 graduate students gave a talk along with Dr. Joel Goldstein from OMNOVA and Dr. Dave Campbell from BASF. Marc gave an excellent lecture and visited the Departments of Chemical Engineering and Chemistry on May 10<sup>th</sup>, 2018.

A few more “info-bits” about IPR’s trajectory at UW follow (see Appendix 4):

(a) IPR’s first director was Professor Ken O’Driscoll (Chemical Engineering) from IPR’s inception in 1978 till 1988. The second director was Professor Alf Rudin (Chemistry), from 1988 to 1994. The third director was Professor Alex Penlidis (Chemical Engineering) from 1994 till 2010. He was succeeded in 2011 by the fourth director, Professor Jean Duhamel (Chemistry), who has headed the institute for the past 9 years.

(b) From its inception, IPR’s mandate has been, and continues to be, the facilitation and “seeding” of interactions between its academic members/students and polymer industry. The mandate is not to fund research or duplicate other services provided by the University. After an interaction is initiated, the IPR academic member(s), along with the industrial partner, may proceed towards a research grant or contract, under the auspices of the Office of Research of UW. IPR’s achievements speak for themselves (extensive information about IPR and its activities, on an annual basis, can be found in

the annual IPR Newsletters, which are located, along with other information about IPR, on the IPR website <https://uwaterloo.ca/institute-polymer-research/> and of which two examples can be found in Appendix 5). These achievements were attained by keeping a tightly focussed core group of academics with common interests in polymerization/polymeric materials, by taking direct action, and by having little bureaucracy since the IPR administration consists of a part-time Administrative Coordinator (Colleen Mechler) and the Director (Jean Duhamel). Also, IPR Directors receive no teaching relief and no stipend. An organizational chart is provided in Appendix 6.

(c) The interested reader can peruse previous Newsletters (available on IPR's website and two attached in Appendix 5 herein) for more information on IPR's extensive contributions to science and engineering, in general, and, more particularly, to the Departments, Faculties and University community, along with more information on "metrics" about its activities and output.

(d) Some benefits of industrial membership in IPR include:

- two days of consulting per year by any IPR faculty member
- preprints of research publications before they appear in the open literature
- free registration to the IPR annual symposium
- reduced rates at potential "in-house" courses for company employees' continuing education/update.
- reduced rates at annual industrial short courses for member companies
- preferential consideration in undertaking contract research and other interactions
- analytical services at reduced cost (no routine analysis)
- rates on specialized lab equipment (no routine use)
- membership on Industrial Advisory Board

(e) A short overview of IPR can be found in Appendix 4. More details about research interests of its academic faculty members and its experimental facilities can be found either in previous IPR Newsletters (accessible via the website or in Appendix 5) or directly via the websites of the individual faculty members.

The last five years have seen some consolidation in the portfolio of IPR activities. Profs. Derek Schipper from Chemistry and Tizazu Mekkonen from Chem. Eng. have joined the IPR. They bring to the institute increased expertise in the areas of light emitting/conducting polymers and biopolymer nanocomposites, respectively. As a matter of fact, four IPR members (Duhamel, Gauthier, Tam, and Zhao) are currently active in this latter research area which is now reaching a critical mass. IPR members continue to participate in and support all major new initiatives in the Faculties of Engineering and Science, and in the University in general as illustrated by their membership in a wide range of centers on campus (e.g., WIN, Nano-technology Engineering, the Waterloo Center for Automotive Research, the Water Institute, the Center for Bioengineering and Biotechnology, the UW Artificial Intelligence Institute, the Waterloo Institute for Sustainable Energy, the Center for Advanced Materials Joining, etc.). The services of IPR to industry have certainly had (in the last 25 years or so) a strong international flavour with industrial members stemming not only from Canada, but also from Saudi Arabia, Europe, and the US. Collaborative research among members of

IPR and also between IPR and other universities was also strengthened.

A summary of IPR's strengths would read as follows.

- A unique breadth and depth in polymer research (from polymer synthesis to polymer modification and characterization); IPR offers a wide spectrum of polymer expertise, plus high quality, fundamental and applied, research results, including extremely well-trained graduate students.
- The IPR provides a springboard for our graduate students to interact with senior researchers from the Polymer Industry and begin successful careers as industry researchers.
- A very cohesive polymer research group in its collaborative, multidisciplinary efforts, encompassing researchers from chemical engineering and chemistry (and more recently, from physics and astronomy, civil, mechanical and electrical engineering, and biology).
- IPR has contributed greatly in continuing to 'keep UW on the international map'.

## **Funding**

IPR academic members have been extremely successful in attracting considerable federal, provincial and industrial funding. During the past five years, all IPR academics have held NSERC Discovery grants, and have been very successful with NSERC Strategic, Collaborative Research and Development (CRD), NSERC Research Tools and Instruments (NSERC RTI), Engage, Collaborative Research Opportunities (CRO), Mitacs Accelerate grants, Ontario Centres of Excellence (OCE), Ontario Ministry of Transportation (MOT), Innovations for Defense Excellence and Security (IDEaS). Please note that IPR researchers had been awarded a Tier 1 Canada Research Chair (CRC) in Polymer Engineering (Penlidis, 2002, renewed in 2009 and 2016 for another 7 years) and a Tier 2 CRC in Organic Material Synthesis (Schipper, 2014, renewed in 2019). Forrest and Tam hold a University Research Chair. The IPR academics have also been involved in numerous research collaborations with industry involving research grants or contracts (e.g., Afton Chemicals with Duhamel; Celluforce with Mekonnen, Tam, and Tzoganakis; BASF with Duhamel and Gauthier; Origin Materials with Duhamel and Gauthier; EcoSynthetix with Duhamel, Gauthier, Tam, Simon, and Zhao; PetroChina, Woods, 3M Canada, MW Canada, and Trojan UV with Tam; Aerus Shield Tech, Celestica Inc., Microbonds Inc., MSW Plastics Inc., and EverBond Interface Techniques Inc. with Zhao; Tyromer with Mekonnen and Tzoganakis; Innotech Alberta with Mekonnen; Canadian General Tower, SiliCyle Inc., and OTI Lumionics Inc. with Li; Imtex with Feng; Airboss Rubber Compounding and Canuck Compounders with Tzoganakis).

The Institute is also delighted to provide five (~\$ 3,500) IPR bursaries every year that are given to graduate students conducting research in the laboratories of IPR members. Furthermore, the IPR is particularly proud to offer on an annual basis two IPR awards worth \$ 600 each to IPR graduate students based on general academic and research performance. Instrumental here has been the continuous support from OMNOVA Solutions, USA, over the last 20 years.

## **Teaching/Graduate and Undergraduate Education**



With the advent of IPR, a formal program of graduate and undergraduate teaching in polymers was agreed to by both the Chemical Engineering and Chemistry Departments. This program provides for the teaching of about four graduate and four undergraduate courses in each academic year. These courses range from 1-2 introductory courses in Polymer Science and Engineering to specialized advanced graduate-level courses in Polymer Reactor Design, Physical Properties of Polymers, Advanced Polymerization Techniques, Metal Containing Polymers, Polymer Glasses, Polymer Self-Assembly, and Polymer Rheology and Processing. All polymer courses are open to Chemical Engineering, Chemistry, and Astronomy and Physics students and are taught to a mix of students (several academic members of IPR have cross-appointments between Chemical Engineering and Chemistry, e.g., Penlidis, Simon, Duhamel).

The collaboration with the Nanotechnology program continues. Two introductory polymer UG courses are also offered in the Nanotechnology program, taught by Profs. Simon and Tam from Chemical Engineering.

IPR students can also access two undergraduate and two graduate courses in polymer science offered by the department of Astronomy and Physics.

The IPR polymer courses are all heavily attended by graduate students from many other departments and disciplines, outside Chemical Engineering, Physics and Astronomy, and Chemistry.

In 2018, the IPR launched the IPR Student Seminar Series where senior IPR graduate students were invited to give an educational presentation on a topic that they had mastered during their graduate studies. The students gave ~ 3-4 presentations in the Fall and Winter terms amounting to 6-8 presentations/yr. The goal of the series is to teach an audience of fellow students the fundamentals of a specific technique that was mastered by a graduate student during the course of her/his graduate work. These presentations are supervised by the IPR director. They have had an excellent turn out and are a wonderful educational tool offered by students to students. A list of students' presentations that were offered as part of the IPR Students Seminar Series is provided as Appendix 7.

### **IPR Annual Symposium/Conference**

Seminar programs offered by IPR and the annual symposium each May provide the opportunity for graduate students (and selected undergraduates) to not only be exposed to other presentations (extremely important for their general education), but also give presentations and posters on their research to an audience composed of representatives from industry as well as academics (typical audience of 50-70 people per conference). Sample information is given in Appendix 3.

### **Research Accomplishments**

The mandate of IPR is not to fund any research or handle any contracts, but rather to provide an interface where industry and academia meet. Contract research by IPR academic members is handled through UW's Office of Research. Therefore, the research accomplishments of IPR are those of its academic members and graduate students. Again, as a quick measure, IPR academics have published on average more than 90 full refereed papers per year, more precisely 97, 97, 86, 94, and 96 in the last 5 years. The manuscripts in their MS-Word format are circulated via IPR to the industrial

members. IPR academics have given more than 30 conference presentations/invited talks per year (91, 66, 77, 44, and 30 in the last 5 years).

Research-related highlights can be found in Appendix 5. This appendix contains two IPR annual Newsletters (from the last 5-yr period), sent to academic and industrial members and selected other affiliates in February of each year (and posted on the IPR web site). See specifically the sections under “Student Awards”, “Faculty Awards”, “Research Publications” and “Other Highlights”.

Over the past five years, Profs. Schipper from Chemistry and Mekonnen from Chem. Eng. have joined the IPR membership in 2017 and 2018, respectively. Prof. Schipper is a Tier 2 Canada Research Chair in Organic Material Synthesis. He brings a strong synthetic expertise to the area of conducting polymers. Prof. Mekonnen’s research focuses on renewable polymers, polymer blends, and nanocomposites. In particular, his work on polysaccharides complements nicely the research conducted by IPR members Duhamel, Simon, Tam, and Gauthier. The annual IPR symposium held in May continues to be an excellent forum where more than 20 IPR students (over a quarter of the IPR student population) present their research in front of an audience constituted of industry researchers, fellow students, and academics. The high esteem of the research conducted within the IPR can be gauged by the number of senior industry researchers who make the effort to attend the IPR symposium every year (3-12 depending on the year). The IPR has also invited several researchers from industry and academia to present their work at Waterloo. These included Drs. Steve Brown from NovaChem, Calgary, AB and Prince Antony from 3M Canada, London, ON on May 4<sup>th</sup>, 2016; Drs. Greg Davidson from Arlanxeo, London, ON and Andrew Kee from Woodbridge Foam Corporation in Mississauga, ON on May 3<sup>rd</sup>, 2017; Prof. Nikos Kalogerakis from the University of Crete on June 2, 2017; Drs. Joel Goldstein from OMNOVA Solutions Inc. in OH, USA and Dave Campbell from BASF, Wyandotte, MI, USA on May 9<sup>th</sup>, 2018; Dr. Peter Scott from 3M Advanced Materials Division, St. Paul, MN, USA on June 26<sup>th</sup>, 2018; Prof. Elizabeth Gillies from Western University, London, ON and Dr. Anna Mathew from Dupont, Kingston, ON on May 8<sup>th</sup>, 2019; Prof. Guang Yang from Huazhong University of Science and Technology, China on August 8<sup>th</sup>, 2019. For its 40<sup>th</sup> anniversary in 2018, the IPR also introduced the IPR Distinguished Lecture Series. The first IPR Distinguished Lecturer was Prof. Marc Hillmyer, the Editor-in-Chief of *Macromolecules*, the top journal in Macromolecular Science in the world. He gave his presentation on *Nanoporous Materials Employing Disordered Block Polymers as Key Ingredients* on May 10<sup>th</sup>, 2018. The second IPR Distinguished Lecturer was Prof. Mitchell A. Winnik from the University of Toronto, ON, Canada. His presentation on *Biomedical Applications of Metal-Chelating Polymers and Lanthanide Nanoparticles* was held on February 5<sup>th</sup>, 2019. The abstracts of the distinguished lecturers can be found in Appendix 8.

Other IPR highlights in research from the past five years include the following: Alex Penlidis and Derek Schipper are the holders of a Tier 1 and 2 CRC, respectively, and Jamie Forrest and Michael Tam are the holders of a University Research Chair. Between 2016 and 2019, Mario Gauthier was the recipient of the High-End Foreign Experts Program Award with Wuhan in the Hubei Province (China).

## Service

- a) **To Industry and to the Community at Large:** The IPR provides continuous interactions not only with our IPR industrial members but also with other small/medium (local) and more global companies (see again items in Appendix 4).

A sample of companies that have interacted with IPR on a more informal basis in the last five years include: Canadian General Tower, Cambridge, ON; Cooper Standard, Georgetown, ON; Honeywell, Pottsville, PA, USA; Chitoytic Inc., St. John's NF.

- b) **To the Academic Community:** IPR academic members serve on Editorial Boards, act as journal referees and serve as editors or co-editors for numerous internationally respected journals (Prof. Duhamel serves as associate editor for *Polymers*; Prof. Feng is an editorial board member of *J. Membrane Sci., Sep. Purif. Technol., J. Eng. Sci. (Pakistan), J. Membrane Sci. Res., and J. Technol. (Malaysia)*; Prof. Yuning Li serves as an Editorial Board member of *Intl. J. Nano Stud. Technol., Electronics, AIMS Env. Sci., Adv. Nanopart.,* and was a guest co-editor for *Adv. Poly. Technol.*; Prof. Mekonnen was an editorial board member of *Processes* and served as guest editor for *Processes*; Prof. Penlidis has been an editorial board member of *J. Macromol. Sci.-Pure and Appl. Chem., Polymer-Plastics Technol. Eng., Macromol. React. Eng., and Processes*; Prof. Tam is an associated editor for *ACS Sustain. Chem. Eng.*; Prof. Tzoganakis serves on the editorial board of *Adv. Polym. Technol.*; Prof. Zhao has served as guest editor for *Polymers*.

- c) **Additional examples of service include:** Forrest, Director of Academic programs, Perimeter Institute for Theoretical Physics; Gauthier, Chemistry Associate Chair, Graduate Studies and Research; Li, Associate Chair for Graduate Studies, Department of Chemical Engineering; Mekonnen, Undergraduate recruitment and outreach committee lead, Department of Chemical Engineering; The IPR members have also been organizing numerous conference sessions and editorship of special conference theme journal issues (e.g., *Intl. Symp. Membranes Environ. Pollution Control*, April 2016, Tianjin, China; *2016 North American Membrane Soc. Meet.*, May 2016, Bellevue, WA, USA; *37<sup>th</sup> High Polymer Forum*, August 2016, Gananoque, ON; *Intl. Congr. on Membranes and Membrane Processes (ICOM)*, Jul-Aug 2017, San Francisco, CA, USA; *Intl. Symp. on Oil Vapor Emission and Recovery*, Aug 2017, Changzhou, China; *26<sup>th</sup> Intl. Mater. Res. Conf.*, August 2017, Cancún, México; *Intl. Conf. on Polym. and Adv. Mater. (POLYMAT)*, October 2017, Huatulco, Mexico; *67<sup>th</sup> Canadian Chem. Eng. Conf.*, Oct 2017 Edmonton, AL; *2017 Annual Meet. of the Adhesion Soc.*, Feb 2017, St. Petersburg, Florida, USA; *68<sup>th</sup> Canadian Chem. Eng. Conf.*, Oct. 2018, Toronto; *2018 AIChE Annual Meeting*, Oct. 2018, Pittsburgh, PA, USA; *2018 AIChE Annual Meeting*, Oct.-Nov. 2018, Pittsburgh, PA, USA; *101<sup>st</sup> Canadian Chemistry Conf.* June 2018, Edmonton; *38<sup>th</sup> High Polymer Forum*, July 2018, Gananoque, ON; *27<sup>th</sup> Intl. Mater. Res. Conf.*, August 2018, Cancún, México; *Intl. Symp. on Bioplastics, Biocomposites, and Biorefinery*, July 2018, Guelph, ON; *34<sup>th</sup> Intl. Conf. of the Polym. Processing Soc. (PPS)*, May 2018, Taipei, Taiwan; *2018 Annual Meet. of the Adhesion Soc.*, Feb.

2018, San Diego, CA, USA; 5<sup>th</sup> Global Conf. on Polym. and Composite Mater. (PCM 2018), Apr. 2018, Kitakyushu City, Japan; 4<sup>th</sup> Intl. Conf. on Nanojoining and Microjoining (NMJ 2018), Dec. 2018, Nara, Japan; 35<sup>th</sup> Intl. Conf. of the Polym. Processing Soc. (PPS), May 2019, Cesme, Turkey; 3<sup>rd</sup> Intl. Conf. of Energy Harvesting, Storage, and Transfer (EHST'19) June 2019, Ottawa, ON; 6<sup>th</sup> Intl. Conf. of Fluid Flow, Heat and Mass Transfer (FFHMT'19), June 2019, Ottawa, ON; 102<sup>nd</sup> Canadian Chem. Conf. June 2019, Québec; 6<sup>th</sup> Intl. Conf. of Fluid Flow, Heat and Mass Transfer (FFHMT'19), June 2019, Ottawa; 2019 Annual Meet. of the Adhesion Soc., Feb. 2019, Hilton Head, SC, USA; 69<sup>th</sup> Canadian Chem. Eng. Conf., Oct. 2019, Halifax, NS)

- d) Other Collaborations:** IPR members collaborate extensively with researchers in Brazil at the University of Campinas (Tam), in Canada at McMaster U. (Duhamel), the U. of Toronto (Li), Carlton U. (Li), the University of Ottawa (Penlidis), Ryerson University (Penlidis), and TRIUMF (Forrest), in China at Huazhong University of Science of Technology (Gauthier), Henan Academy of Science (Li), Soochow University (Li), the Hong Kong University of Science and Technology (Wang), and Sun Yat-sen University (Li), in the Czech Republic at the Tomas Bata University in Zlin (Tzoganakis), in Finland at the U of Helsinki (Duhamel), in France at the U. of Bordeaux (Duhamel, Forrest, Gauthier, Li), the University of Aix-Marseille (Li), and the Ecole Supérieure de Physique et Chimie Industrielle (ESPCI, Forrest), in Germany at the U. of Munchen (Duhamel), in Greece at the University of Crete, Heraklion (Gauthier), in India at the CSIR-North East Institute of Science & Technology (Feng), in Israel at Technion (Li), in Mexico at UNAM (Duhamel, Penlidis), in Singapore at Nanyang Technological University (Tam) and the National University of Singapore (Zhao), in Taiwan at the National Chiao Tung University (Wang), in the UAE at the Khalifa University of Science and Technology (Feng), in the UK at the Imperial College, London (Li), in the USA at Georgetown U. (Duhamel), Kent State University (Zhao), the University of California, Berkely (Zhao), and Case Western Reserve U. (Li).

### **Plan for the Next Five Year Period**

- a) **Projected Budget:** The yearly expenses and income of the IPR, averaged over the past five years but excluding Yr-2018 for the 40<sup>th</sup> anniversary of the IPR, are summarized in Table 1. In terms of annual costs, the IPR spends \$ 5,500 to pay for the different venues of the annual IPR Symposium (without including the salary cost of IPR Administrative Coordinator), \$ 1,200 for the two annual IPR Awards of \$ 600 each, \$ 17,500 for 5 IPR research stipends/yr of \$ 3,500 each offered to IPR members on a rotation basis, \$ 2,500 for the IPR Distinguished Lecturer, \$ 7,580 in consulting fees, and \$ 13,230 to cover the yearly salary of the IPR Administrative Coordinator. Consequently, the total annual cost for running the IPR amounts to \$ 47,510/yr.

In terms of revenues, the IPR presently receives \$ 24,000 from industrial memberships, \$ 4,000 (down from \$ 8,000) in university support for the organization of the IPR Symposium, \$ 18,700 donation from OMNOVA for student stipends, and

\$ 1,500/yr in interest from the Xerox account. Together, the IPR is receiving \$ 48,200/yr in revenue.

**Table 1A.** Averaged yearly expenses and income of the IPR for 2020

<b>Yearly expenses</b>		<b>Yearly income</b>	
IPR Symposium	\$ 0	Industry Membership	\$ 23,965
2 IPR Awards (\$ 600 each)	\$ 1,200	University support for IPR Symposium	\$ 0
5 IPR Student Stipends (\$ 3.5K each)	\$ 17,500	OMNOVA Donation	\$ 18,700
IPR Distinguished Lecturer	\$ 0	Xerox Account Interest	\$ 1,500
Salary of Administrative Coordinator (Colleen Mechler)	\$ 13,230		
Consulting fees	\$ 7,580		
<b>Total</b>	<b>\$ 39,510</b>	<b>Total</b>	<b>\$ 44,165</b>

In 2020, the IPR symposium was cancelled and was held virtually on September 2<sup>nd</sup>. The IPR Distinguished lecture was also cancelled. Mondelez joined the IPR for one year and requested several days of consulting.

**Table 1B.** Averaged yearly expenses and income of the IPR for 2021

<b>Yearly expenses</b>		<b>Yearly income</b>	
IPR Symposium	\$ 0	Industry Membership	\$ 14,000
2 IPR Awards (\$ 600 each)	\$ 1,200	University support for IPR Symposium	\$ 0
5 IPR Student Stipends (\$ 3.5K each)	\$ 17,500	OMNOVA Donation	\$ 18,700
IPR Distinguished Lecturer	\$ 0	Xerox Account Interest	\$ 1,500
Salary of Administrative Coordinator (Colleen Mechler)	\$ 13,700		
Consulting fees	\$ 1,200		
<b>Total</b>	<b>\$ 33,600</b>	<b>Total</b>	<b>\$ 34,200</b>

The 2021 budget takes into account the withdrawal of Mondelez and the inability to hold the symposium due to Covid. The predicted consulting fees are much reduced as a result. A \$ 500 increase in the salary of the administrative coordinator is also included.

**Table 1C.** Averaged yearly expenses and income of the IPR for 2022

<b>Yearly expenses</b>		<b>Yearly income</b>	
IPR Symposium	\$ 5,500	Industry Membership	\$ 14,000
2 IPR Awards (\$ 600 each)	\$ 1,200	University support for IPR Symposium	\$ 4,000
5 IPR Student Stipends (\$ 3.5K each)	\$ 17,500	OMNOVA Donation	\$ 18,700
IPR Distinguished Lecturer	\$ 2,500	Xerox Account Interest	\$ 1,500
Salary of Administrative Coordinator (Colleen Mechler)	\$ 14,200	Sponsorships	\$ 2,000
Consulting fees	\$ 1,200		
<b>Total</b>	<b>\$ 42,100</b>	<b>Total</b>	<b>\$ 40,200</b>

A normal symposium is expected to resume in 2022 along with the IPR Distinguished Lecture. With the symposium comes the opportunity for sponsorships which have been added to the budget.

**Table 1D.** Averaged yearly expenses and income of the IPR for 2023

<b>Yearly expenses</b>		<b>Yearly income</b>	
IPR Symposium	\$ 5,500	Industry Membership	\$ 14,000
2 IPR Awards (\$ 600 each)	\$ 1,200	University support for IPR Symposium	\$ 4,000
5 IPR Student Stipends (\$ 3.5K each)	\$ 17,500	OMNOVA Donation	\$ 18,700
IPR Distinguished Lecturer	\$ 2,500	Xerox Account Interest	\$ 1,500
Salary of Administrative Coordinator (Colleen Mechler)	\$ 14,700	Sponsorships	\$ 2,000
Consulting fees	\$ 1,200		
<b>Total</b>	<b>\$ 42,600</b>	<b>Total</b>	<b>\$ 41,200</b>

As Table 1D indicates, the budget has a structural deficit. There are three ways of dealing with this deficit. First, UW might be willing to increase its support for the IPR Symposium (it used to stand at \$ 8K with \$ 1K from Chemistry, \$ 1K from Chem. Eng., \$ 1K from Science, \$ 1K from Engineering, and \$ 4K from OR). Second, we should be able to secure another company sponsorship. Third, if the two previous options do not work, we might have to cancel our IPR Distinguished Lectureship.

**Table 1E.** Averaged yearly expenses and income of the IPR for 2024

<b>Yearly expenses</b>		<b>Yearly income</b>	
IPR Symposium	\$ 5,500	Industry Membership	\$ 14,000
2 IPR Awards (\$ 600 each)	\$ 1,200	University support for IPR Symposium	\$ 4,000
5 IPR Student Stipends (\$ 3.5K each)	\$ 17,500	OMNOVA Donation	\$ 18,700
IPR Distinguished Lecturer	\$ 2,500	Xerox Account Interest	\$ 1,500
Salary of Administrative Coordinator (Colleen Mechler)	\$ 15,200	Sponsorships	\$ 2,000
Consulting fees	\$ 1,200		
<b>Total</b>	<b>\$ 43,100</b>	<b>Total</b>	<b>\$ 41,200</b>

Same comments as for Table 1D.

- b) **Future Research Directions and Development Strategies:** Samples of the IPR budget are cited in Appendix 9. We plan to maintain the IPR faculty membership at approximately the same size as it is now and with the same objectives. These objectives are to continue fostering polymer research at Waterloo via interactions with researchers from academia on campus or from other universities and from the industry sector and expanding the polymer expertise of the IPR in new directions by including new members as new hires are being done on campus. Key in this process is the annual IPR symposium that brings together researchers from academia and industry and offers a venue where potential members can get a glimpse of what the IPR is about. With the gathering of information required to complete the annual newsletter, the organization of the annual symposium held in

May is the single most time-consuming item in the list of tasks that need to be conducted during the year, and this action will continue during the next five years.

Continuity of the research and teaching activities of IPR is guaranteed by (a) the increasing maturity exhibited in the last five years by its new/young members and (b) the increased mentorship exhibited by its older, more established, members.

Some immediate and longer term initiatives for the next five years will include:

- (a) offering of short courses at Waterloo in Polymer Science and Engineering opened to industry scientists/engineers. The offering of short courses represents an excellent means to increase the IPR visibility in the polymer research community.
- (b) inclusion of new members to the IPR as new hires in Polymer Science or Engineering take place on campus
- (c) diversification of the composition of the IPR membership. Although the IPR membership is incredibly diverse from a nationality perspective (only 25% of its members were born in Canada) and the IPR student population is 42% female, the absence of female academic members in the IPR needs to be attended to.
- (d) continue the IPR Students Seminar Series by encouraging senior graduate students to deliver lectures on a research topic that they have mastered during their graduate studies.
- (e) find funding to continue the IPR Distinguished Lecture Series. These presentations given by outstanding researchers in Polymer Science and Engineering are inspirational for the young students conducting their research within the IPR.

## LIST OF APPENDICES

<b>APPENDIX 1</b> .....	<b>14-17</b>			
IPR current academic members and their research interests				
<b>APPENDIX 2</b> .....	<b>18</b>			
IPR current industrial membership list				
<b>APPENDIX 3</b> .....	<b>19-52</b>			
IPR Annual symposium: <b>sample</b> information <span style="color: red;">Secretary Note: Appendix 3 found here</span>				
<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; border-right: 1px solid black; padding: 5px;"> <u>Schedules and lists of participants</u> 2016 and 2018             </td> <td style="width: 33%; border-right: 1px solid black; padding: 5px;"> <u>Two extended abstracts for</u> <b>2017</b> -Nimer Murchid -Nicholas Lanigan             </td> <td style="width: 33%; padding: 5px;"> <u>Two extended abstracts for</u> <b>2019</b> -Remi Casier -Ewomazino Ojogbo             </td> </tr> </table>		<u>Schedules and lists of participants</u> 2016 and 2018	<u>Two extended abstracts for</u> <b>2017</b> -Nimer Murchid -Nicholas Lanigan	<u>Two extended abstracts for</u> <b>2019</b> -Remi Casier -Ewomazino Ojogbo
<u>Schedules and lists of participants</u> 2016 and 2018	<u>Two extended abstracts for</u> <b>2017</b> -Nimer Murchid -Nicholas Lanigan	<u>Two extended abstracts for</u> <b>2019</b> -Remi Casier -Ewomazino Ojogbo		
<b>APPENDIX 4</b> .....	<b>53-55</b>			
IPR Overview				
<b>APPENDIX 5</b> .....	<b>56-110</b>			
Sample Newsletters <span style="color: red;">Secretary Note: Appendix 5 found here</span> 2016 and 2018				
<b>APPENDIX 6</b> .....	<b>111-112</b>			
Organizational Chart				
<b>APPENDIX 7</b> .....	<b>113</b>			
List of presentations for the Winter 2018 and Winter 2019 IPR Students Seminar Series				
<b>APPENDIX 8</b> .....	<b>114-115</b>			
Abstracts of the 2018 and 2019 IPR Distinguished Lecturer				
<b>APPENDIX 9</b> .....	<b>116-119</b>			
Detailed financial statement with an itemized budget for 2018 and 2019 (2 pages)				
<b>APPENDIX 10</b> .....	<b>120-122</b>			
Letters of Support from IPR Members				
<b>APPENDIX 11</b> .....	<b>123-126</b>			
Letters of Support from Chairs and Deans				



## IPR CURRENT ACADEMIC MEMBERS/RESEARCH INTERESTS

**Dr. Jean Duhamel**, Professor, *Director: Institute for Polymer Research* Department of Chemistry

### **Research Interests**

Characterization of the internal dynamics and conformation of macromolecules and their aggregates in solution using a combination of fluorescence, light scattering, rheology, and surface tension;

### **Research Projects**

Modification of oil-soluble dispersants and their characterization, polymer/surfactant associations in solution, dynamics and conformation of polymeric bottle brushes, polypeptides, and polysaccharides in solution, polymer diffusion during latex film formation.

**Dr. Xianshe Feng**, Professor, Department of Chemical Engineering

### **Research Interests**

Synthetic membranes and membrane processes, hollow fibers, membrane-based contactors and reactors, adsorption separation, facilitated transport, and hybrid separation processes.

### **Research Projects**

Development and characterization of hollow fiber membranes, gas separation and purification, separation of azeotropic and close-boiling liquids by pervaporation, olefin/paraffin separation, volatile organic compounds (VOCs) recovery, CO<sub>2</sub> capture from flue gas.

**Dr. James Forrest**, Professor, Department of Physics and Astronomy

### **Research Interests**

Deals with the physical phenomena that are observed in soft materials in general and more particularly in polymer thin films. He is interested in the characterization of confined polymer chains through the study of their glass transition and the properties of polymer interfaces and adhesion phenomena.

### **Research Projects**

Properties of polymeric materials with a particular emphasis on the properties of thin films of polymers or the properties of polymers at surfaces or interfaces.

**Dr. Mario Gauthier**, Professor, Department of Chemistry

### **Research Interests**

Synthesis, characterization, and applications of highly branched (arborescent) polymers. Polymer-supported reagents and catalysts, polymer modification, copolymerization, ion-containing polymers, water-soluble polymers. Polymer-modified metallic particles. Microencapsulation and drug release. Emulsion polymerization.

### **Research Projects**

Novel synthetic routes to highly branched (arborescent) polymers. Arborescent polymers as drug delivery vehicles. Interfacial properties of amphiphilic copolymers. Copolymer micelles for the preparation of polymer-stabilized metallic nanoparticle catalysts. Polyisobutylene ionomers. Starch modification for applications in water decontamination and oil recovery from bituminous sands.

**Dr. Yuning Li, Associate Professor, Department of Chemical Engineering**

**Research Interests**

Design and synthesis of conducting and semiconducting polymers. Processing and molecular organization control of crystalline polymers.

**Research Projects**

Development of polymers and printed organic electronics including organic thin film transistors (OTFTs) for flexible displays, radio frequency identification (RFID) tags, sensors, and memory devices, organic photovoltaics (OPVs) for solar cells and photodetectors and organic light-emitting diodes (OLEDs), and rechargeable batteries.

**Dr. Tizazu Mekonnen, Assistant Professor, Department of Chemical Engineering**

**Research Interests**

Polymer modifications and processing, Dispersion Rheology and dynamics of colloidal nanomaterials, Renewable polymers, Nanostructured polymers, Polymer structure-property and applications development, Multifunctional composites for coating and packaging applications.

**Research Projects**

Synthetic strategies of nanocellulose surface modification for functional bio-nanocomposites, Natural rubber and nitrile based latex glove and condom nanocomposites, Enzymatic polymerization derived engineered polysaccharides as reinforcing fillers of polymers, Recycled polymers for wood plastic composites, and Sustainable reinforcing fillers for rubber composites.

**Dr. Alexander Penlidis, Professor, Department of Chemical Engineering**

**Research Interests**

Kinetics, mathematical modelling and simulation of polymerization processes, polymer and latex sensors, polymer reactor design, optimization and computer control.

**Research Projects**

Optimal sensor selection for polymerization processes, initiator performance evaluation, multifunctional initiators, depropagation kinetics, modelling and kinetics of emulsion copolymerizations, model discrimination in polymerization processes, polymer kinetics, trajectory control in batch and semi-batch emulsion reactors, multiresponse estimation and experimental design methods, control of polymer reactors, suspension polymerization of styrene/divinyl benzene, properties of polymeric materials, creep in pipes, living radical polymerization, design of polymeric molecules for targeted applications, terpolymers for EOR, polymers as sensing materials.

**Dr. Derek Schipper, Associate Professor, Department of Chemistry**

**Research Interests**

Organic materials chemistry. Development of novel synthetic methods that allow efficient access to important conjugated materials to be used as organic photovoltaics, light emitting diodes and field-effect transistors.

**Research Projects**

Our research is focused on tackling synthetic challenges posed in the context of conjugated organic materials. These materials are poised to make significant technological breakthroughs that will enable the advancement of flexible, lightweight, low-cost electronic devices such as photovoltaics, light emitting diodes and field-effect transistors. The performance of any device depends on the bulk properties of the active material. Improvements of the material properties arise from modification of the material on the molecular level and, therefore, stem from advances in the design and synthesis of new molecular architectures. Our ability to design and

construct new materials is limited only by the synthetic tools available to us. Innovative new synthetic capabilities will allow the design of novel molecular architectures and enable the ability to answer fundamental questions about structure/function relationships. Ultimately, this will lead to enhanced properties for these new materials and, therefore, improved device performances.

**Dr. Leonardo Simon, Associate Professor, Department of Chemical Engineering**

**Research Interests**

Synthesis of polymers using coordination catalysis, characterization of polymer structure, and testing thermal and mechanical properties of polymers; development of novel polymer nanocomposites, mathematical modeling of polymerization mechanisms.

**Research Projects**

Modeling structure-properties of ethylene-alpha olefin copolymers; preparation of polymer nanocomposites with nanosize fillers using in situ polymerization for applications in energy, automotive and coatings; chemical, thermal and mechanical characterization of materials; synthesis and modeling of advanced thermoplastic elastomers; characterization of membrane electrolyte assemblies (MEA) for hydrogen fuel cells; wood and crop polymer bio-composites; chemical mapping of thin-films with Fourier transform spectroscopy (FTIR) microscopy.

**Dr. Michael Tam, Professor, Department of Chemical Engineering**

**Research Interests**

Magnetic nano-particles for protein purification, Nano-structured systems from templating process, Block copolymers and self assembly systems, Enhanced drug delivery systems, Atom transfer radical polymerization (ATRP) and stimuli responsive polymeric systems, Polymer-surfactant interactions, Sustainable nanomaterials, Temperature and pH-responsive microgel systems, Rheological, calorimetric titration and light scattering techniques.

**Research Projects**

Functionalized of nanocrystalline cellulose, delivery systems for personal care and medical applications, polymer surfactant interactions, development of conductive inks, sustainable nanomaterials for water treatment applications.

**Dr. Costas Tzoganakis, Professor, Department of Chemical Engineering**

**Research Interests**

Polymer processing, reactive extrusion of polymers, rubber devulcanization, chemical modification of polymers, polymer and rubber composites, processing of polymers with supercritical fluids, mathematical modeling and computer simulations of polymer processing, and rheology of polymer melts.

**Research Projects**

UV modification of polymer films, rubber devulcanization using supercritical CO<sub>2</sub>, analysis of flows in twin-screw extruders, plastics recycling, wood-plastic composites, rubber-cellulose composites, compounding of polymer blends, scale-up rules for polymer reactive extrusion, inferential sensors for rheological properties, hydrosilylation of polyolefins through reactive extrusion, extrusion of polymer blends with supercritical CO<sub>2</sub>, analysis of mixing in twin screw extruders, controlled-rheology polypropylenes, polymer micronization with supercritical CO<sub>2</sub>.

**Dr. Boxin Zhao, Assistant Professor, Department of Chemical Engineering**

**Research Interests**

Smart polymers, bionanomaterials, polymer nanocomposite, surface science, biomimicry, soft robotics, hydrogels, coating and adhesives, colloids and interfacial technology.

**Research Projects**

Biomimetic adhesion and bio-inspired materials for soft robotic devices, antimicrobial polymers and coatings, electrically conductive polymers, polyelectrolyte colloids, interfacial phenomena and surface chemistry, nanoparticles functionalization and dispersion in nanocomposites, flexible electronics, smart windows.

## APPENDIX 2

### IPR CURRENT INDUSTRIAL MEMBERSHIP LIST

Afton Chemical Corporation

Lanxess Inc.

Mondelez

Omnova Solutions Inc.

Princeton Polymer Consultants

Compuplast Canada Inc.

PolyVation, The Netherlands

# APPENDIX 4 IPR OVERVIEW

## IPR Overview

### **INSTITUTE FOR POLYMER RESEARCH (IPR) University of Waterloo Overview**

- Established in 1978
- Officially recognized by the University Senate in 1984 (5-yr Senate Renewal reports)
- Longest-serving active Institute at the University of Waterloo
- Mainly researchers in the Departments of Chemical Engineering and Chemistry and their research groups (and other affiliates) **PLUS** Industrial organizations with interests in: Synthesis, Production, Characterization, Processing and Modification of Polymers
- Collaborative efforts between departments, faculties, universities and countries

### **IPR MEMBER COMPANIES (2015-2020)**

Afton  
BASF (until 2019)  
Lanxess Inc.  
OMNOVA Solutions Inc., USA  
Princeton Polymer Consultants, USA  
Compuplast Canada Inc.  
PolyVation, The Netherlands

### **SOME BENEFITS OF INDUSTRIAL MEMBERSHIP**

1. A total of two days consulting per year at a location of your choice. The company's obligations are concerned with travel expenses, only, if any.
2. Receipt of pre-prints of our research manuscripts as they are accepted for publication. This gives the member company access to recent state-of-the-art research results before they appear in the open literature.
3. Free registration (except for room and board) for representatives of the member company at the annual Symposium of the Institute for Polymer Research which takes place annually in May.
4. Industrial Short Courses
  - General Courses--Polymer Science and Polymer Reaction Engineering
  - Courses on specific technologies (e.g., polyolefins, PVC, emulsions...)
  - Special discounts for member companies
  - Special rates for in-house courses for member companies
5. Preferential consideration in undertaking contract research and other interactions.

6. Reduced rates on our specialized equipment (GPC/MALLS, Rheology, high temperature GPC/Viscometer, etc.).

- Such services are normally not available to non-member companies.
- Rates are negotiated based on the number of samples or the scope of project.
- Analysis possible only for short-term research purposes, not for routine analysis

### **MEMBERSHIP FEE**

- The membership fee is \$6000
- Membership renewable annually
- Several levels of membership
- Possibilities of additional donations (e.g., federal or provincial matching scholarships)

### **TRAINING**

- Waterloo has the largest co-op education program in North America.
  - The polymer research group has had over the last 25 years or so, on the average, ~80 graduate students per year in chemical engineering and chemistry. The IPR provides interdisciplinary training and develops high calibre polymer scientists and engineers.
- **IPR provides intensive short courses at Waterloo, or in-house, for industry.**

### **ACADEMIC MEMBERS OF IPR**

Ramdhane Dhib	Chemical Eng, Ryerson
Thomas Duever	Chemical Eng, Ryerson
Jean Duhamel, Director	Chemistry
Xianshe Feng	Chemical Eng
Jamie Forrest	Physics and Astronomy
Mario Gauthier	Chemistry
Yuning Li	Chemical Eng.
Tizazu Mekonnen	Chemical Eng. (member since 2018)
Alex Penlidis	Chemical Eng
Derek Schipper	Chemistry (member since 2017)
Leonardo Simon	Chemical Eng
Michael Tam	Chemical Eng
Costas Tzoganakis	Chemical Eng
Eduardo Vivaldo-Lima	ChE/UNAM/Mexico
Xiaosong Wang	Chemistry (member since 2012)
Boxin Zhao	Chemical Eng. (member since 2011)

### **MAJOR PIECES OF TEST, ANALYTICAL OR PROCESS EQUIPMENT**

- twin screw compounding equipment
- single- and twin-screw extruders
- injection molder (50 ton)
- polymer molecular weight, composition and structural analysis
- rheological characterization of plastics
- thermal characterization equipment

- torque rheometer
- on-line density/flow/viscosity sensors
- high temperature gel permeation chromatography
- dynamic mechanical analysis
- Magneflow MagStation (Oxford Instruments): Low field (20 MHz) solid state NMR for product quality control studies
- Equinox 55 FTIR + Scope II (Bruker): FTIR Spectrometer with a microscope
- DMTA V (Rheometrics): Dynamical mechanical test analyser
- parallel disk rheometer (Westech/TA)
- Disc centrifuge photosedimentometer for high resolution particle size distribution analysis (Brookhaven instruments)
- general (all purpose) particle size analyser for colloidal suspensions (Brookhaven instruments)
- NCTL Device for analysing stress crack resistance
- microcalorimeter DSC III (Setaram): DSC and ultra sensitivity calorimetry for polymerisation reaction and crystallization studies
- additional \$100,000. for laboratory enhancements, including the construction of a walk-in fumehood for a new gas-phase reactor system
- CFI from Sci.: SEM/EDX, Imaging ESCA/SIMS
- Tensor 27 (Bruker) for FT-infrared spectroscopy with attenuated total reflectance (ATR) for surface analysis
- Hyperion 2000 (Bruker) for optical microscopy coupled to FT-infrared spectroscopy, transmission and reflectance modes
- Minimat 2000 (Rheometrics) for stress-strain tension, compression, and flexural mechanical testing
- Cryo-ultramicrotome Leica UC6, preparation of rubber, thermoplastic or thermo-setting polymer samples, biomaterials or industrial materials. Sections down to 10 nanometers prepared below glass transition temperature, temp. as low as -160 °C.



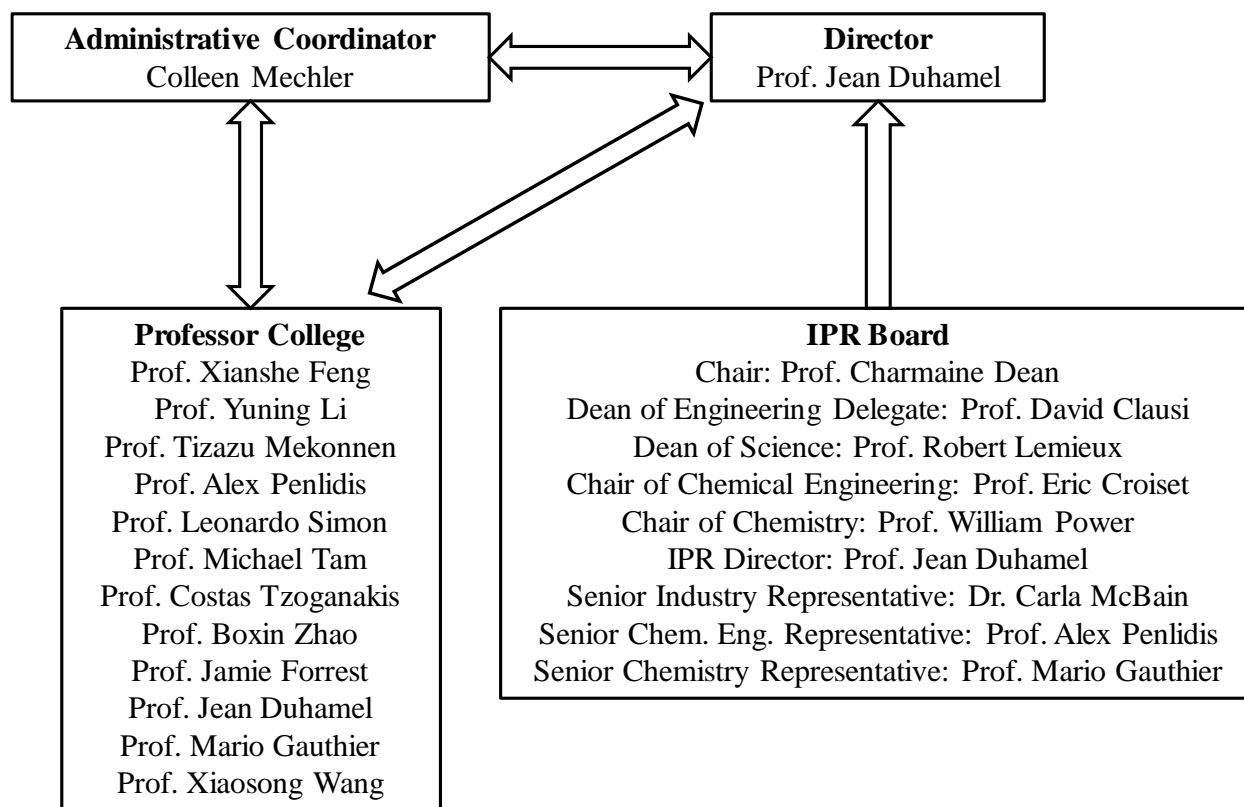
# APPENDIX 6

## Organizational Chart

### Organizational Chart of the IPR

The IPR organization consists of a Director (Prof. Jean Duhamel), an administrative Coordinator (Colleen Mechler), a college of 13 professors based at UW (Profs. Xianshe Feng, Yuning Li, Tizazu Mekonnen, Alex Penlidis, Leonardo Simon, Michael Tam, Costas Tzoganakis, Boxin Zhao from Chemical Engineering, Prof. Jamie Forrest from Physics, and Profs. Jean Duhamel, Mario Gauthier, and Xiaosong Wang from Chemistry), and the IPR board (Profs. Charmaine Dean (Chair), David Clausi (Dean of Engineering Delegate), Robert Lemieux (Dean of Science), Eric Croiset (Chair of Chemical Engineering), Bill Power (Chair of Chemistry), Jean Duhamel (IPR Director), Alex Penlidis (Senior Chem. Eng. Representative), Mario Gauthier (Senior Chemistry Representative), and Dr. Carla McBain (Senior Industry Representative)). These constituting units and their interactions within the IPR are illustrated in Figure 1 and are briefly described hereafter.

The Director and Administrative Coordinator are interacting constantly to ensure the day-to-day operation of the Institute. In particular, the Administrative Coordinator will communicate request by the Director for actions to be completed by the members of the Professor College (information for newsletter or senate report, suggestions for student presenters at the IPR Symposium or for the IPR Student Presentation Series, ....) and will bring up issues/actions that need to be dealt with by the Director. Members of the Professor College can communicate issues/concerns with the Administrative Coordinator who will communicate them to the Director if necessary or can contact the Director directly. Every year, the Director holds a 1-hr State of the IPR Address for the Professor College where the Director reviews what happened in the IPR during the previous year, explains the various activities that are planned for the next year (IPR Symposium, Distinguished IPR Lecturer, Student Seminar Series...), and reminds the attendees to provide information when needed (IPR annual Newsletter, Senate report) and student volunteers for the different IPR activities (IPR Symposium and IPR Student Presentation Series). Finally, the Director will take into account recommendations made to him by the IPR Board (last IPR Board Meeting on December 2<sup>nd</sup>, 2019).










**Figure 1.** Organizational chart of the IPR

#### **IPR Board**

Chair: Prof. Charmaine Dean  
 Dean of Engineering Delegate: Prof. David Clausi  
 Dean of Science: Prof. Robert Lemieux  
 Chair of Chemical Engineering: Prof. Eric Croiset  
 Chair of Chemistry: Prof. William Power  
 IPR Director: Prof. Jean Duhamel  
 Senior Industry Representative: Dr. Carla McBain  
 Senior Chem. Eng. Representative: Prof. Alex Penlidis  
 Senior Chemistry Representative: Prof. Mario Gauthier

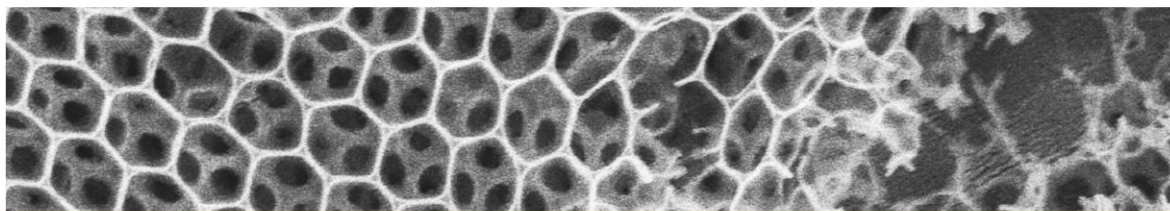
# APPENDIX 7

## IPR Students Seminar Series

Winter 2018	Winter 2020
 <p><b>2017-18 IPR Student Seminar Series</b></p> <div> <p><b>January 26</b> Nicholas Lanigan Using Rheology to Characterize the Mechanical Behaviour of Supramolecular Polymers</p>  </div> <div> <p><b>March 2</b> Alison Scott A Look Inside Elemental Analysis</p>  </div> <div> <p><b>April 27</b> Kuo Yang Feeling Surfaces with Contact Mechanics</p> <p><b>March 30</b> Remi Casier The Fundamentals and Application of Fluorescence</p>  </div> 	<div> <p>WINTER 2020 </p> </div> <div> <p>February 14th at 11:30 in E6-4022 <b>Eduardo Vivaldo-Lima</b> Polymer Production and Modification in Supercritical Carbon Dioxide from a Chemical Engineering Perspective</p> </div> <div> <p>February 28th at 11:30 in E6-4022 <b>Natun Dasgupta</b> Thermoresponsive Polymers: Synthesis and Properties</p> </div> <div> <p>March 6th at 11:30 in E6-4022 <b>Joanne Fernandez</b> Grafting of Polymers to Starch by Various Techniques</p> </div> <div> <p>March 20th at 11:30 in E6-4022 <b>Damin Kim</b> Discussion on some Polysaccharides: Their Structure, Properties, and Applications</p> </div>  <p><b>IPR STUDENT SEMINAR</b></p>

# APPENDIX 8

## IPR Distinguished Lecturer Series



### **Nanoporous Materials Employing Disordered Block Polymers as Key Ingredients**

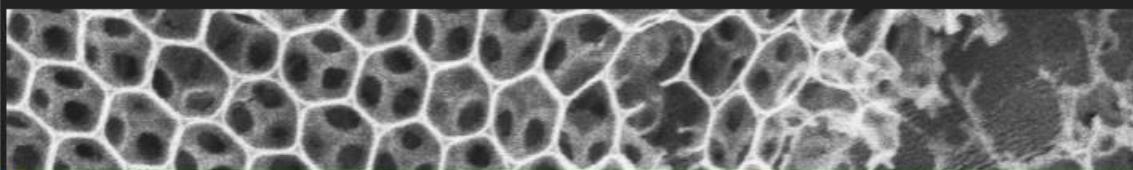
**May 10<sup>th</sup>, 2018 at 10:00 AM in QNC 0101**

40<sup>th</sup> IPR Anniversary - Distinguished Lecturer: Prof. Marc Hillmyer

Self-assembled block polymers containing a sacrificial (i.e., chemically etchable) component are versatile precursors to functional nanoporous materials. The two most common ordered morphologies used to generate nanoporous materials in this way are the hexagonally-packed cylindrical and bicontinuous gyroid phases. In this talk I will discuss our approaches to nanostructured, bicontinuous but disorganized morphologies through either thermal or light-induced chemical fixation of block polymers in the disordered state in close proximity to the order-disorder transition. Composition fluctuations in disordered block polymers can be trapped using this versatile strategy. In the cases where one of the blocks is chemically etchable (e.g., polylactide), nanoporous polymers with narrow pore size distributions can be generated and utilized as, for example, ultrafiltration membranes for water purification. I will focus on the synthesis, characterization and applications of this class of nanoporous and related nanostructured materials.

**Marc Hillmyer** received his B.S. in Chemistry from the University of Florida in 1989 and his Ph.D. in Chemistry from the California Institute of Technology in 1994. After completing a postdoctoral research position in the University of Minnesota's Department of Chemical Engineering and Materials Science he joined the Chemistry faculty at Minnesota in 1997. He is currently the McKnight Presidential Endowed Chair in Chemistry and leads a research group focused on the synthesis and self-assembly of multifunctional polymers. In addition to his teaching and research responsibilities, Marc served as an associate editor for the ACS journal *Macromolecules* from 2008-2017 and is currently the editor-in-chief of *Macromolecules*. He is also the director of the Center for Sustainable Polymers headquartered at the University of Minnesota, a National Science Foundation Center for Chemical Innovation.





FEBRUARY 5, 2019 - 10:30 AM IN QNC1010

## Biomedical Applications of Metal-chelating Polymers and Lanthanide Nanoparticles

Distinguished Lecturer: Prof. Mitchell A. Winnik

One of the goals of modern bioanalytical chemistry is the simultaneous (multiplexed) detection of multiple biomarkers in individual cells. A biomarker can be broadly defined as a characteristic protein, gene, or small molecule that can be objectively measured and evaluated as an indicator of normal biological or pathogenic processes. The classical approach to high throughput biomarker detection employs flow cytometry, in which antibodies (Abs) are labeled with fluorescent dyes. Here spectral overlap limits the number of dyes that can be detected simultaneously and restricts the number of biomarkers per cell that can be detected.

Mass cytometry (MC) is a much newer technique in which various Abs are labeled with different heavy metal isotopes. Cells are injected into the plasma torch of an inductively coupled plasma mass spectrometer with time of flight detection. Here signal intensity increases linearly with the number of copies of an isotope carried by each Ab. Our contribution to this technique is the synthesis of metal-chelating polymers (MCPs) with 20 to 50 chelators for carrying a metal ion and functionality at one end for covalent attachment to the Ab. In this way, each Ab can carry up to 200 copies of an isotope, and with these reagents, detection and quantification at high throughput of 40 to 45 biomarkers per cell is now routine. There is a need to increase the sensitivity of MC by one to two orders of magnitude, so that one can detect as few as 100 molecules per cell. To address this problem, we synthesize heavy metal nanoparticles such as 12 nm NaHoF<sub>4</sub> NPs that contain on the order of 15000 Ho atoms. The two main challenges are passivating the NP surface to prevent non-specific interactions with cells and introducing functionality for attachment of Abs.

We are also part of a team led by my colleague R. M. Reilly in our Faculty of Pharmacy to develop MCPs as radioimmunotherapeutic agents for imaging tumors and treating pancreatic cancer. Our MCPs are attached to therapeutic antibodies or antibody fragments. The conjugates are labeled with <sup>111</sup>In for  $\mu$ SPECT imaging or <sup>64</sup>Cu for PET imaging. Electrons emitted by the radiometals enhance the cytotoxicity of the antibodies. <sup>111</sup>In undergoes Auger decay, emitting electrons that are highly destructive to cells but travel only short distances (up to 1  $\mu$ m). For effective use in therapy, we need to develop polymer conjugates that not only target tumor cells, but are transported to the cell nucleus, to ensure localized destruction of nuclear DNA. For studies in animal models and for eventual clinical applications, the polymers also have to be designed to maximize blood circulation time and to minimize uptake in the body by healthy tissues like the liver and spleen. In my talk I will summarize our progress in trying to meet these challenging goals.

**Mitch Winnik** is Professor of Chemistry at the University of Toronto, specializing in fundamental and applied aspects of polymer science. His research group provided new scientific knowledge that helped the coatings industry develop the environmentally friendly paints that are now sold commercially. In parallel, he collaborated with Ian Manners to pioneer the study of crystallization-driven self-assembly of block copolymer micelles in solution. In 2005, he joined a team of scientists who were developing mass cytometry for rapid multiparameter cell-by-cell analysis of biomarker expression. He and his students created polymer reagents for this technique. More recently, he has become involved in a collaboration to develop metal-chelating polymers into targeted reagents for radioimmunotherapy treatment of breast cancer and pancreatic cancer. He is an ISI "Most cited author" in chemistry, with 730+ publications and 20,000+ citations. His contributions have been recognized by an Alexander von Humboldt Senior Scientist Award (Germany), the 2013 national award in Applied Polymer Science of the American Chemical Society, the 2004 CIC Medal, and the 2011 LeSueur Memorial Award, Society of the Chemical Industry, Canada. He is a Fellow of the Royal Society of Canada, and in 1998 he was named University Professor, the University of Toronto's highest recognition for scholarly achievement.



## APPENDIX 9

# Financial statement with itemized budget for 2015 and 2019

### IPR Budget for 2015 – 2017 (using FORE)

2015	
Account (T)	Amount
Revenue Membership	31,094.13
sponsorship	450.00
courses	6,108.20
OMNOVA	19,697.00
Salaries-Staff	-14,307
benefits	-2,629
Honorarium Non Employee	-721.24
consulting	-4490.62
bursaries	-18270
IPR Awards	-1200
Printing	-377.37
Supplies & Other	-14.48
Hospitality	-3,482.63
Equip & Furn Rentals	-80
Fund Transfer (Chem)	1,000.00
Fund Transfer (Chem. Eng.)	1,000.00
Fund Transfer (Science)	1,000.00
Fund Transfer (Eng.)	1,000.00
Fund Transfer (OR)	4,000.00
<b>Balance</b>	<b>+19,777.09</b>

2016	
Account (T)	Amount
Revenue Membership	28,889.76
sponsorship	600.00
courses	-
OMNOVA	19,797.00
Salaries-Staff	-13,089
benefits	-1,235
Honorarium Non Employee	-
consulting	-3500
bursaries	-19695
IPR Awards	-1200
Printing	-757.05
Supplies & Other	-80.46
Hospitality	-6,248.09
Equip & Furn Rentals	-70
Fund Transfer (Chem)	1,000.00
Fund Transfer (Chem. Eng.)	1,000.00
Fund Transfer (Science)	1,000.00
Fund Transfer (Eng.)	1,000.00
Fund Transfer (OR)	4,000.00
<b>Balance</b>	<b>+11,411.90</b>

2017	
Account (T)	Amount
Revenue Membership	21,860.76
sponsorship	-
Courses	-
OMNOVA	20,928.00
Salaries-Staff	-12,529
benefits	-1,126
Honorarium Non Employee	-
consulting	-200
bursaries	-20928
IPR Awards	-1200
Printing	-240.09
Supplies & Other	-15.07
Hospitality	-4,092.70
Equip & Furn Rentals	-70
Fund Transfer (Chem)	1,000.00
Fund Transfer (Chem. Eng.)	1,000.00
Fund Transfer (Science)	1,000.00
Fund Transfer (Eng.)	1,000.00
Fund Transfer (OR)	4,000.00
<b>Balance</b>	<b>+10,387.78</b>

**IPR Budget for 2018 (Using UNIT 4)**

OrgUnit	Fund	Period	WorkOrder	Activity	Activity (T)	Account	Account (T)	Amount	TransDate	POrderNo	Supplier/Customer	Updated
8352	100		10000-10079	100	Administration	40290	Revenue Membership	13,515.03		60004334	Arlanxeo Canada Inc. and BASF Corporation	2018/05-09
8352	100	2018/03-12	10000-10079	100	Administration	1500	Salaries-Staff	-12,846	2017/07 – 2018/04			2017/08 – 2018/04
8352	100	2018/12	10000-10079	100	Administration	60230	Honorarium Non Employee	-627.96	2018-04-27	NA		2018-05-01
8352	100	2018/05-12	10000-10079	100	Administration	60360	Printing	-257.62				
8352	100	2018/05-12	10000-10079	100	Administration	1610	Supplies & Other	-925.58				
8352	100	2018/01-12	10000-10079	100	Administration	60680	Hospitality	-4,577.84	2017/06 – 2018/04		IPR Symposium	2017/06 – 2018/05
8352			10000-10079			60880	Equip & Furn Rentals	-60.00				
8352	100	10000-10079	8352 100	100	Administration	Non-Salary Budget	Fund Transfer	1,000.00	10000-10079		Department of Chemistry	
8352	100	10000-10079	8352 100	100	Administration	Non-Salary Budget	Fund Transfer	1,000.00	10000-10079		Department of Chem. Eng.	
8352	100	10000-10079	8352 100	100	Administration	Non-Salary Budget	Fund Transfer	1,000.00	10000-10079		Faculty of Science	
8352	100	10000-10079	8352 100	100	Administration	Non-Salary Budget	Fund Transfer	1,000.00	10000-10079		Faculty of Engineering	
8352	100	10000-10079	8352 100	100	Administration	Non-Salary Budget	Fund Transfer	4,000.00	10000-10079		Office of Research	
							<b>Balance</b>	<b>+2,220</b>				

**IPR Budget for 2019 (using UNIT 4)**

OrgUnit	Period	WorkOrder	WorkOrder (T)	Activity	Activity (T)	Account	Account (T)	Amount	TransDate	Supplier/Customer (T)	Updated
8352	201901	10000-10079	IPR General	100	Administration	40270	Revenue Conference/Seminar/membership	-14,491.28	2018-05-22	Ryerson University/Afton Chemicals Corp. and Arlanxeo Canada Inc.	2018-05-22
8352	201902	10000-10079	IPR General	100	Administration	50030	Salary Staff PT & Casual	-12,131.21	2018/06 - 2019/04		2018-07-03
8352	201911	10000-10079	IPR General	100	Administration	60230	Honorarium Non Employee	-500.00	2019-03-29		2019-04-01
8352	201901	10000-10079	IPR General	100	Administration	60310	Miscellaneous Expense	-130.00	2018-05-24	Colleen Mechler	2018-05-30
8352	201901	10000-10079	IPR General	100	Administration	60360	Printing, Supplies & Others	-809.41	2018/05 - 2019/04	Colleen Mechler	2018/05 - 2019/05
8352	201901	10000-10079	IPR General	100	Administration	60680	Hospitality	-10,084.78	2018/05 - 2019/04	Marc Hillmyer/Mitch Winnik/2019 IPR Symposium	2018/05 - 2019/04
8352	201903	10000-10079	IPR General	100	Administration	60880	Equip & Furn Rentals	-80.00	2018-07-17		2018-07-18
8352	100	10000-10079	8352 100	100	Administration	Non-Salary Budget	Fund Transfer	500.00	10000-10079	Department of Chemistry	
8352	100	10000-10079	8352 100	100	Administration	Non-Salary Budget	Fund Transfer	1,000.00	10000-10079	Department of Chem. Eng.	
8352	100	10000-10079	8352 100	100	Administration	Non-Salary Budget	Fund Transfer	500.00	10000-10079	Faculty of Science	
8352	100	10000-10079	8352 100	100	Administration	Non-Salary Budget	Fund Transfer	1,000.00	10000-10079	Faculty of Engineering	
8352	100	10000-10079	8352 100	100	Administration	Non-Salary Budget	Fund Transfer	1,000.00	10000-10079	Office of Research	
							<b>Balance</b>	<b>-5,244</b>			



### **Budget notes**

During the first 4 years of my tenure (2011 – 2015) as IPR Director, Rosemary Anderson was the full-time IPR Administrative Coordinator and the IPR was losing ~\$ 20-30K/yr. This situation was the result of decreasing company memberships and having to pay for the salary of a full time Administrative Coordinator. Since the previous IPR Director (Prof. Alexander Penlidis) had left a hefty surplus in the IPR account (> \$ 100K) and Rosemary was due to retire in 2013, the IPR continued to support Rosemary until 2013. However, with the number of company memberships dwindling, something needed to be done to balance the IPR budget. The position of the IPR Administrative Coordinator was made part-time, since less work was needed to handle 5-6 companies compared to the 15-20 companies that were IPR members in the 1990's. Melissa Anderson became the part-time Administrative Coordinator of the IPR working ~15 hrs/wk but the IPR was still losing money, albeit at a slower rate. This is when I asked for financial help from the university to support the IPR Symposium. At the same time, Melissa took another job and left the IPR. Melissa was replaced by Colleen Mechler, who after a short transition period, realized that she could do the job of the IPR Administrative Coordinator in 9 hrs/wk, including serving as webmaster for the IPR Website, thus providing further savings to the IPR budget. The combination of Colleen working 9 hrs/wk (instead of 35 hrs/wk) and the university support for the IPR Symposium explain the sudden \$ 19,777 positive balance in 2015. However, as company memberships continued to decrease, the annual balance continued to decrease until the negative balance of \$ -5,244 of 2019. This negative balance was also a consequence of several expenses incurred in 2018 for the 40<sup>th</sup> anniversary of the IPR symposium (diner at the University Club for all students and members of the IPR, plus the visit by our IPR Distinguished Lecturer, Prof. Mark Hillmyer) that came due in 2019.

Looking forward, Mondelez joined the IPR in 2020. Furthermore, since the physical IPR Symposium was replaced by a virtual symposium on September 2<sup>nd</sup>, 2020 and there was no 2020 IPR Distinguished Lectureship, our costs were much lower in 2020 and the IPR is expected to make a benefit as shown in Table 1A in Page 10 of this report. Tables 1B – 1E in Pages 10 – 11 provide predictions for the IPR budget in 2021 – 2024.

## **APPENDIX 10**

# **Letters of Support from IPR Members**

### **Statement from Prof. Michael Tam (Chemical Engineering, current academic member)**

My research is in polymers and sustainable nanomaterials, which are topics that fit into the research thrust of IPR. My graduate students and I participate in almost all the seminars organized IPR in the field of polymers. For example, when IPR invited distinguished guest speakers, such as Professor Winnik to Waterloo, I had a productive interaction with the speaker over dinner and at his seminar. Every year, IPR organized a symposium with industry's participation, and my graduate students have received awards and also presented invited talks to those attendees of the symposium. In addition, I have received financial support provided by OMNOVA to augment the stipend of my graduate students. Professor Duhamel has been very active in promoting polymer research@Waterloo to industry and polymer researchers in other Canadian universities. At each of the annual State of the IPR address, he outlines the strategic plans he has for the institutes, and the members participated in contributing ideas on ways to advance polymer research at UW. I strong support the continuation of IPR at Waterloo.

Michael Tam

### **Statement from Prof. Alexander Penlidis (Chemical Engineering, former IPR Director and current academic member)**

I am delighted to express my support to IPR, its Director and its many impressive activities. I have been involved with IPR almost since its inception, and later served as Associate Director and Director for about 2 decades. In its first 2 decades, IPR operated on its own, based on the efforts of the individual academic members, with an impressive list of industrial members, and no funding from the university.

IPR's operations have been characterized by a strong collaborative effort among its academic members. The interactions with its industrial members worked as the trigger for many long- and short-term contracts, which brought extra funding to the university via matching funding as well. The graduate students involved in the operation (and, often, many undergraduate students who got involved via senior design projects or research co-op projects) strongly benefited from these interactions and contact with industry, as many used the annual IPR conference as a means to have the first 'interview' with industrial members, who later employed them. Some of these students are returning these days as IPR industrial or academic members. IPR is well known internationally by the 'who's who' in industry and academia, as is evident from many international conferences, in North America, Europe and Japan, etc. Another important contribution of IPR has been the annual workshops/intensive industrial short courses, offered over more than 35 years to industrial and academic audiences, often 3 times a year in Canada, US and Europe. In essence, all IPR-related graduate students or associates are gainfully employed in industry or academia.

Other examples of these very beneficial (for students, academics, industry and the university community in general) interactions include: The annual IPR conference, usually held in May (already mentioned above);

IPR lecture series, extremely important for the education of students and also networking; 4 annual courses on different aspects of polymer science and engineering (2 graduate and 2 undergraduate), along with other more specialized courses (offered less regularly), in Chemical Engineering; IPR graduate student presentation series, where graduate students explain a certain piece of equipment or analytical characterization technique to the rest; regular financial support from IPR companies distributed to (5 to 6) graduate students (for example, Xerox and OMNOVE solutions, over 20-30 years, etc.).

Of course, all of these items above are facilitated considerably by the activities and tutelage of the IPR Director (O'Driscoll, Rudin, Penlidis and Duhamel, since 1978). I am sure some people will recognize these names, internally and internationally.

Alexander Penlidis

**Statement from Prof. Mario Gauthier (Chemistry, current academic member) – See following page.**



### Statement about the IPR from Professor Mario Gauthier, current IPR academic member

I have been involved in the activities of the IPR since my arrival in Waterloo, in July 1991, and consequently I have been able to see it evolve over the past 29 years. One of the most obvious benefits of being an IPR member, from my point of view, has been the establishment of a network of industrial collaborators including 3M Canada, Lanxess (Arlanxeo), BASF and NOVA, among others. This has been an important factor allowing my career to bloom.

From a more general viewpoint, I believe that the IPR has greatly contributed to fostering interactions between its industrial, academic and graduate student members alike, through the organization of activities such as the Annual Symposium, the Distinguished IPR Lecturer Series, and the Student IPR Presentation Series. These activities not only provide graduate students with exposure to potential employers, but also allow them to broaden their horizons by learning about research activities taking place in the industry as well as in other labs in Waterloo. Furthermore, the IPR has provided generous financial support for a few graduate students every year, by a rotation system ensuring an even distribution among all the academic IPR members, which I believe has been greatly appreciated under the recent difficult times we have been facing.

I must also say a word about Professor Duhamel's leadership of the IPR, which has been outstanding and certainly among the most transparent I have seen over the years. In his Annual State of the IPR Address, he always explains very clearly the financial aspects of the Institute, its achievements over the past year, and sets up future goals.

In a nutshell, I believe that the activities of the IPR have been extremely useful not only to its academic, student and industrial members, but also to raise the profile of the University of Waterloo at both national and international levels. This is obvious when looking at the large number of IPR student alumni now working in the industry, for current and past IPR industrial members. Without any doubt, these interactions with the industry deserve to be fostered.

Sincerely,

A handwritten signature in black ink, appearing to read "M. Gauthier".

Mario Gauthier  
Professor

Phone: (519) 888-4567 ext. 35205

E-mail: [gauthier@uwaterloo.ca](mailto:gauthier@uwaterloo.ca)



# APPENDIX 11

## Letters of Support from Chairs and Deans



Department of Chemistry  
Faculty of Science

University of Waterloo  
200 University Avenue West  
Waterloo, ON Canada  
N2L 3G1

July 20, 2020

Professor Charmaine Dean  
Vice President, Research and International  
University of Waterloo

RE: Five Year Review of the Institute for Polymer Research

Dear Professor Dean,

This letter confirms that I, on behalf of the Department of Chemistry, am fully supportive of a continued mandate for the Institute for Polymer Research (IPR). The IPR is one of the longest serving Institutes at the University of Waterloo. The Institute continues to provide a focus for polymer research at the University of Waterloo and has fostered collaboration between colleagues in Science and Engineering and with industry. With its annual symposium, the IPR provides a unique platform for students to expose their research on polymer science and/or engineering to industry researchers, and thus potential employers. The promotion of polymer research at Waterloo was further expanded in 2018 by the introduction of the IPR Students Seminar Series and the IPR Distinguished Lecturer Series. Both activities have further enhanced the level of interactions between students and faculties involved in polymer research. The Department of Chemistry and Chemical Engineering have both benefitted from these collaborations.

As the Senate Report put together by Jean Duhamel, the current Director, makes clear, the Institute for Polymer Research is active and effective, and I fully support a five-year renewal.

Sincerely,

A handwritten signature in black ink, appearing to read "W. Power", followed by a horizontal line.

William P. Power, Chair  
Department of Chemistry  
Phone: +1-519 888 4567, x43626  
wppower@uwaterloo.ca



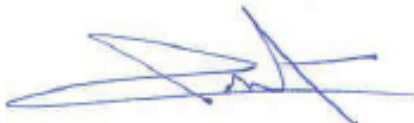
# Memo

**To:** Chamaine Dean, Vice-President, Research & International  
**From:** Eric Croiset, Chair  
**CC:** Jean Duhamel, Director Institute for Polymer Research  
**Date:** July 14, 2020  
**Re:** Institute for Polymer Research Renewal

---

I am writing this memo to confirm that I, on behalf of the Department of Chemical Engineering, am in full support to renew the mandate of the Institute for Polymer Research (IPR). The Department of Chemical Engineering counts 8 active members in IPR, who all have been strong supporters and participants in this institute. Professor Duhamel has been the Director of the IPR for the past nine years, and under his leadership, the Institute has continued to foster effectively polymer research at the University of Waterloo by promoting collaborations between colleagues in Science and Engineering and with industry. Its annual symposium represents an excellent opportunity for students involved in polymer research to present their work in front of an audience that includes industry researchers, and thus potential employers. The recently introduced IPR Student Seminar Series and IPR Distinguished Lecturer Series have also offered new platforms to further expose the Science and Engineering students to Polymer Research.

The Senate Report prepared by Jean Duhamel, the current IPR Director, illustrates the numerous accomplishments of the Institute over the past five years, demonstrating that the IPR is active and effective and I fully support a five-year renewal.



Eric Croiset

July 6, 2020

Prof. Charmaine Dean  
Vice-President, Research & International  
University of Waterloo

**Re: Renewal of the Institute for Polymer Research**

Dear Charmaine:

I write to express my strong support for the renewal of the Institute for Polymer Research (IPR). As presented in the Senate Report prepared by Prof. Jean Duhamel, the current IPR Director, the Institute has been involved in several activities promoting polymer research over the past five years. More specifically, the IPR Symposium held every year in May provides an important venue where about 80 participants, including graduate students, faculty members, and industry researchers come together to discuss current issues in polymer science and engineering. In addition to this forum on polymer research, the Institute also initiated in 2018 the IPR Students Seminar Series where senior graduate students who have mastered one aspect of polymer research give an educational presentation on a topic of their choice to a student audience. Finally, the IPR Distinguished Lecturer Series, where outstanding researchers in polymer science and engineering are invited to give a lecture on their research, aims to inspire UW students to pursue a career in polymer research. These activities reported in the Annual IPR Newsletter are excellent examples that illustrate the commitment of IPR in promoting polymer research at Waterloo.

Hence, I am pleased to support the renewal of the Institute for Polymer Research for another 5-year term with enthusiasm.

Sincerely,



Robert P. Lemieux, PhD  
Dean of Science and Professor of Chemistry



200 UNIVERSITY AVENUE WEST, WATERLOO, ON, CANADA N2L 3G1

## Memorandum

**To:** Charmaine Dean, Vice-President, Research  
**From:** Jean Duhamel, Institute for Polymer Research  
**Date:** July 8, 2020  
**Subject:** Institute for Polymer Research Renewal

---

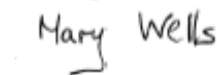
Charmaine:

This memo is to provide full support for the renewal of the Institute for Polymer Research (IPR) on behalf of the Faculty of Engineering. Over the past five years, the Institute has not only continued its traditional activities such as the organization of the annual IPR Symposium, but it has also begun new initiatives by launching the IPR Students Seminar Series and the IPR Distinguished Lecture Series.

Both series of presentations were attended by many students and all these activities generate an excellent platform for promoting the Polymer Research being conducted at Waterloo. The annual IPR Symposium continues to be the main event of the Institute with more than 20 student presentations, representing a quarter of the IPR-graduate student population, that are attended by industry researchers and faculty members. These undertakings promote interactions between researchers from industry and academia which are very beneficial to both the Science and Engineering faculties.

The Senate Report prepared by Jean Duhamel, the current IPR Director, describes these points in much more details and demonstrates the strong performance of the Institute over the past five years. Based on these elements, the Institute has my full support for its renewal.

Thank you.



Mary A. Wells, Dean  
Dean of Engineering





## Handling of Final Assessment Reports & Two-Year Progress Reports related to academic program reviews

### Introduction

Waterloo's Senate Undergraduate Council (SUC) and Senate Graduate and Research Council (SGRC) have a duty to consider all aspects relating to the academic quality of undergraduate studies and graduate studies within the University. As described in Waterloo's Institutional Quality Assurance Process ([IQAP](#)), documentation emerging from the [cyclical program review](#) process includes:

- [Final Assessment Report](#), which summarizes the self-study, external reviewers' report, program response, and implementation plan, and
- [Two-Year Progress Report](#), which reports on progress related to the implementation plan.

Final Assessment Reports (FARs), require two SUC or SGRC members to review the report, whereas, Two-Year Progress Reports only require one SUC or SGRC member, although at the SUC/SGRC Chair's discretion, a second reviewer may be sought. In order to ensure that student representatives have the opportunity to review each report, the WUSA VP, Education and GSA President receive these documents in advance for information. Any questions or concerns they might have can be raised and addressed, if needed, prior to the report being approved at SUC/SGRC. This review process is coordinated by the Quality Assurance (QA) Office.

To promote transparency and foster integrity in the review process, reviewers should not be members of the Faculty or Affiliated and Federated Institutions of Waterloo (AFIW) from which the report originates.

### Assessment

Reviewers will consider a series of **guiding questions** (see below) in arriving at their recommendation for revision or approval to SUC or SGRC. Before reporting to SUC or SGRC, reviewers will ask questions and share their observations, as well as any concerns they have identified with the report, to the Quality Assurance Office, who will then connect with the Chair or Director of the program. The FEDS and GSA representative will also receive these reports for information prior to submission to SUC/SGRC.

The Quality Assurance Office will ensure that any revisions to the reports are completed by the Chair or Director of the program, prior to the QA Office submitting the report for approval at a SUC or SGRC.

#### Does the Final Assessment Report:

- 1) Include a credible implementation plan that not only addresses the substantive issues identified from the program review process but also identifies clearly:
  - What actions will follow from specific recommendations?
  - Who will be responsible for acting on those recommendations?
  - Who will be responsible for providing resources?
  - Priorities for implementation and realistic timelines for initiating and monitoring actions?
- 2) Provide a rationale as to why a recommendation(s) will not be pursued?

**Does the Two-Year Progress Report:**

- 1) Clearly describe progress achieved on the various action items in the implementation plan?
- 2) Explain convincingly any circumstances that would have altered the original implementation plan?
- 3) For items that are behind schedule, propose an amended implementation schedule that is reasonable and credible?
- 4) Address significant developments or initiatives that have arisen since the program review process, or that were not contemplated by the program review process?

The program Chair or Director (or their chosen delegate) will attend the SUC or SGRC meeting to address any questions or concerns that might arise during SUC/SGRC.

SUC's and SGRC's responsibility will be to focus on the overall credibility and feasibility of the report and the proposed plan of action – seeking to uncover, for example, unexplained disjunctions between the reviewers' recommendations and the program's response – as opposed to the minutiae of course content and curriculum structure.

A Final Assessment Report or Two-Year Progress Report that is approved by a majority vote of SUC/SGRC will be submitted to Senate for information. Should the discussion at SUC or SGRC reveal issues of concern that require revision, the Quality Assurance Office will work with the program Chair or Director to address the concern(s). If minor revisions are needed, the report will be edited and then it will proceed to Senate for information without re-approval from SUC/SGRC; however, any major revisions will require SUC/SGRC review and approval.

**Status of Reports under Review**

A summary of the status of all reports under review, including reports for which the QA Office is seeking reviewers, can be found at the following link:

<https://uwaterloo.ca/academic-program-reviews/status-reports-under-review>

# Two-Year Progress Report

## Systems Design Engineering

### (MAsc/PhD/MEng)

### July 2020

---

#### Background

The review team examined the self-study documentation and conducted a site visit at the University of Waterloo on June 11-12, 2015. The visit included interviews with the Vice President, Academic & Provost, Associate Provost, Graduate Studies<sup>1</sup>, the Dean and Associate Dean, Graduate Studies, of the Faculty of Engineering, Chair and Associate Chair, Graduate Studies, of the Department, faculty members, administrative and technical staff and a group of six current graduate students and support staff. The reviewers also had an opportunity to visit three research laboratories.

#### Summary of strengths, challenges and weaknesses based on self-study:

##### Strengths

- Systems Design Engineering (SDE) is unique in Canada, providing an engineering program that focuses on both design as well as systems analysis, two areas that are typically in separate programs.
- The program boasts leading edge research in emerging areas, such as Biomedical engineering, intelligent systems & signals, human factors engineering as well as societal & environmental engineering.

##### Challenges

- SDE is a diverse department, which is reflected in the diverse areas of research topics and they continually question what can unify their program. In the undergraduate program the unification is via design & system modelling which is not as explicit in the graduate program.
- There is a difficulty in attracting excellent domestic students to the Department's graduate programs, especially their own undergraduates who are highly desirable in the work force. This problem is also shared by other engineering departments at Waterloo and in Canada in general. A working group at the faculty level is addressing this issue.

<sup>1</sup> The Associate Provost, Graduate Studies title changed to Associate Vice-President, Graduate Studies and Postdoctoral Affairs as of June 2017.

- Struggles with graduate course offerings chiefly due to the lack of teaching resources available, i.e., a lack of faculty.

### Weaknesses

- Many of the faculty collaborate with other departments and faculties, but comparatively few collaborate with each other. Collaboration is an opportunity to unify the program and attract more domestic graduate students. We anticipate that space consolidation in EC4 (former RIM / Blackberry space) and the opening of E7 will partially address this weakness.

### Summary of key findings from the external reviewers

The external reviewers report was positive and noted “The general environment in the department is open, receptive, inclusive and collaborative.” It also reported that the graduate students “value the interdisciplinary, collaboration and freedom that the SDE philosophy facilitates and see it as allowing them to see the big picture and transcend traditional engineering boundaries”.

Faculty members are seen as supportive, personable and compassionate and ‘very special’ people who go beyond what is expected by graduates. In addition, the program’s retention rates and times to completion are good, and overall student numbers are reasonably healthy and growing.

Reviewers identified a few challenges which included a shortage of graduate courses to serve the broad interests of graduate students and a continuing shortage of lab space.

### Progress on Implementation Plan

#### Recommendations

1. A “systems level philosophy to problem solving” is implicitly found in the general environment in the department, but has not been developed and articulated at the graduate level in a formal manner.
  - a. **Status:** We are introducing core courses to the graduate program that addresses this. Initially the core courses will only be core for the MEng students however other graduate students in Systems Design will be able to take these courses. The Department approved these courses at a departmental meeting on July 19, 2017.
  - b. **Details:** The proposed new core courses include SYDE600 Systems Theory, Models, Research & Design; SYDE 660 Systems Design Graduate Workshop 1; & SYDE 662 Systems Design Graduate Workshop 2. These courses are available to MAsc, MEng and PhD students in our department as well as within the Faculty of Engineering.

2.

- a. Graduate students in the course based MEng program will benefit greatly from guidance to navigate their course selections.
  - i. **Status:** The Associate Graduate chair has met with students on a regular basis to assist MEng students. We are also introducing core grad courses for MEng students (see above) as well as a variety of five specializations which will provide direction for MEng students as well as providing them with a focus.
  - ii. **Details:** The specializations were approved at Senate in April 2019 with the intention to have these available for students beginning in the Fall 2019 term. The specializations being introduced are: Artificial Intelligence and Machine Learning; Biomedical Systems; Human Factors; Mechatronic & Physical Systems; and Vision, Image & Signal Processing. Concurrently, 5 additional variants of SYDE660 (Systems Design Graduate Workshop 1) were created SYDE660A, SYDE660B, SYDE660C, SYDE660D, and SYDE660E to allow the students to gain design experience specific to their specialization. Those variants are being offered for the first time in Spring 2020.
- b. The mechanism for graduate student body feedback and involvement in matters related to the graduate program should be more formalized.
  - i. **Status:** A Graduate student representative was chosen to act as an intermediary the past two years. We have decided that a formal GSA is necessary and in September elections will be held for its executive.
  - ii. **Details:** The SDE GSA constitution has been approved at the university GSA level in July 2017. A faculty mentor is also working with the SDE GSA leadership.
- c. The average funding for thesis-based students in the department seems good, however, the minimum funding levels could be improved.
  - i. **Status:** The reviewers report suggested looking into offering funded TA-ships at the time of admission; this could certainly make an offer letter more attractive, but carries a risk of offering a TA position to a student with unknown pedagogical skills. We would point out that our average income for funded graduate students is \$31,857, compared to the Faculty of Engineering average income of \$30,295. Similarly, 27.5% of SDE graduate students have external scholarship support, compared to 20.3% across the faculty of Engineering. These two statistics are evidence, in fact, that Systems Design Engineering funding support is competitive relative to the rest of the faculty. The minimum level of funding for full-time research Masters students is set by the Faculty of Engineering and as of May 2019 is \$18,000/year. The minimum level of funding for full-time doctoral

students is set by the University. In Engineering, any income earned by students serving as TAs/CAs is on top of this minimum funding.

ii. **Details:** No further progress required at departmental level.

- d. There is a general sense among the graduate students that the hours put in by the teaching assistants are significantly above the expected norms.
    - i. **Status:** The program has, and will continue, to articulate to professors the expectation of 130 hours of total work for teaching assistants. This information has been and will continue to be annotated in the TA appointment letter. Instructors are also requested to submit a time allocation sheet for each TA, signed by both the graduate student and instructor, showing a distribution of duties within this time period. To the extent that this expectation is not met in certain courses, we would propose that the graduate student feedback representative or SYDE GSA, discussed in point 2b, should allow such cases to be communicated anonymously to the graduate chair and ensure that discrepancies are dealt with promptly.
    - ii. **Details:** No further details necessary.
3. The number of annual graduate course offerings seems low relative to the wide span of areas in the department.
    - a. **Status:** In order to increase annual graduate course offerings, this problem will be addressed by the core courses introduced as well as the need for graduate courses for the specializations.
    - b. **Details:** Core courses are introduced and courses needed to support the specializations are being scheduled to be offered on a regular basis. Courses are also being added to ensure that each specialization has unique graduate courses, as required by the current University of Waterloo guidelines for specializations.
  4. Current research space is fragmented and insufficient for the needs of the department.
    - a. **Status:** When this review was undertaken in 2015, when the measures of space requirements per student etc. were accounted for, Systems Design was the furthest behind of any other department in Engineering at the University of Waterloo.
    - b. **Details:** Since the acquisition of space in EC4 and E7, Systems Design is now, arguably, further ahead in space than most other departments. However, since hiring for the new Biomedical Engineering undergraduate program in the department remain ongoing, our space allocation will revert to being closer to the faculty average over time.

Address any significant developments or initiatives that have arisen since the program review process, or that were not contemplated during the review

Fourteen faculty members joined the department in the last five years. Two more will be joining before the end of 2020. We are currently reorganizing the graduate course cohort to better serve the needs of our graduate students. As a part of this reorganization, we are planning a new joint graduate program in Biomedical Engineering.

One of the expressed concerns during the review was the number of domestic graduate students. We currently only have anecdotal evidence around the increase in domestic graduate students and the variation in distribution between domestic and international students at various levels (MAsc, MEng, PhD). As our cyclical review is upcoming, this analysis will be a key focus of the upcoming (2021-22) review. It will be helpful to identify any changes in graduate student numbers across the programs since the time of the 2015-16 review and any variation in distribution between domestic and International students.

Updated Implementation Plan

	Recommendations	Proposed Actions	Responsibility for Leading and Resourcing (if applicable) the Actions	Timeline for addressing Recommendations
1.	Systems level philosophy	New core courses	Associate Graduate Chair	Dept approval: July 2017 EGSO approval: Fall 2017 Effective Fall 2018
2.	MEng issues	New specializations	Associate Graduate Chair	Senate approval April 2019 – effective Fall 2019
3.	Shortage of annual graduate course offerings	Annual courses scheduled to support specialization will address this problem	Associate Graduate Chair	Senate approval April 2019 – effective Fall 2019
4.	Department research space fragmented & insufficient	New EC4 space added July 2016. E7 space added fall 2018.	Department Chair	Completed Fall 2018

The Department Chair/Director, in consultation with the Dean of the Faculty shall be responsible for monitoring the Implementation Plan.





Date of next program review: \_\_\_\_\_ 2021  
Date

Signatures of Approval:

[Signature] \_\_\_\_\_ April 29/19  
Chair/Director Date

N/A \_\_\_\_\_  
AFIW Administrative Dean/Head (For AFIW programs only) Date

[Signature] \_\_\_\_\_ April 30/2019  
Faculty Dean Date

\_\_\_\_\_  
Associate Vice-President, Academic Date  
(For undergraduate and augmented programs)

[Signature] \_\_\_\_\_ September 24, 2019

\_\_\_\_\_  
Associate Vice-President, Graduate Studies and Postdoctoral Affairs Date  
(For graduate and augmented programs)

## Two-Year Progress Report: Systems Design Engineering

Name of Reviewer: Rhona Hanning

Date: 3/9/2020

---

### Does the Two-Year Progress Report:

1. Clearly describe progress achieved on the various action items in the implementation plan?  Yes  No
2. Explain convincingly any circumstances that would have altered the original implementation plan?  Yes  No
3. For items that are behind schedule, propose an amended implementation schedule that is reasonable and credible?  Yes  No
4. Address significant developments or initiatives that have arisen since the program review process, or that were not contemplated by the program review process?  Yes  No

### General Comments

Click or tap here to enter text.

# Two-Year Progress Report – New Program Applied Philosophy (PhD) August 2020

---

## **Background**

The Applied Philosophy PhD program was created by the Philosophy Department through a consultative process between 2013 and 2017. In February 2016, the proposed program was reviewed by two external reviewers: Christy Simpson, Associate Professor and Department Head, Department of Bioethics, Faculty of Medicine, Dalhousie University and Daniel Weinstock Professor and Director, McGill Institute for Health and Social Policy McGill University. Overall, their report was very positive, describing the program as "innovative," "a unique program with little or no equivalent in North America," and one that the "excellent Department of Philosophy" is "uniquely situated, given the range of their [research] interests, and of their professional and personal interests, to make a success." The reviewers also had some suggestions, discussed below. The program was formally approved in 2017, and we began admitting students in Fall 2017.

This new four-year program is distinct from our more traditional Philosophy PhD program, though students in the two programs take some courses concurrently and participate in Departmental life together. The Applied Philosophy PhD program combines traditional PhD requirements (such as the completion of course work and a dissertation project) with experiential learning components. As with PhD programs in general, students are expected to advance the state of knowledge in the field; the particular focus of the Program involves the integration of theoretical training in philosophy with the ability to apply philosophy to practical problems. The most distinctive feature of the new program is the Applied Research Placement, an eight-month research activity in which three or four months are spent doing philosophical work at a host organization. Students also have opportunities to incorporate applied components such as the creation of policy briefs, databases, or the writing for non-scholarly audiences into their coursework and dissertation projects.

## **Enrolment**

We currently have six students enrolled in the Applied Philosophy PhD program; for comparison, we have about twenty students currently enrolled in our (more traditional) PhD Program in Philosophy. The enrolment numbers below include three students who switched into our Applied Philosophy PhD program from our Philosophy PhD program, three who were admitted directly into the Applied PhD program, and one who was admitted into the Applied Philosophy program and chose to switch into our Philosophy PhD program.

Year	Number of Applicants	Number of Students Enrolled
2017-2018 (1 <sup>st</sup> year)	7	3
2018-2019 (2 <sup>nd</sup> year)	5	4

### Progress on Implementation

The program is working well and there have been no changes to the program structure. We have been pleased to connect with a number of potential host institutions for our Applied Research Placements, and the placements are working as planned. In January 2016, the Department signed a Memorandum of Understanding with Mitacs expressing plans to cooperate on funding for about 4 Applied Philosophy students per year through the Accelerate program. In 2016, the Department ran a pilot project in which three students completed Applied Research Placements, with one funded through Mitacs Accelerate. The host organizations for the pilot program were Sunnybrook Hospital, the Centre for Clinical Ethics in Toronto, and Facilitation Wellington-Dufferin.

The Department appoints an Applied Philosophy Advisor who focuses on the students in the program and coordinates the processes for placements. So far, each student has entered the program with a pretty clear sense of where they would like to do their placement, and the Applied Philosophy Advisor has been able to make personalized connections suited to their particular needs. Since the program is a four-year program, most of the six students are still at early stages of completing their degrees. Since the pilot project, we have had two more students complete placements, one at the Canadian Medical Association and another at the Indigenous Student Centre at UW.

The one challenge we have encountered is that we expected to have more applicants and more students enrolling in the program. However, we are encouraged by the increase between the first and second year. We note that this year there were five applicants and three acceptances, which will grow our overall cohort from six students to nine.

### Recommendations

1. Establish an Advisory Council/Group for the Applied Philosophy PhD program

Status: **in progress**

Details: As mentioned in our Department's response to the evaluator's comments in 2016, while we are working toward this aim, we are proceeding deliberately and, at first, somewhat informally. As we planned to do, we are currently seeking out connections in a variety of sectors, making use of our alumni network, and we are in touch with a range of host organizations. One reason the evaluators mentioned for favoring a Council was to help connect us with potential hosts and with people having

experience beyond the university; we have made connections with a good number of potential hosts and others who are interested in our program. As mentioned above, most students come to the program with preferences about hosts already formed, and we have been successful in coordinating placements that meet those preferences. Another reason we are waiting to formalize this committee is that we don't yet have a clear sense of how to populate it, since we haven't run enough students through the program to see what sectors/institutions/industries would be a good fit for the committee. Most of our initial placements were in health/social services fields, but incoming students have other interests (including the potential for on-campus placements in science, for example), and so we want to wait until we have more examples before trying to recruit members to a committee. While we therefore have a solid network of connections, we thought it prudent to wait until the program has more students to formalize an Advisory Council. We plan to start the process of forming the Advisory Council in the academic year 2021-2022.

2. Undertake ongoing monitoring to ensure equivalency across the program (building on the processes and mechanisms already identified and in development).

**Status: in progress**

Details: The evaluators pointed out that there may be challenges ensuring consistency in evaluation, especially for the work students perform in their placements and the applied components of course work and the dissertation projects. These applied components can take a range of forms, such as the creation of policy briefs or databases or the production of written work for a popular audience.

We have taken several steps toward ensuring the kind of consistency in evaluation that the recommendation refers to. First, we have implemented a new policy in which all the contracts for the Applied Research Placements are reviewed by the Associate Chair for Graduate Studies and the Applied Philosophy Advisor before being approved. Second, we are creating a library of examples of such contracts, so that students and supervisors can compare their plans with past placements. This allows us to develop rough guidelines about how applied components should be compared. Finally, as in our more traditional Philosophy PhD program, three faculty will serve on each student's committee; we expect that as more students move through the program, by working together on committees, faculty will develop shared standards over time.

3. Address the marketability of this new PhD program

**Status: in progress**

Details: With respect to marketing the PhD program to potential applicants, we have taken several steps. We have created a one-page flyer with information about the program, about the faculty, and about the placements that students have engaged in so far. The flyer has been shared at conferences, on our website, and by email. We have also discussed the new program at conferences, including at a poster session presented by a faculty member at the Philosophy of Science Association. In 2018, we formed an *ad hoc* committee to generate new ideas for reaching potential audiences.

As the evaluators note, the marketability of the new program will be partly fostered through the success of its graduates. Since the program is only two years old and it is a four-year program, this success is still in the future. Of the students who have enrolled or participated in the 2016 pilot project, one has completed her degree. She is now employed as a full-time Clinical Ethicist at the UHN Princess Margaret Cancer Care Centre in Toronto. As expected, she has helped recruit interested students, and regularly puts us in touch with applicants. We expect the two other pilot project students to complete their degrees in the coming year. Our enrolled students also participate successfully in high-profile events like the 3-Minute Thesis competition: in 2017 our pilot project student Andria Bianchi won the Arts Heat and came in second in the University of Waterloo competition, and in 2019 our Applied Philosophy student Kathryn Morrison won the Arts heat.

As mentioned above, while we have fewer students than expected, the numbers are increasingly substantially from year to year. As of September 2020, there were 9 students enrolled in the program. We are thus optimistic that the program will continue to grow and flourish.

**2023-2024**

Date of first program review: February 16, 2016  
Date

Signatures of Approval:

Patricia Mason  
Chair/Director Date Apr 30 2019

N/A  
AFIW Administrative Dean/Head (For AFIW programs only) Date

[Signature]  
Faculty Dean Date 23/10/19

**Note:** AFIW programs fall under the Faculty of ARTS; however, the Dean does not have fiscal control nor authority over staffing and administration of the program.

Associate Vice-President, Academic  
(For undergraduate programs) Date

Jeffrey M. Cassel  
Associate Vice-President, Graduate Studies and Postdoctoral Affairs  
(For graduate programs) Date November 1, 2019

**Two-Year Progress Report: Applied Philosophy PhD**

**Name of Reviewer: Siva Sivoththaman**

**Date: 10/20/2020**

---

**Does the Two-Year Progress Report:**

1. Clearly describe progress achieved on the implementation of the program?  **Yes**  **No**
2. Explain convincingly any circumstances that would have altered the original implementation plan?  **Yes**  **No**
3. For items that are behind schedule, propose an amended implementation schedule that is reasonable and credible?  **Yes**  **No**
4. Address significant developments or initiatives that have arisen since the program began?  **Yes**  **No**

**General Comments**

**N/A**



**To:** Kathy Winter, Secretary, Senate Graduate and Research Council  
**From:** Amanda McKenzie, Director, Quality Assurance (Academic Programs)  
**Cc:** Jeff Casello, Associate Vice-President, Graduate Studies and Postdoctoral Affairs  
**Re:** Global Governance PhD Final Assessment Report

## MEMO

---

The cyclical review of programs joint with other institutions are led by one of the partner institutions and governed by the respective Institutional Quality Assurance Process (IQAP). The review of the PhD in Global Governance was led by Wilfrid Laurier University (WLU). The Final Assessment Report (FAR) for the PhD in Global Governance was approved by Wilfrid Laurier University in early 2019. The FAR was then reviewed at Waterloo by Jeff Casello, as well as Simron Singh, Associate Dean, Graduate Studies in the Faculty of Environment and Linda Warley, Associate Dean, Graduate Studies in the Faculty of Arts in March 2019.

According to the University of Waterloo IQAP, the FAR must also be approved by Senate Graduate and Research Council and reported to Senate for information. As per typical practice, this FAR was reviewed by two members of Senate Graduate and Research Council, Bernie Duncker and David Clausi. Feedback was generally positive, with specific comments such as: “The implementation plan does address which recommendations will be followed along with who will be responsible for each recommendation” and “It would have been helpful to have a synopsis of the self-study findings, but perhaps this is not the practice at Laurier.”

Because this FAR has already been approved by WLU, changes to the report are not possible at this time, though feedback from the reviewers was greatly appreciated.

To streamline this process, moving forward, FARs and Two-Year Reports for joint programs that are previously approved by a partner institution will be approved by Senate Graduate and Research Council without the assignment of reviewers. Comments and suggestions raised at SGRC about these approved reports will be captured in the meeting minutes and will be kept on record with the program files in the Quality Assurance Office for future consideration at their next cyclical program review.

# Final Assessment Report for the 2017-2018 Cyclical Program Review of the Joint PhD in Global Governance

## INTRODUCTION

In accordance with Laurier's Institutional Quality Assurance Procedures ([Policy 2.1](#)), this Final Assessment Report provides a summary of the review process for the PhD in Global Governance (PhDGG) program prepared by the Quality Assurance Office, along with an identification of strengths of the program authored by the Dean of the Faculty of Graduate and Postdoctoral Studies. All recommendations made by the external review committee are listed, followed by a summary of the PhDGG program's response, and the Dean's response. Recommendations not approved for implementation have been identified, and those that have been prioritized are listed in the Implementation Plan.

The Final Assessment Report is reviewed and approved by the Associate Vice-President: Teaching and Learning and the Vice-President: Academic. Following completion of the Final Assessment Report, it is approved by the Program Review Sub-Committee and Senate Academic Planning Committee. Approval dates are listed at the end of this report. Final Assessment Reports are submitted to Senate as part of an annual report on cyclical reviews, and to the Ontario Universities Council on Quality Assurance for information. Final Assessment Reports and Implementation Reports are posted on the public-facing page of the [Quality Assurance Office](#) website.

The PhDGG is a joint program with the University of Waterloo, housed within the Balsillie School of International Affairs (BSIA). As Directorship of the program was held by Laurier during the review, the review process followed Laurier's Institutional Quality Assurance Procedures, but was highly collaborative. The Self-Study was discussed and reviewed by the necessary constituents at both Laurier and UW. The site visit itinerary was arranged collaboratively and included meetings with senior administrators from both universities. The Final Assessment Report will be approved through the regular procedures at both institutions. Follow-up reporting will adhere to Laurier's process, outlined below.

The Implementation Plan for the recommendations prioritized in the Final Assessment Report can be found at the end of this report. Units will submit their first Implementation Report two years following approval of the Final Assessment Report at Senate. The Implementation Report will include comments from the unit on actions taken toward the completion of recommendations, comments from the relevant Dean(s) related to the progress made, and comments from the Program Review Sub-Committee, which is responsible for approving the Implementation Report and deciding if further follow-up reports are required. The Senate Academic Planning Committee will also approve the Implementation Report.

## SUMMARY OF REVIEW PROCESS

The last cyclical review of the PhDGG program was conducted by OCGS in 2010. The program was classified as GOOD QUALITY with no specific issues to be addressed in the next cyclical review. The lead author of the PhDGG Self-Study was Dr. Andrew Thompson, Program Officer, with input from the PhDGG faculty at both institutions through the Inter-University Programming Committee. In addition to the Self-Study (Volume I), the program also submitted a copy of associated faculty curricula vita (Volume II), a volume of course syllabi, and a list of proposed external reviewers (Volume III). A draft of the Self-Study was reviewed by the Quality Assurance Office and Dean of the Faculty of Graduate and Postdoctoral Studies at Laurier, and by the Quality Assurance Office and the Associate Vice-President, Graduate Studies and Postdoctoral Affairs at the University of Waterloo prior to submission of the final version.

The external review committee for the review consisted of two external reviewers from outside the university, and one internal reviewer from Laurier but outside of the department. The review committee was selected by the Program Review Sub-Committee on September 14, 2017, and the site visit was scheduled by the Quality Assurance Office for January 4-5, 2018. The slate of reviewer candidates was submitted to the University of Waterloo's Quality Assurance Office in advance of the Program Review Sub-Committee meeting, and a ranking of candidates was brought forward by the Director of Quality Assurance at UW, who attended the meeting.

The review committee consisted of Dr. Suzanne Zeller from the Department of History at Wilfrid Laurier, Dr. David Black from the Department of Political Science at Dalhousie University, and Dr. Randall Germain from the Department of Political Science at Carleton University. During the site visit, the review committee met with the following individuals and groups:

- Dr. Dan Gorman, Director; Dr. Simon Dalby, Outgoing Associate Director, Dr. Andrew Thompson, Program Officer; Kelly Brown, Program Officer; Dr. Alistair Edgar, SIPG
- Dr. Douglas Deutschman, Dean of Graduate and Postdoctoral Studies, Wilfrid Laurier University
- Dr. Paul Jessop, Vice-President: Academic and Dr. Kathryn Carter, Associate Vice-President: Teaching and Learning, Wilfrid Laurier University
- Faculty who teach and supervise in the PhDGG program from both universities
- Dr. John Ravenhill, Director of the Balsillie School of International Affairs
- Graduate students in the PhDGG program
- Library representatives: Ms. Charlotte Innerd, Head of Collections (Laurier), Ms. Hélène LeBlanc, Liaison Librarian (Laurier), Ms. Jane Forgay (University of Waterloo)
- Dr. Jeff Casello, Associate Vice-President, Graduate Studies and Postdoctoral Affairs, University of Waterloo
- Dr. Linda Warley, Associate Dean of Graduate Studies, University of Waterloo
- Dr. George Dixon, Vice-President, Academic and Provost, University of Waterloo

The review committee submitted their completed report on February 6, 2018. The executive summary from the report is provided below.

## External Reviewers' Report Executive Summary

The joint WLU-WU PhD in Global Governance is an outstanding program. It has benefited from a very high-quality faculty complement, including many productive researchers and dedicated teachers and supervisors. Indeed, largely as a legacy of the CIGI Chairs program, a significant number enjoy prominent international reputations. This in turn has been a key factor in attracting a diverse cohort of excellent students, who bring a wide range of disciplinary and professional experiences to the program. Although the PhDGG is rightly concerned with being able to attract and support a larger number of international students, the products of this relatively young program have already enjoyed success in a range of professional and academic careers. In addition to the high quality of faculty available to them, students are also attracted by the excellent facilities at the CIGI campus, the rich array of events and research clusters at the Balsillie School of International Affairs, and strong financial support, again rooted in the generous initial funding provided to the School and to the program. The curriculum and courses offered by the program have provided a balanced and cutting edge training in the emerging interdisciplinary field of Global Governance, which has prepared them for a range of post-graduate pursuits. Students express a high level of satisfaction with the courses they have access to, and the support they receive from program staff and faculty.

As with any program, there are areas that require periodic re-examination and refinement. Most are relatively routine, and part of the normal process for review of an excellent – indeed flagship - program offering. Two are more pressing, however, and if unaddressed, could compromise the future of the program. In the former category, there are a number of inter-related curriculum issues that would benefit from collective consideration, including: the status of the existing six 'fields'; the current means by which the core course requirements are met; and the existing comprehensive examination process, including a common core examination and a choice of six field examinations. A second set of recommendations concern procedures and processes of communication, in relation to student research and conference funding, website coordination, and processes of complaint and appeal, for example. A third set of recommendations is related to the desire of the two universities to grow the size of the incoming student cohort, and to provide adequate financial support for this process through the systematic introduction of teaching and research assistantships.

In the latter category, and most urgent, is the looming challenge of faculty renewal as the initial cohort of CIGI Chairs (and leading international scholars who were initially recruited as CIGI Chairs) move towards retirement, and/or take up positions in other institutions. This is closely related to a second concern, which is the program's byzantine governance structure. This structure, in effect, means that the program is unable to robustly represent its own interests in the process of faculty renewal, and must rely (problematically) on the goodwill of other units to renew its faculty complement. Since the program's outstanding faculty cohort has been critical to its initial success, a failure to address these linked issues could jeopardize the future of this unique, world-class program.

Following receipt of the External Reviewers' Report, the Department collaborated on a Unit Response, which was submitted on May 24, 2018.

## RECOMMENDATIONS AND RESPONSES

The External Reviewers' Report included 21 recommendations, which have been listed verbatim below, followed by a summary of the program's response, and the decanal response from the Dean of the Faculty of Graduate and Postdoctoral Studies at Laurier.

**Recommendation #1:** It is important for the PhDGG's **websites** at the two partner institutions to provide the same information about the functioning of the program, and the various options available to students. Fields and course codes should be listed in identical order on both sites.

**Unit Response:** The program agreed to conduct a review of the websites over the summer.

**Decanal Response:** It is important to note that information for current students leads (from students.wlu.ca) only to the BSIA website and hence we have no access to update that site. Nonetheless, the FGPS agrees a review of the website would be useful.

**Recommendation #2:** The PhDGG should consider adding to its **Learning Outcomes:**

- a) a series of skills related to **Teaching and Learning** –including the Teaching Certificate available at WLU-- especially as the program is likely to add Teaching Assistantships to its student funding packages during the next cycle; and
- b) a series of **research skills** with training offered by the WLU/ UW Libraries. Such skills might usefully be promoted as components of the core course in Research Methods, and/ or as Doctoral Seminar milestones.

**Unit Response:** The program agreed with the recommendation and indicated that they would add learning outcomes related to both areas.

**Decanal Response:** The FGPS supports this recommendation and proposed action, which is related to a broader curriculum review that includes recommendations #3 and #5.

**Recommendation #3:** That the program undertake a formal review of the six **thematic fields**, with a view to reaching agreement on the following questions:

- a) can the field on Multilateral Institutions and Diplomacy be integrated into the core field on Global Governance, and/or can issues of institutions and diplomacy be integrated into the remaining thematic fields?
- b) can the field on Global Justice and Human Rights be made regularly and reliably available over the next cycle, or alternatively integrated into the remaining four thematic fields (and therefore removed as a discrete field option)?

**Unit Response:** Following the reviewers' visit, the program consulted students about the importance of the fields and have decided to leave them intact. For the 2019-2020 academic year, the program will remove the requirement that students are required to take two courses in their field of concentration.

**Decanal Response:** FGPS still has significant concerns about the current field structure. In the last 5 years, only 4 of 43 students (9%) took their comprehensive exams in the fields of Multilateral Institutions and Diplomacy or Global Justice and Human Rights. There were no exams in either field in four of the past five years. If these fields have not attracted more students before the 2-year implementation report, I would strongly recommend that the program consolidate the fields as suggested by the external reviewers.

**Recommendation #4:** That the program inform students in their acceptance packages which field courses will be offered during their first year in the program.

**Unit Response:** The program indicated that it will aim to inform students in early summer about which field courses would be offered, and to offer suitable alternatives should there be a case where a core field course cannot be offered.

**Decanal Response:** The FGPS agrees that students should have access to full information about course availability and alternative options as soon as is practical.

**Recommendation #5:** That the program review the existing **core course sequence and structure**, with a focus on: a) the relationship between the History of Global Governance and Globalization and Global Governance core course requirements; b) the means through which the Economics requirement should be met; and c) the focus and purpose of the Research Methods course.

**Unit Response:** The program agreed with the recommendation to undertake a review of the course sequence and structure and indicated that any curriculum changes that resulted from this review would be submitted for approval in Fall 2018.

**Decanal Response:** The FGPS supports the recommendation that course sequencing and progression requirements should be assessed with some regularity and would be pleased to discuss this further with the program.

**Recommendation #6:** That the program review the structure and format of the **comprehensive examination process**, to:

- a) ensure that comprehensive options align with the range of available core courses and fields; and
- b) consider whether to maintain the current practice of setting a core and a field exam, respectively, or tailoring the second comprehensive exam to the specific research interests of the candidate.

**Unit Response:** The program indicated that a review of the comprehensive examinations was connected to Recommendation #5, and would take place over the summer with any changes being submitted for approval in Fall 2018.

**Decanal Response:** FGPS supports a more streamlined process and would be pleased to discuss this further with the program.

**Recommendation #7:** That the program reconsider the time involved in its internship option and its follow-up requirements, given the tight timelines laid out for the completion of the degree, and therefore whether it should continue to be advertised as a program option.

**Unit Response:** The program believes that there is value in keeping the internship option available to students and does not wish to remove the option at this time.

**Decanal Response:** As described in the brief, the interest in the internship option is low in part because of demographics of the PhD students. Internship are likely to be more attractive to students coming directly from a Masters' program. Unless the program shifts its target market, it will have to actively advertise the benefits that students gain as a result of participating in the internship. FGPS thinks that there is a need for an ongoing discussion about the internship option.

**Recommendation #8:** That all comprehensive examinations be verified for authenticity of authorship and checked for plagiarism, to ensure their Academic Integrity.

**Unit Response:** The program will include this recommendation as part of its curriculum review process.

**Decanal Response:** The value of routine screening of graduate exams and theses for plagiarism using software tools like Turnitin is being discussed at the Ontario Council of Graduate Studies. FGPS supports further discussion on this matter. As this is related to several other initiatives that are part of the curriculum review process, it has not been included as a separate item in the Implementation Plan.

**Recommendation #9:** The program should move towards the incorporation of TA and RA duties as part of funding packages, and in the interest of enhancing student training. This is important not only to enable program growth and fifth-year support, but to link the program more visibly and organically to main campus programs. While both the Self-Study and the students express the hope that future funding packages will limit TA duties to Years 2 and 4 of the program, it may be more realistic to recognize that most other doctoral programs include such duties as essential to student training and support from Year 1.

**Unit Response:** The program outlined the challenges associated with the incorporation of TA and RA opportunities for PhD students, including the absence of a related undergraduate program and the necessity of consistent practices across institutions. The program reiterated its commitment to identifying suitable teaching opportunities for its students.

**Decanal Response:** While it is true there is no direct access to an undergraduate program, there are TA opportunities for the students. FGPS agrees with the external reviewers that most other doctoral programs include such duties as essential to student training and support from Year 1.

**Recommendation #10:** That WLU confirm its commitment to its joint programmes by offering students admitted to these programs funding equal to that offered by partner institutions.

**Unit Response:** The program indicated that the funding packages offered by both universities are currently consistent.

**Decanal Response:** FGPS agrees that maintaining funding parity across the university is an important goal. At the same time, it is important to acknowledge that the two universities have access to different resources, so it is not possible to guarantee parity in the future. Given this, this recommendation has not been included in the Implementation Plan.

**Recommendation #11:** That the program provide transparent and regular communication about the procedures for accessing student research and travel funding.

**Unit Response:** The program indicated that it agreed with this recommendation and had already begun to implement it. Related information had been communicated to students, and would be included in the program's student handbook.

**Decanal Response:** The FGPS has also made the request that any BSIA research/travel funds allocated to WLU students should be communicated (and made available to Laurier students) via the institution's standard means, thereby ensuring that each student's financial record is current and reflects the full level of financial support provided.

**Recommendation #12:** That WLU's Office of Graduate Studies consult with its graduate students to clarify its student policies and procedures with respect to program registration and the disbursement of funding, to align these with the experience of students enrolled through the University of Waterloo.

**Unit Response:** The program indicated that it would defer to Laurier's Faculty of Graduate and Postdoctoral Studies on this recommendation.

**Decanal Response:** FGPS uses a multi-channel communication approach through its website, bi-weekly news bulletin. Students are supported by FGPS staff, and that of the program officer and graduate program coordinator. Institutional policies and procedures are available online for all Laurier students (including the Laurier registrants in the global governance program). While the degree program requirements in this joint program are consistent across both institutions, as registrants in a joint program, the students are bound to policies and procedures of their home institution.



**Recommendation #13:** That the two universities and the program consult on common rules regarding student complaints and appeals, and ensure that these rules are clearly known to both students and instructors.

**Unit Response:** The program indicated that students are bound by the rules of their home institution, but that they would add information about relevant policies and procedures to the program handbook.

**Decanal Response:** The FGPS agrees with the unit response and would be pleased to see the program handbook enhanced to reflect current information equally from both institutions in this regard. It is also appropriate to expect PhD students to take responsibility for being informed about their own degree program.

**Recommendation #14:** That the two universities agree on an administrative arrangement for the program that ensures strong representation of its interests in university level strategic and appointments decision-making.

**Unit Response:** The program indicated that its administrative arrangement was a matter for senior administration at both universities to address.

**Decanal Response:** The FGPS agrees that the program deserves and needs strong representation in university-level strategic planning. The dean of FGPS has discussed this issue with the Provost/VPA.

**Recommendation #15:** That the PhDGG program consult with its students regarding their Support Service needs, and liaise with appropriate administration and staff to mitigate students' concerns.

**Unit Response:** The program indicated that it would add information about support services to the orientation session held at the beginning of each year at both institutions.

**Decanal Response:** The FGPS agrees that Support Services available at each institution should be identified in a program handbook.

**Recommendation #16:** That the School and the partner universities explore the feasibility of a mechanism by which the share of research overheads generated by BSIA affiliated faculty be transferred to the school in proportion to the share of their time devoted to BSIA program responsibilities.

**Unit Response:** The program indicated that this recommendation was a matter for senior administration at both universities.

**Decanal Response:** This recommendation falls outside of the expectations of a program review and is a matter for senior administration at both universities. Thus, it has not been included in the Implementation Plan.

**Recommendation #17:** That the two universities commit to a plan for recruiting high-level research chairs who will be substantially committed to teaching and supervision in the PhDGG and other BSIA programs.

**Unit Response:** The program agrees with this recommendation but responded that its implementation was outside of the program's control as hiring decisions are not made by the PhDGG program itself. The program is committed to discussion with senior administration at both universities, which would be required to implement this recommendation.

**Decanal Response:** This recommendation falls outside of the expectations of a program review and is a matter for senior administration at both universities. This is tied to recommendation #14, which calls for the identification of the person who will advocate for the program at the highest levels of the administration. This recommendation has not been included in the Implementation Plan.

**Recommendation #18:** That the program carefully monitor its Teaching and Supervisory capacities over the next cycle, to ensure that its commitments to students do not exceed these capacities.

**Unit Response:** The program responded that it would ensure any growth would be sustainable and in alignment with available faculty resources.

**Decanal Response:** Enrolment targets are managed at the institutional level, and are established consultatively at the graduate level to ensure that faculty teaching, supervisory and financial resources are sufficient. As this is an ongoing operational process, it has not been included in the Implementation Plan.

**Recommendation #19:** That the program compile more detailed data regarding its applicants' institutional and disciplinary origins over the next cycle.

**Unit Response:** The program indicated that it was already collecting this information and would continue to do so throughout the next review period.

**Decanal Response:** The FGPS welcomes this suggestion, and is prepared to assist in any way possible. As this reflects a current and ongoing rather than new initiative, it has not been included in the Implementation Plan.

**Recommendation #20:** That the universities and the program continue to explore innovative means to enable and support increased international student recruitment as part of the effort to increase entering cohort numbers.

**Unit Response:** The program agreed with the importance of attracting international students and is committed to working with the administration at both universities to implement this recommendation.

**Decanal Response:** Laurier strives to attract a diverse graduate student cohort, including international students. Early recruitment of strong prospects may strengthen the quality of Vanier applicants, which may lead to greater success. Adequate and sustainable financial support contributions from faculty research grants would also strengthen the program's ability to attract and fund additional international students. The scope of this recommendation is institutional rather than program-specific, so it has not been included in the Implementation Plan.

**Recommendation #21:** That the program compile more detailed data regarding the sources of its students' external funding over the next cycle.

**Unit Response:** The program indicated that it already tracks this data and would continue to do so.

**Decanal Response:** The FGPS agrees with this recommendation and would be pleased to discuss this further. As a current and ongoing initiative, it has not been included in the Implementation Plan.

## STRENGTHS OF THE PROGRAM(S)

- The program benefits from the unique arrangement supported at the Balsillie School. It is important to continue to leverage that strength in planning for the future.

## OPPORTUNITIES FOR IMPROVEMENT AND ENHANCEMENT

- There are two sets of issues where the program and university need to do a better job of collaborating on decision-making and clearly communicating this to the students.
  - The first set of issues are about tactical details like policies, procedures, and day-to-day management of the program (e.g. recommendations 4, 11, 12, 13 and 15).
  - The second set of issues have to do with identifying and institutionalizing the person or people responsible for advocating for resources for students and faculty in strategic planning (e.g. recommendations 14, 16, 17, and 18).

## SIGNATURES

Dr. Douglas Deutschman

August 2, 2018



Dr. Kathryn Carter

September 18, 2018



Dr. Rob Gordon

October 5, 2018



## RECOMMENDATIONS PRIORITIZED FOR IMPLEMENTATION AND ACTION PLAN

Recommendation to be Implemented	Responsibility for Implementation	Anticipated Completion Date	Responsibility for Resourcing (if applicable)	Additional Notes
<p><b>Recommendation #1:</b> It is important for the PhDGG's <b>websites</b> at the two partner institutions to provide the same information about the functioning of the program, and the various options available to students. Fields and course codes should be listed in identical order on both sites.</p>	Program Director or designee(s)	July 2019		
<p><b>Recommendation #2:</b> Addition of learning outcomes related to teaching and research skills.</p>	Program Director or designee(s)	September 2019		
<p><b>Recommendation #3:</b> That the program undertake a formal review of the six <b>thematic fields</b>.</p>	Program Director	September 2019		
<p><b>Recommendation #4:</b> That the program inform students in their acceptance packages which field courses will be offered during their first year in the program. (Notice, this should also be reflected in the revisions to the website mentioned in #1 and the university policies and funding packages described in #2)</p>	Program Director, FGPS	December 2019		The offer letter for all graduate students are generated within FGPS and contain information on funding and deadlines. The Program Director and FGPS need to coordinate communication so that the information is sent at the same time, whether in a separate communication or combined into a single communication.

Recommendation to be Implemented	Responsibility for Implementation	Anticipated Completion Date	Responsibility for Resourcing (if applicable)	Additional Notes
<p><b>Recommendation #5:</b> That the program review the existing <b>core course sequence and structure</b>, with a focus on: a) the relationship between the History of Global Governance and Globalization and Global Governance core course requirements; b) the means through which the Economics requirement should be met; and c) the focus and purpose of the Research Methods course.</p>	Program Director	September 2020		This is an essential part of the review of the thematic fields (#3) and the comprehensive examination (#6).
<p><b>Recommendation #6:</b> That the program review the structure and format of the <b>comprehensive examination process</b>, to ensure that comprehensive options align with the range of available core courses and fields; and consider whether to maintain the current practice of setting a core and a field exam, respectively, or tailoring the second comprehensive exam to the specific research interests of the candidate.</p>	Program Director	September 2020		
<p><b>Recommendation #7:</b> That the program reconsider the time involved in its internship option and its follow-up requirements, given the tight timelines laid out for the completion of the degree, and therefore whether it should continue to be advertised as a program option.</p>	Program Director	September 2020		Two more years of data will inform the decision about maintaining this option.

Recommendation to be Implemented	Responsibility for Implementation	Anticipated Completion Date	Responsibility for Resourcing (if applicable)	Additional Notes
<b>Recommendation #9:</b> The program should move towards the incorporation of TA and RA duties as part of funding packages, and in the interest of enhancing student training.	Program Director, VPA/Provost, Dean of FGPS	September 2020		If the program has aspirations for growth, the incorporation of TA and RA opportunities may prove integral to funding a larger cohort. In accordance with the university's funding policy for doctoral students, the opportunity to TA or to teach a course is deemed integral to the program and student training.
<b>Recommendation #11:</b> That the program provide transparent and regular communication about the procedures for accessing student research and travel funding.	Program Director, VPA/Provost, Dean of FGPS	September 2020		Related to Recommendation #9 above: while funding currently is reasonably comparable between institutions, increasing the variety of sources from which funding can be drawn will help diversify the opportunities available to students.
<b>Recommendation #12:</b> That WLU's Office of Graduate Studies consult with its graduate students to clarify its student policies and procedures with respect to program registration and the disbursement of funding, to align these with the experience of students enrolled through the University of Waterloo.	FPGS with input from PhDGG Program Director.	July 2019		Alignment of our policies and procedures will be harmonized with the University of Waterloo as much as possible. FGPS will communicate policies and procedures and highlight any areas where the two schools operate under different systems or constraints.
<b>Recommendation #14:</b> That the two universities agree on an administrative arrangement for the program that ensures strong representation of its interests in university level	VPA/Provost, Dean of FGPS, Associate Dean (SIPG)	September 2019		This is an important recommendation to ensure that the programs in SIPG have strong advocacy and adequate representation at Laurier.

strategic and appointments decision-making.				
<b>Recommendation #15:</b> That the PhDGG program consult with its students regarding their Support Service needs, and liaise with appropriate administration and staff to mitigate students' concerns.	Program Director or designee(s)	September 2019		

## MEMORANDUM

TO: Kathy Winter, Secretary, Senate Graduate and Research Council

FROM: Tracy Taves, Faculty Graduate Administrator, Applied Health Sciences

cc: Brian Laird, Associate Dean, Graduate Studies

DATE: September 29, 2020

SUBJECT: **Applied Health Sciences Faculty Graduate Studies Committee (FGSC) Report to Senate Graduate and Research Council**

---

The attached report was approved by the Applied Health Sciences Faculty Council on September 25, 2020, was reviewed by Trevor Clews and is now being forwarded to Senate Graduate & Research Council for inclusion on the agenda for the next meeting.

Thank you!



## Graduate calendar changes for Applied Health Sciences

### 1. PROGRAM INACTIVATIONS

#### 1.1 **Kinesiology\*** effective Winter 2021

##### 1.1.1 **Motion:** Discontinue the collaborative doctoral program in Work and Health in Kinesiology

**Rationale:** The AHS collaborative program in Work and Health has had low enrolment in the past five years and Faculty whose research interests centre around Work and Health feel that the student's interests are fully accommodated within the Department-specific program.

#### 1.2 **Recreation and Leisure Studies\*** effective Winter 2021

##### 1.2.1 **Motion:** Discontinue the collaborative doctoral program in Work and Health in Recreation and Leisure Studies

**Rationale:** The AHS collaborative program in Work and Health has had low enrolment in the past five years and Faculty whose research interests centre around Work and Health feel that the student's interests are fully accommodated within the Department-specific program.

#### 1.3 **School of Public Health and Health Systems\*** effective Winter 2021

##### 1.3.1 **Motion:** Discontinue the collaborative doctoral program in Work and Health in School of Public Health and Health Systems

**Rationale:** The AHS collaborative program in Work and Health has had low enrolment in the past five years and Faculty whose research interests centre around Work and Health feel that the student's interests are fully accommodated within the Department-specific program.

### 2. COURSE CHANGES

#### 2.1 **Department of Kinesiology\*** Effective Winter 2021

##### 2.1.1. **Motion:** Revise KIN 632 (0.25) Clinical and Health Measurement to KIN 632 (0.50) Clinical and Health Measurement

**Rationale:** Clinical Epidemiology and Health Measurement will build on basic research methods to discuss issues in clinical epidemiology. Measurement of disease and statistical and research methodology to develop good measures will be a focus. The purpose of this course is to enhance research design and critical appraisal skills while introducing students to clinical and health measurement including: purpose of measurement; development concepts and approaches (e.g. clinimetric vs. psychometric); validation and reliability testing; key statistical tests (sensitivity, intra-class correlation); and responsiveness to treatment. After completing this course, students should expect to have mastered the ability for determining if a clinical or health measurement has value in practice or research. They will attain critical appraisal skills of various clinical tools and health measures. The depth of knowledge and exposure to concepts requires more than a 0.25 weighting.

\*attachment

Prior to form submission, review the [content revision instructions](#) and information regarding [major/minor modifications](#). For questions about the form submission, contact [Trevor Clews](#), Graduate Studies and Postdoctoral Affairs (GSPA).

**Faculty:** Applied Health Sciences

**Program:** Doctor of Philosophy (PhD) in Kinesiology - Work and Health

**Program contact name(s):** Andrew Laing

**Form completed by:**

**Description of proposed changes:**

Note: changes to courses and milestones also require the completion/submission of the SGRC Course/Milestone-New/Revision/Inactivation form ([PC docx version](#) or [MAC docx version](#)).

*Discontinue the collaborative program in Work and Health.*

**Is this a [major modification](#) to the program?** Yes

**Rationale for change(s):** The AHS collaborative program in Work and Health has had low enrolment in the past five years and Faculty whose research interests centre around Work and Health feel that the student's interests are fully accommodated within the Department-specific program.

**Proposed effective date:** Term: Winter Year: 2021

**Current [Graduate Studies Academic Calendar \(GSAC\)](#) page** (include the link to the web page where the changes are to be made):

<https://uwaterloo.ca/graduate-studies-academic-calendar/applied-health-sciences/department-kinesiology/doctor-philosophy-phd-kinesiology-work-and-health>

Current Graduate Studies Academic Calendar content:	Proposed Graduate Studies Academic Calendar content:
<p><b><del>DOCTOR OF PHILOSOPHY (PHD) IN KINESIOLOGY - WORK AND HEALTH</del></b></p> <p><b><del>Program information</del></b></p> <ul style="list-style-type: none"> <li><del>• Admit term(s)-               <ul style="list-style-type: none"> <li>◦ Fall</li> </ul> </del></li> <li><del>• Delivery mode-               <ul style="list-style-type: none"> <li>◦ On-campus</li> </ul> </del></li> <li><del>• Length of program-               <ul style="list-style-type: none"> <li>◦ Must be completed within 12 terms (full time) from completion of the Master's degree.</li> <li>◦ Students must have permission of the Department Graduate Committee to continue enrolment beyond term limits.</li> </ul> </del></li> </ul>	

Current Graduate Studies Academic Calendar content:	Proposed Graduate Studies Academic Calendar content:
<ul style="list-style-type: none"> <li>○ <del>Students are expected to devote as much time as is necessary to complete their thesis within this timeline.</del></li> <li>○ <del>Students must be continuously enrolled at the University to the end of the term in which they complete the degree requirements.</del></li> <li>• <del>Program type-</del> <ul style="list-style-type: none"> <li>○ Collaborative</li> <li>○ Doctoral</li> <li>○ Research</li> </ul> </li> <li>• <del>Registration option(s)-</del> <ul style="list-style-type: none"> <li>○ Full-time</li> <li>○ Part-time</li> </ul> </li> <li>• <del>Study option(s)-</del> <ul style="list-style-type: none"> <li>○ Thesis</li> </ul> </li> </ul> <p><b>Admission requirements</b></p> <ul style="list-style-type: none"> <li>• <del>Minimum requirements-</del> <ul style="list-style-type: none"> <li>○ <del>A Master's degree with a minimum 75% average in a relevant field (normally Kinesiology, Recreation and Leisure Studies, or Health Studies and Gerontology, but other degrees in Life, Behavioural and Social Sciences could be suitable as well).</del></li> <li>○ <del>Letter stating research interests and why the student wishes to pursue graduate studies.</del></li> </ul> </li> <li>• <del>Application materials-</del> <ul style="list-style-type: none"> <li>○ Curriculum vitae</li> <li>○ Supplementary information form</li> <li>○ Transcript(s)</li> <li>○ Writing sample <ul style="list-style-type: none"> <li>▪ <del>Submit one copy of a term paper, research project or thesis written during the last year of their master's studies.</del></li> </ul> </li> </ul> </li> <li>• <del>References-</del> <ul style="list-style-type: none"> <li>○ <del>Number of references: 3</del></li> <li>○ <del>Type of references: from faculty members who taught the student while in a Master's program. Normally, 1 must be from the Master's supervisor.</del></li> </ul> </li> <li>• <del>English language proficiency (ELP) (if applicable)</del></li> </ul> <p><b>Degree requirements</b></p> <p><del>Thesis option:</del></p> <ul style="list-style-type: none"> <li>• <del>Graduate Academic Integrity Module (Graduate AIM)</del></li> </ul>	

Current Graduate Studies Academic Calendar content:	Proposed Graduate Studies Academic Calendar content:
<ul style="list-style-type: none"> <li>• <del>Courses-</del> <ul style="list-style-type: none"> <li>◦ <del>Students will normally complete a minimum of 2.00 units of graduate courses (e.g. 4 courses each at a 0.50 unit weight), that must include the courses listed below. All graduate courses must be assigned a numerical grade. Students must obtain an average of at least 75% in the set of courses which they present in fulfilment of course requirements. A grade below 70% on any individual course or an average below 75% on the set of courses for the degree will result in a review of the student's status by the Department Graduate Committee. If a student receives a grade in any individual course below 60%, the Department Graduate Committee review may result in the requirement to withdraw from the program. If the student is permitted to proceed, any course with a grade below 60% will not be eligible towards the degree requirements, thus requiring the course to be repeated or additional course work to be completed.</del> <ul style="list-style-type: none"> <li>• <del>KIN 730 Fundamentals of Work and Health (0.50 units)</del></li> <li>• <del>KIN 731 Approaches to Research in Work and Health (0.50 units)</del></li> <li>• <del>0.50 units of graduate level statistics/research methods</del></li> </ul> </li> <li>◦ <del>Students must also complete the following CR/NCR graduate seminars:</del> <ul style="list-style-type: none"> <li>• <del>KIN 732A Work and Health Research Seminar I</del></li> <li>• <del>KIN 732B Work and Health Research Seminar II</del></li> </ul> </li> </ul> </li> <li>• <del>Link(s) to courses</del> <ul style="list-style-type: none"> <li>◦ <del>Kinesiology (KIN) courses</del></li> <li>◦ <del>Graduate course search</del></li> </ul> </li> <li>• <del>Academic Integrity Workshop</del></li> <li>• <del>PhD Professional Development Seminar</del> <ul style="list-style-type: none"> <li>◦ <del>Students are required to complete a series of professional development seminars and workshops throughout their program of study.</del></li> </ul> </li> <li>• <del>PhD Comprehensive Examination</del> <ul style="list-style-type: none"> <li>◦ <del>Students are required to meet the University-level PhD Comprehensive Examination minimum requirements outlined in the "Minimum requirements for the PhD degree" section of the</del></li> </ul> </li> </ul>	

Current Graduate Studies Academic Calendar content:	Proposed Graduate Studies Academic Calendar content:
<p><del>Graduate Studies Academic Calendar (GSAC), with certain noted differences that are specific to the Faculty of Applied Health Sciences</del></p> <p><del>Comprehensive Examination minimum requirements:</del></p> <ul style="list-style-type: none"> <li><del>▪ Comprehensive examination purpose: Consistent with University-level minimum requirements. Note: In the Faculty of Applied Health Sciences, the novel research topic is tested through a separate thesis proposal process.</del></li> <li><del>▪ Timing: Consistent with University-level minimum requirements.</del></li> <li><del>▪ Committee: Consistent with University-level minimum requirements with the exception that in the Faculty of Applied Health Sciences, the composition of the comprehensive examining committee will be approved by the Associate Chair or Director, Graduate Studies for the student's Department/School, as delegated by the Associate Dean, Graduate Studies.</del></li> <li><del>▪ Who Chairs an examination: Consistent with University-level minimum requirements.</del></li> <li><del>▪ Format / Content: Consistent with University-level minimum requirements.</del></li> <li><del>▪ Academic integrity: Consistent with University-level minimum requirements.</del></li> </ul> <ul style="list-style-type: none"> <li>• <del>PhD Thesis</del> <ul style="list-style-type: none"> <li>◦ <del>Thesis Proposal: Following successful completion of the comprehensive exam, each student will be required to compete a PhD thesis proposal. The proposal involves a written document related to the student's thesis area. The thesis project and proposal are developed in consultation with the supervisor. Each student must orally defend the thesis proposal to the Advisory Committee, consisting of the supervisor (or co-supervisors), and two other members (one of which must be from a home Department within the</del></li> </ul> </li> </ul>	

Current Graduate Studies Academic Calendar content:	Proposed Graduate Studies Academic Calendar content:
<p><del>collaborative program in Work and Health). A chair to oversee the oral thesis proposal defense will be appointed by the home Department.</del></p> <ul style="list-style-type: none"> <li><del>○ Thesis Defence: Each student is required to submit a thesis embodying the results of original research carried out under the direction of an Advisory Committee headed by the supervisor. The candidate defends the thesis before an Examining Committee approved by the Department Graduate Committee. The Examining Board should consist of the Advisory Committee (see thesis proposal above), an additional member that is external to the Department (referred to as the internal-external), and finally an additional member that is external to the University (referred to as the external examiner).</del></li> <li><del>○ The thesis will be in an area relevant to Work and Health.</del></li> </ul> <ul style="list-style-type: none"> <li>● <del>Other requirements-</del> <ul style="list-style-type: none"> <li><del>○ Student evaluation: A review of each student's progress by both the supervisor and Department Graduate Committee takes place each year. Students are evaluated on several criteria, including performance in courses, progress towards course and milestone completion, thesis progress, scholarly activity, and research and teaching assistantship activity.</del></li> </ul> </li> </ul>	

**How will students currently registered in the program be impacted by these changes?** There are no students currently enrolled in the program.

**Department/School approval date (06//23/20):**

**Reviewed by GSPA (for GSPA use only)  date (mm/dd/yy):**

**Faculty approval date (mm/dd/yy):**

**Senate Graduate & Research Council (SGRC) approval date (mm/dd/yy):**

**Senate approval date (mm/dd/yy) (if applicable):**

Prior to form submission, review the [content revision instructions](#) and information regarding [major/minor modifications](#). For questions about the form submission, contact [Trevor Clews](#), Graduate Studies and Postdoctoral Affairs (GSPA).

**Faculty:** Applied Health Sciences

**Program:** Doctor of Philosophy (PhD) in Recreation and Leisure Studies - Work and Health

**Program contact name(s):** Bryan Grimwood

**Form completed by:**

**Description of proposed changes:**

Note: changes to courses and milestones also require the completion/submission of the SGRC Course/Milestone-New/Revision/Inactivation form ([PC docx version](#) or [MAC docx version](#)).

*Discontinue the collaborative program in Work and Health.*

**Is this a [major modification](#) to the program?** Yes

**Rationale for change(s):** The AHS collaborative program in Work and Health has had low enrolment in the past five years and Faculty whose research interests centre around Work and Health feel that the student's interests are fully accommodated within the Department-specific program.

**Proposed effective date:** Term: Winter Year: 2021

**Current [Graduate Studies Academic Calendar \(GSAC\)](#) page** (include the link to the web page where the changes are to be made):

<https://uwaterloo.ca/graduate-studies-academic-calendar/applied-health-sciences/department-recreation-and-leisure-studies/doctor-philosophy-phd-recreation-and-leisure-studies-work-and-health>

Current Graduate Studies Academic Calendar content:	Proposed Graduate Studies Academic Calendar content:
<p><del><b>DOCTOR OF PHILOSOPHY (PHD) IN RECREATION AND LEISURE STUDIES - WORK AND HEALTH</b></del></p> <p><del><b>Program information</b></del></p> <ul style="list-style-type: none"> <li><del>• Admit term(s)               <ul style="list-style-type: none"> <li><del>◦ Fall</del></li> </ul> </del></li> <li><del>• Delivery mode               <ul style="list-style-type: none"> <li><del>◦ On-campus</del></li> </ul> </del></li> <li><del>• Length of program               <ul style="list-style-type: none"> <li><del>◦ Must be completed within the following time periods from completion of the Master's degree unless an extension has been granted:                   <ul style="list-style-type: none"> <li><del>• Full-time: 12 terms</del></li> <li><del>• Part-time: 18 terms</del></li> </ul> </del></li> </ul> </del></li> </ul>	

Current Graduate Studies Academic Calendar content:	Proposed Graduate Studies Academic Calendar content:
<ul style="list-style-type: none"> <li>• Program type- <ul style="list-style-type: none"> <li>◦ Collaborative</li> <li>◦ Doctoral</li> <li>◦ Research</li> </ul> </li> <li>• Registration option(s)- <ul style="list-style-type: none"> <li>◦ Full-time</li> <li>◦ Part-time</li> </ul> </li> <li>• Study option(s)- <ul style="list-style-type: none"> <li>◦ Thesis</li> </ul> </li> </ul> <p><b>Admission requirements</b></p> <ul style="list-style-type: none"> <li>• Minimum requirements- <ul style="list-style-type: none"> <li>◦ Normally a Master's degree with a minimum 75% average in a field that is relevant to the area of work and health (normally kinesiology, recreation and leisure studies or health studies and gerontology, but other degrees in life and social sciences could be suitable as well).</li> </ul> </li> <li>• Application materials- <ul style="list-style-type: none"> <li>◦ Résumé/Curriculum vitae <ul style="list-style-type: none"> <li>▪ Indicating past academic and professional experience.</li> </ul> </li> <li>◦ Supplementary information form</li> <li>◦ Transcript(s)</li> <li>◦ Writing sample <ul style="list-style-type: none"> <li>▪ Students must submit a copy of previous academic work, such as a term paper, published manuscript or master's thesis.</li> </ul> </li> </ul> </li> <li>• References- <ul style="list-style-type: none"> <li>◦ Number of references: 3</li> <li>◦ Type of references: academic</li> </ul> </li> <li>• English language proficiency (ELP) (if applicable)</li> </ul> <p><b>Degree requirements</b></p> <p>Thesis option:</p> <ul style="list-style-type: none"> <li>• Graduate Academic Integrity Module (Graduate AIM)</li> <li>• Courses- <ul style="list-style-type: none"> <li>◦ Students must obtain credit for each of the courses listed below. They will normally complete a minimum of 4 half (0.50 credit) courses, consisting of 2 core/fundamentals course, a graduate level statistics/research methods course, and an elective which will be related to work and health. In addition,</li> </ul> </li> </ul>	



Current Graduate Studies Academic Calendar content:	Proposed Graduate Studies Academic Calendar content:
<p>students will participate in the doctoral research seminar in work and health.</p> <ul style="list-style-type: none"> <li>▪ Foundational Knowledge on Work and Health</li> <li>▪ Approaches to Research in Work and Health</li> <li>▪ A Graduate Level Course in Research Methods or Statistics</li> <li>▪ 1 elective course (see list of electives below)</li> <li>▪ Work and Health Seminar (graded on credit basis)</li> </ul> <p>○ Elective courses:</p> <ul style="list-style-type: none"> <li>▪ REC 601 Theoretical and Methodological Issues in Leisure Research</li> <li>▪ REC 603 Leisure and Social Policy</li> <li>▪ REC 605 Social and Psychological Analysis of Leisure</li> <li>▪ REC 608 Gender, Leisure &amp; the Use of Time</li> <li>▪ REC 610 Administrative Practice in Recreational Service</li> <li>▪ REC 672 Quantitative Research Data Analysis and Interpretation</li> <li>▪ REC 673 Qualitative Research Data Analysis and Interpretation</li> <li>▪ REC 792 Advanced Research Methods (PhD only)</li> <li>▪ REC 798 Advanced Topics in Leisure Studies (PhD only)</li> <li>▪ KIN 601 Muscle Physiology</li> <li>▪ KIN 602 Respiratory and Cardiovascular Physiology</li> <li>▪ KIN 616 Neural Control of Human Movement</li> <li>▪ KIN 620 Ergonomic Aspects of Occupational Musculoskeletal Injuries</li> <li>▪ KIN 631A Introduction to Statistics</li> <li>▪ KIN 631C Correlation and Regression</li> <li>▪ KIN 631E Analysis of Variance I</li> <li>▪ KIN 631F Analysis of Variance II</li> <li>▪ KIN 631G Biological Deterministic Modeling and Signal Processing</li> <li>▪ KIN 651 Motor Learning</li> <li>▪ KIN 656 Neurobehavioural Analyses of Perceptual and Motor Deficits</li> </ul>	

Current Graduate Studies Academic Calendar content:	Proposed Graduate Studies Academic Calendar content:
<ul style="list-style-type: none"> <li>• <del>KIN 727 Low Back Disorders: Optimizing Prevention, Rehabilitation and Performance</del></li> <li>• <del>HSG 601 Lifespan Approaches to Health Promotion and Disease Prevention</del></li> <li>• <del>HSG 604 Evaluation of Health and Human Services Programs</del></li> <li>• <del>HSG 605A Introduction to Statistics</del></li> <li>• <del>HSG 605C Correlation and Regression</del></li> <li>• <del>HSG 605E E Analysis of Variance I</del></li> <li>• <del>HSG 605F Analysis of Variance II</del></li> <li>• <del>HSG 606 Epidemiological Methods</del></li> <li>• <del>PHS 604 Public Health and the Environment (online course)</del></li> <li>• <del>Link(s) to courses</del> <ul style="list-style-type: none"> <li>◦ <del>Recreation and Leisure Studies (REC) courses</del></li> <li>◦ <del>Graduate course search</del></li> </ul> </li> <li>• <del>Academic Integrity Workshop</del></li> <li>• <del>PhD Research Seminar</del> <ul style="list-style-type: none"> <li>◦ <del>Students will participate in the PhD Research Seminar in Work and Health.</del></li> </ul> </li> <li>• <del>Research Presentation</del> <ul style="list-style-type: none"> <li>◦ <del>All PhD students in the Department of Recreation and Leisure Studies in their second year or later must deliver a public research presentation to faculty and students during their doctoral program. Forums at which this milestone can be completed are the PhD Research Seminar or an independently arranged departmental seminar (excludes conferences and symposia). Supervisor approval/confirmation of completion of this milestone is required.</del></li> </ul> </li> <li>• <del>PhD Comprehensive Examination</del> <ul style="list-style-type: none"> <li>◦ <del>Students are required to meet the University-level PhD Comprehensive Examination minimum requirements outlined in the “Minimum requirements for the PhD degree” section of the Graduate Studies Academic Calendar (GSAC), with certain noted differences that are specific to the Faculty of Applied Health Sciences Comprehensive Examination minimum requirements:</del></li> </ul> </li> </ul>	

Current Graduate Studies Academic Calendar content:	Proposed Graduate Studies Academic Calendar content:
<ul style="list-style-type: none"> <li>• <del>Comprehensive examination purpose: Consistent with University-level minimum requirements. Note: In the Faculty of Applied Health Sciences, the novel research topic is tested through a separate thesis proposal process.</del></li> <li>• <del>Timing: Consistent with University-level minimum requirements.</del></li> <li>• <del>Committee: Consistent with University-level minimum requirements with the exception that in the Faculty of Applied Health Sciences, the composition of the comprehensive examining committee will be approved by the Associate Chair or Director, Graduate Studies for the student's Department/School, as delegated by the Associate Dean, Graduate Studies.</del></li> <li>• <del>Who Chairs an examination: Consistent with University-level minimum requirements.</del></li> <li>• <del>Format / Content: Consistent with University-level minimum requirements.</del></li> <li>• <del>Academic integrity: Consistent with University-level minimum requirements.</del></li> <li>• <del>PhD Thesis <ul style="list-style-type: none"> <li>◦ <del>A PhD thesis proposal is required of all PhD students after passing the comprehensive examinations, and before proceeding to data collection. The proposal should contain a detailed statement of the research problem and its significance for a body of leisure-related theory, a precise account of the methodology or research techniques to be employed, plus a detailed outline of the proposed data analyzes. The candidate will be required to present and defend this proposal before the thesis committee. The final thesis report based on the completed research must also be successfully defended to satisfy the thesis requirement. The PhD thesis advisory committee is normally comprised of a minimum of three members including</del></li> </ul> </del></li> </ul>	

Current Graduate Studies Academic Calendar content:	Proposed Graduate Studies Academic Calendar content:
<p><del>the supervisor, one faculty member appointed in the student's department, and one other member from either the student's department or from another department within the University. Normally, any additional members of the advisory committee must have academic appointment. The thesis advisory committee must be approved by the Associate Chair, Graduate Studies. The proposal will be defended before the thesis advisory committee. Upon completion of the thesis, the final document will be defended before a five person Examination Board made up of the supervisor, three other members of the University community (two of whom are normally the advisory committee members and one other individual from outside the home department), and an external examiner.</del></p> <ul style="list-style-type: none"> <li>◊ <del>The thesis will be on a topic in an area relevant to Work and Health.</del></li> <li>• <del>Other requirements-</del> <ul style="list-style-type: none"> <li>◊ <del>Student evaluation: a review of each student's progress takes place during the month of May each year. Students are evaluated on several criteria, including performance in courses, progress with regard to the comprehensive examination and thesis work and, where appropriate, reports submitted by the students regarding their research and teaching assistantship activity. A grade average of at least 75% must be maintained.</del></li> </ul> </li> </ul>	

**How will students currently registered in the program be impacted by these changes?** There are no students currently enrolled in the program.

**Department/School approval date (06/30/20):**

**Reviewed by GSPA (for GSPA use only)  date (mm/dd/yy):**

**Faculty approval date (mm/dd/yy):**

**Senate Graduate & Research Council (SGRC) approval date (mm/dd/yy):**

**Senate approval date (mm/dd/yy) (if applicable):**

Prior to form submission, review the [content revision instructions](#) and information regarding [major/minor modifications](#). For questions about the form submission, contact [Trevor Clews](#), Graduate Studies and Postdoctoral Affairs (GSPA).

**Faculty:** Applied Health Sciences

**Program:** Doctor of Philosophy (PhD) in Public Health and Health Systems - Work and Health

**Program contact name(s):** Ellen MacEachen

**Form completed by:**

**Description of proposed changes:**

Note: changes to courses and milestones also require the completion/submission of the SGRC Course/Milestone-New/Revision/Inactivation form ([PC docx version](#) or [MAC docx version](#)).

*Discontinue the collaborative program in Work and Health.*

**Is this a [major modification](#) to the program?** Yes

**Rationale for change(s):** The AHS collaborative program in Work and Health has had low enrolment in the past five years and Faculty whose research interests centre around Work and Health feel that the student's interests are fully accommodated within the Department-specific program.

**Proposed effective date:** Term: Winter Year: 2021

**Current [Graduate Studies Academic Calendar \(GSAC\)](#) page** (include the link to the web page where the changes are to be made):

<https://uwaterloo.ca/graduate-studies-academic-calendar/applied-health-sciences/school-public-health-and-health-systems/doctor-philosophy-phd-public-health-and-health-systems-work-and-health>

Current Graduate Studies Academic Calendar content:	Proposed Graduate Studies Academic Calendar content:
<p><del><b>DOCTOR OF PHILOSOPHY (PHD) IN PUBLIC HEALTH AND HEALTH SYSTEMS - WORK AND HEALTH</b></del></p> <p><del><b>Program information</b></del></p> <ul style="list-style-type: none"> <li>• <del>Admit term(s)-</del> <ul style="list-style-type: none"> <li>◦ <del>Fall</del></li> </ul> </li> <li>• <del>Delivery mode-</del> <ul style="list-style-type: none"> <li>◦ <del>On-campus</del></li> </ul> </li> <li>• <del>Length of program-</del> <ul style="list-style-type: none"> <li>◦ <del>Must be completed within the following time periods from completion of the Master's degree unless an extension has been granted:</del> <ul style="list-style-type: none"> <li>▪ <del>Full-time: 12 terms</del></li> </ul> </li> </ul> </li> </ul>	

Current Graduate Studies Academic Calendar content:	Proposed Graduate Studies Academic Calendar content:
<ul style="list-style-type: none"> <li>▪ <del>Part-time: 18 terms</del></li> <li>• <del>Program type-</del> <ul style="list-style-type: none"> <li>◦ Collaborative</li> <li>◦ Doctoral</li> <li>◦ Research</li> </ul> </li> <li>• <del>Registration option(s)-</del> <ul style="list-style-type: none"> <li>◦ Full-time</li> <li>◦ Part-time</li> </ul> </li> <li>• <del>Study option(s)-</del> <ul style="list-style-type: none"> <li>◦ Thesis</li> </ul> </li> </ul> <p><b>Admission requirements</b></p> <ul style="list-style-type: none"> <li>• <del>Minimum requirements-</del> <ul style="list-style-type: none"> <li>◦ Normally a Master's degree with a minimum 75% average in a field that is relevant to the area of work and health (normally kinesiology, recreation and leisure studies or health studies and gerontology, but other degrees in life, behavioural and social sciences could be suitable as well).</li> <li>◦ Submit a letter indicating reasons for pursuing graduate studies and a written statement outlining research interests.</li> </ul> </li> <li>• <del>Application materials-</del> <ul style="list-style-type: none"> <li>◦ Résumé/Curriculum vitae</li> <li>◦ Supplementary information form</li> <li>◦ Transcript(s)</li> <li>◦ Writing sample <ul style="list-style-type: none"> <li>▪ <del>Students must submit a copy of previous academic work, such as copies of preprints, reprints, or master's thesis, or other evidence of written scholarly work.</del></li> </ul> </li> </ul> </li> <li>• <del>References-</del> <ul style="list-style-type: none"> <li>◦ Number of references: 3</li> <li>◦ Type of references: academic</li> </ul> </li> <li>• <del>English language proficiency (ELP) (if applicable)</del></li> </ul> <p><b>Degree requirements</b></p> <p><del>Thesis option:</del></p> <ul style="list-style-type: none"> <li>• <del>Graduate Academic Integrity Module (Graduate AIM)</del></li> <li>• <del>Courses-</del> <ul style="list-style-type: none"> <li>◦ <del>With the exception of HLTH 701 Interdisciplinary Seminar in Public Health and Health Systems, students must fulfill the minimum requirements of the PhD program in the School of</del></li> </ul> </li> </ul>	

Current Graduate Studies Academic Calendar content:	Proposed Graduate Studies Academic Calendar content:
<p>Public Health and Health Systems (SPHHS) and will normally complete a minimum of 9 one-term (0.50 unit) graduate courses beyond an Honours Bachelor degree, including at least 4 courses beyond the Master's degree. Course requirements are as follows:</p> <ul style="list-style-type: none"> <li>▪ HLTH 730 Fundamentals of Work and Health</li> <li>▪ HSG 731 Approaches to Research in Work and Health</li> <li>▪ 1 graduate level statistics/research methods course (1 of HLTH 704, HLTH 705, HLTH 706, or HLTH 719) with assignments and major projects focused on work and health</li> <li>▪ 1 additional elective course related to work and health</li> </ul> <ul style="list-style-type: none"> <li>○ Students must also complete the following CR/NCR graduate seminars: <ul style="list-style-type: none"> <li>▪ HSG 732A Work and Health Research Seminar I and HLTH 732B Work and Health Research Seminar II</li> </ul> </li> <li>○ At a minimum, students must obtain an average of 75% or higher in aggregate on the courses presented in fulfilment of the degree requirements. Grades on all courses presented to fulfill the degree requirements must be 70% or higher. A grade below 70% in any course or failing to maintain an average of 75% will necessitate a review of the student's status by the School and may result in a student being required to complete additional coursework or being required to withdraw from the program. The School reserves the right to stipulate additional coursework if it is necessary for the student's preparation.</li> </ul> <ul style="list-style-type: none"> <li>• Link(s) to courses <ul style="list-style-type: none"> <li>○ Health Studies (HLTH) courses</li> <li>○ Graduate course search</li> </ul> </li> <li>• Academic Integrity Workshop</li> <li>• PhD Comprehensive Examination <ul style="list-style-type: none"> <li>○ Students are required to meet the University-level PhD Comprehensive Examination minimum requirements outlined in the "Minimum requirements for the PhD degree" section of the Graduate Studies Academic Calendar (GSAC), with certain noted differences that are specific to the Faculty of</li> </ul> </li> </ul>	

Current Graduate Studies Academic Calendar content:	Proposed Graduate Studies Academic Calendar content:
<p>Applied Health Sciences Comprehensive Examination minimum requirements:</p> <ul style="list-style-type: none"> <li>▪ Comprehensive examination purpose: Consistent with University-level minimum requirements. Note: In the Faculty of Applied Health Sciences, the novel research topic is tested through a separate thesis proposal process.</li> <li>▪ Timing: Consistent with University-level minimum requirements.</li> <li>▪ Committee: Consistent with University-level minimum requirements with the exception that in the Faculty of Applied Health Sciences, the composition of the comprehensive examining committee will be approved by the Associate Chair or Director, Graduate Studies for the student's Department/School, as delegated by the Associate Dean, Graduate Studies.</li> <li>▪ Who Chairs an examination: Consistent with University-level minimum requirements.</li> <li>▪ Format / Content: Consistent with University-level minimum requirements.</li> <li>▪ Academic integrity: Consistent with University-level minimum requirements.</li> </ul> <p>○ In addition to the University-level and Faculty-level PhD Comprehensive Examination minimum requirements, students in the PhD in Public Health and Health Systems – Work and Health program must also note the following:</p> <ul style="list-style-type: none"> <li>▪ The purpose of the comprehensive examination is to test the breadth and depth of the candidate's comprehension of the methodological and theoretical aspects of their field of study. The process is designed to enable candidates to acquire a solid grounding in their core area of public health research that will provide a foundation for undertaking</li> </ul>	



Current Graduate Studies Academic Calendar content:	Proposed Graduate Studies Academic Calendar content:
<p>dissertation research. The examination will also test the candidate's ability to critically evaluate the literature and synthesize information from sources to identify knowledge gaps and recommend solutions.</p> <ul style="list-style-type: none"> <li>▪ The comprehensive examination consists of three written questions followed by an oral examination. The written questions must be completed within eight weeks from the start date and the oral defence should be completed within four weeks of submission of the written examination.</li> <li>• <del>PhD Thesis</del> <ul style="list-style-type: none"> <li>◦ A PhD thesis on an approved topic is required, which is to be defended in an oral examination. The research is to be conducted under the supervision of the student's supervisor and the advisory committee. The PhD thesis advisory committee consists of at least three members, with the supervisor and at least one other committee member being faculty from within the SPHHS. The proposal will be defended before the thesis committee; however, upon completion of the thesis, the final document will be defended before a five person Examination Board.</li> <li>◦ The thesis will be on a topic in an area relevant to work and health.</li> </ul> </li> <li>• <del>Other requirements</del> <ul style="list-style-type: none"> <li>◦ Student evaluation: a review of each student's progress takes place during the month of May each year. Students are evaluated on several criteria, including performance in courses, progress with regard to the comprehensive examination and thesis work and, where appropriate, reports submitted by the students regarding their research and teaching assistantship activity.</li> </ul> </li> </ul>	

**How will students currently registered in the program be impacted by these changes?** The three students enrolled in the program in the School have completed course and milestone obligations; they will not be affected by the change and will receive the PhD in Public Health and Health Systems - Work and Health degree upon degree completion

*Section will expand to accommodate content. Please include details here.*

**Department/School approval date** (06/22/20):

**Reviewed by GSPA** (for GSPA use only)  date (mm/dd/yy):

**Faculty approval date** (mm/dd/yy):

**Senate Graduate & Research Council (SGRC) approval date** (mm/dd/yy):

**Senate approval date** (mm/dd/yy) (if applicable):

Faculty: Applied Health Science

Effective term: Winter 2021

Course  New  Revision  Inactivation

Milestone  New  Revision  Inactivation

New milestone title: Choose an item.

For course revisions, indicate the type(s) of changes: Unit weight  
(e.g. consent, description, title, requisites)

Course Subject code: KIN

Course number: 632

Course Title (max. 100 characters incl. spaces): Clinical Epidemiology and Health Measurement

Course Short Title (max. 30 characters incl. spaces):

Grading Basis: NUMERICAL

**Course Credit Weight:** 0.50

Course Consent Required:  Choose an item.

Course Description: Clinical Epidemiology and Health Measurement will build on basic research methods to discuss issues in clinical epidemiology. Measurement of disease and statistical and research methodology to develop good measures will be a focus. The purpose of this course is to enhance research design and critical appraisal skills while introducing students to clinical and health measurement including: purpose of measurement; development concepts and approaches (e.g. clinimetric vs. psychometric); validation and reliability testing; key statistical tests (sensitivity, intra-class correlation); and responsiveness to treatment. After completing this course, students should expect to have mastered the ability for determining if a clinical or health measurement has value in practice or research. They will attain critical appraisal skills of various clinical tools and health measures.

New course description (for revision only):

Meet Type(s): Lecture Choose an item. Choose an item.

Primary Meet Type: Choose an item.

### Requisites:

Special topics course: Yes  No

Cross-listed: Yes  No

Course Subject(s) to be cross-listed with and approval status:

Sections combined/heldwith:

### **Rationale for request:**

**Depth of knowledge and exposure to concepts requires more than a 0.25 weighting.**

---

Prepared by: Heather Keller

Date: 5-Mar-20



**M E M O**

TO: Kathy Winter, Assistant University Secretary & Privacy Officer  
Secretariat

FROM: S. Sivoththaman, Associate Dean, Graduate Studies  
Faculty of Engineering

RE: Senate Graduate and Research Council Agenda

DATE: October 26, 2020

---

Please place the following motion forward for approval at the next meeting of SGRC. These motions were approved by EFC on October 19, 2020.

Items for Approval:

1. The department of **Electrical and Computer Engineering** would like to make the following calendar changes:
  - a. Discontinue (type 2) Graduate Diploma (GDip) in Software Engineering

Rationale for Request:

- a. The MEng in ECE program will be offering “Graduate Specializations” in a given area, in place of the currently offered Graduate Diplomas. The change from Graduate Diplomas to Graduate Specializations is to better reflect the nature of the course packaging and also to bring the credentialization of focused course selection into line with Faculty of Engineering objectives. Consequently, ECE will be discontinuing the existing Graduate Diplomas offered with the MEng. In their place, Graduate Specializations have been proposed.

Your attention to these matters is kindly appreciated.

A handwritten signature in blue ink, appearing to be 'Siva Sivoththaman'.

Siva Sivoththaman

SS/em

Prior to form submission, review the [content revision instructions](#) and information regarding [major/minor modifications](#). For questions about the form submission, contact [Trevor Clews](#), Graduate Studies and Postdoctoral Affairs (GSPA).

**Faculty:** Engineering

**Program:** Graduate Diploma (GDip) in Software Engineering

**Program contact name(s):** Kankar Bhattacharya, Jessica Rossi

**Form completed by:** Jessica Rossi

**Description of proposed changes:**

Note: changes to courses and milestones also require the completion/submission of the SGRC Course/Milestone-New/Revision/Inactivation form ([PC docx version](#) or [MAC docx version](#)).

*Discontinue (type 2) Graduate Diploma (GDip) in Software Engineering.*

Is this a [major modification](#) to the program? Yes

**Rationale for change(s):**

*The MEng in ECE program will be offering “Graduate Specializations” in a given area, in place of the currently offered Graduate Diplomas. The change from Graduate Diplomas to Graduate Specializations is to better reflect the nature of the course packaging and also to bring the credentialization of focused course selection into line with Faculty of Engineering objectives. Consequently, ECE will be discontinuing the existing Graduate Diplomas offered with the MEng. In their place, Graduate Specializations have been proposed*

**Proposed effective date:** Term: Winter Year: 2021

**Current [Graduate Studies Academic Calendar \(GSAC\)](#) page** (include the link to the web page where the changes are to be made):

<https://uwaterloo.ca/graduate-studies-academic-calendar/engineering/department-electrical-and-computer-engineering/graduate-diploma-gdip-software-engineering>

Current Graduate Studies Academic Calendar content:	Proposed Graduate Studies Academic Calendar content:
<p><b><del>GRADUATE DIPLOMA (GDIP) IN SOFTWARE ENGINEERING</del></b></p> <p><b><del>Program information</del></b></p> <ul style="list-style-type: none"> <li><del>• Delivery mode               <ul style="list-style-type: none"> <li><del>◦ On-campus</del></li> </ul> </del></li> <li><del>• Program type               <ul style="list-style-type: none"> <li><del>◦ Diploma</del></li> </ul> </del></li> <li><del>• Study option(s)               <ul style="list-style-type: none"> <li><del>◦ Coursework</del></li> </ul> </del></li> </ul>	

Current Graduate Studies Academic Calendar content:	Proposed Graduate Studies Academic Calendar content:
<p><b>Admission requirements</b></p> <ul style="list-style-type: none"> <li>• Minimum requirements- <ul style="list-style-type: none"> <li>◦ The GDip in Software Engineering is earned in conjunction with the Master of Engineering (MEng) in Electrical and Computer Engineering program.</li> </ul> </li> </ul> <p><b>Degree requirements</b> Coursework option:</p> <ul style="list-style-type: none"> <li>• Courses- <ul style="list-style-type: none"> <li>◦ Students will learn the concepts, techniques and methods of modern, effective software development. They will gain knowledge in software specifications, design and testing and will be exposed to data structures and algorithms, networking lower and upper layers, data-base systems, knowledge modeling, computational intelligence, component-based software engineering, re-engineering, and network security.</li> <li>◦ To receive the GDip in Software Engineering, students must successfully complete 3 compulsory courses and 2 elective courses: <ul style="list-style-type: none"> <li>▪ Compulsory courses: <ul style="list-style-type: none"> <li>▪ ECE 650 Methods and Tools for Software Engineering</li> <li>▪ ECE 651 Foundations of Software Engineering</li> <li>▪ ECE 653 Software Testing, Quality Assurance and Maintenance</li> </ul> </li> <li>▪ Elective courses (choose 2 from the following list): Note: not all elective courses may be offered each year. <ul style="list-style-type: none"> <li>▪ ECE 606 Algorithm Design and Analysis</li> <li>▪ ECE 610 Broadband Communication Networks</li> <li>▪ ECE 628 Computer Network Security</li> <li>▪ ECE 654 Software Reliability Engineering</li> <li>▪ ECE 655 Protocols, Software, Issues in Mobile Systems</li> </ul> </li> </ul> </li> </ul> </li> </ul>	

Current Graduate Studies Academic Calendar content:	Proposed Graduate Studies Academic Calendar content:
<ul style="list-style-type: none"> <li>▪ <del>ECE 656 Database Systems</del></li> <li>▪ <del>ECE 657 Tools of Intelligent Systems Design</del></li> <li>▪ <del>ECE 658 Component Based Software</del></li> </ul> <ul style="list-style-type: none"> <li>○ <del>Note: Electrical and Computer Engineering MEng requirements allow for only 3 courses to be taken outside the Department.</del></li> </ul>	

**How will students currently registered in the program be impacted by these changes?**

*Students admitted in Winter 2020 and after, will be directed to the Software Specialization while the GDip will remain in an inactive state, and finally discontinued in Winter 2021.*

**Department/School approval date** (mm/dd/yy): 05/13/2019

**Reviewed by GSPA** (for GSPA use only)  date (mm/dd/yy): 05/29/2020

**Faculty approval date** (mm/dd/yy):

**Senate Graduate & Research Council (SGRC) approval date** (mm/dd/yy):

**Senate approval date** (mm/dd/yy) (if applicable):



October 26, 2020

TO: Kathy Winter, Assistant University Secretary and Privacy Officer, Senate Graduate and Research Council

FROM: Heidi Mussar, Associate Director, Graduate Financial Aid & Awards

RE: **Agenda items for Senate Graduate & Research Council – November 2020**

**Items for Approval**

**a) Martin Simmons Graduate Scholarship for Locally Focused Architecture – trust**

A scholarship, valued at \$5,000, will be awarded annually to a graduate student registered full time in the first term of their master's program in the School of Architecture in the Faculty of Engineering. Interested students must submit an application found on the School of Architecture website along with a 500-word abstract describing how their research focuses on a local project in Waterloo Region or Wellington County. The application must be submitted to the Coordinator of Graduate Studies and Research in the School of Architecture by October 31. This scholarship is supported by both Martin Simmons Architects and the Amy Hallman Snyder Award Fund at Kitchener Waterloo Community Foundation in honour of both their deep roots in Waterloo Region and commitment to growing local architecture. The first award will be given in Fall 2021 and the last in Fall 2024.

Total gift = \$20,000

**b) Caivan Future Cities Graduate Scholarship – trust**

Eight scholarships valued at \$5,000 each will be awarded annually to graduate students who have applied for full-time admission to a Master's program in the Faculty of Environment and whose research addresses the challenges expected to be encountered by future cities. Selection will be based on academic excellence (minimum cumulative average of 80% or equivalent). Preference will be given to students who demonstrate leadership and community engagement which will be assessed based on the student's application for admission to the program. A selection committee within the Faculty of Environment will select recipients by March.

This fund is made possible by donations from Caivan, representing an investment in the development of 32 future leaders, over the course of four years, rewarding those who achieve academic excellence, leadership and perseverance.

The period of this defined term award will be from 2021-2024. The first selection will be made in March 2021 and the last in March 2024.

The total gift towards this graduate scholarship is \$160,000.



### Items for Information

#### **c) University of Waterloo Staff Association Award – trust**

Previously revised in 2016 to incorporate additional eligibility criteria requirements, the award is being revised to incorporate the following changes as a result of an increased donation:

##### CURRENT

- Valued at \$500 each
- Up to three graduate awards annually (normally one per term)
- Applications collected three times per year

##### NEW

- Several awards will be given annually at \$500 or \$1,000; \$1,000 will be for those who receive the UW tuition benefit of 50% or less (or no tuition benefit at all); \$500 will be for those who receive the UW tuition benefit of 100%
- Awards will be distributed equitably among graduate and undergraduate students based on enrolment and/or award application numbers
- Applications collected once per year

#### **d) Jon Mark. Graduate Scholarship in Communication – endowment**

Originally approved at SGRC in January 2009, the agreement is being amended to reflect the following changes:

- The value of the scholarships will be reduced from \$5,000 to \$3,000 with the value paid as follows: \$2,000 from the endowment expendable plus \$1,000 from the UW Provost
- The goal is to provide at least two awards valued at \$3,000 annually
- There will no longer be a requirement from the supervisor to provide a GRS match