### Application Summary

#### Competition Details

<table>
<thead>
<tr>
<th>Competition Title</th>
<th>2020 Curriculum Innovation Award</th>
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<tr>
<td>Category</td>
<td>Institutional Awards - CTL</td>
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<td>Award Cycle</td>
<td>2020</td>
</tr>
<tr>
<td>Submission Deadline</td>
<td>03/02/2020 at 11:59 PM</td>
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#### Application Information

<table>
<thead>
<tr>
<th>Submitted By</th>
<th>Donald Webster</th>
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<tbody>
<tr>
<td>Application ID</td>
<td>4350</td>
</tr>
<tr>
<td>Application Title</td>
<td>Global Engineering Leadership Minor</td>
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<tr>
<td>Date Submitted</td>
<td>03/02/2020 at 8:48 AM</td>
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</tbody>
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#### Personal Details

<table>
<thead>
<tr>
<th>Applicant First Name</th>
<th>Donald</th>
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<tbody>
<tr>
<td>Applicant Last Name</td>
<td>Webster</td>
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<td><a href="mailto:dw139@gatech.edu">dw139@gatech.edu</a></td>
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<td>(404) 894-6704</td>
</tr>
</tbody>
</table>

**Primary School or Department**
Civil & Environmental Engineering

**Primary Appointment Title**
Karen & John Huff School Chair and Professor

#### Application Details

**Proposal Title**
Global Engineering Leadership Minor
Nomination of Dr. Adjo A. Amekudzi-Kennedy, Associate Chair for Global Engineering Leadership and Entrepreneurship and Professor, School of Civil & Environmental Engineering, for CTL Curriculum Innovation Award

March 2, 2020

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Letters of Support

1. Donald Webster, Ph.D., Karen and John Huff Chair and Professor, School of Civil & Environmental Engineering
2. Wendy Newstetter, Ph.D., Assistant Dean for Academic Innovation, College of Engineering
3. Rebecca Yoo, B.S. Environmental Engineering, Class of 2017, and GELM graduate
4. Daniel Rosborough, B.S. Civil Engineering, Class of 2019 and GELM graduate
5. Spencer Maddox, B.S., Civil Engineering, Spring 2020, and enrolled in the GELM
1. Description of Innovation: Global Engineering Leadership Minor

Program Objectives and Curriculum: Beginning in the 2014/15 academic year, I led the development of the Institute’s Minor in Leadership Studies - Global Engineering Track, also known as the Global Engineering Leadership Minor (GELM), working with a range of stakeholders within and beyond the Institute. I have worked with the School of Civil and Environmental Engineering (CEE) School Chair and Associate Chairs, CEE faculty and students, the Institute’s Director and staff of Leadership Education and Development, the Registrar, the Director and staff of International Education, the CEE External Advisory Board, the College of Engineering Assistant Dean for Academic Innovation, and others within and beyond the Institute. My roles have included leading the design of the Global Engineering Leadership Program using the embedded engineering leadership model, grounding the program in the peer-reviewed literature (Amekudzi-Kennedy et al. 2016), facilitating the development of embedded engineering leadership courses involving both engineering faculty and leadership professionals; and, overseeing the design, development and implementation of the Global Practicum - an internship-abroad, research-abroad or study-abroad capstone experience. I served in these roles first in my position as the CEE Associate Chair for Global Engineering Leadership and Research Development (2014-2019) and co-director of the Global Engineering Leadership Minor (2015-2019), and continue to work on advancing the program as Associate Chair for Global Engineering Leadership and Entrepreneurship (2019-Present).

While the Global Engineering Leadership Minor is administered through CEE and primarily serves students in the College of Engineering, there are several students from other colleges, e.g., the College of Design and College of Sciences, who take engineering leadership courses in the Institute today. The GELM is one of three tracks in the Institute’s Minor in Leadership Studies, alongside the Business Management and Public Policy tracks. The Program aims to develop global engineer-leaders, engineers who lead and contribute effectively in solving global grand challenges and other societal problems, in domestic and global contexts, working effectively across cultures when necessary. Global engineer-leaders have the technical know-how, global awareness and leadership skills to solve 21st Century global grand challenges.

The GELM aligns very well with the Institute’s focus on Whole Person Education (WPE) - one of Georgia Tech’s five educational priorities in the 21st Century (Georgia Tech 2018) – and with the College of Engineering’s and Schools of Engineering’s strategic plans (Amekudzi et al., 2016). The GELM also aligns very closely with the Vision for the Engineer of 2020. Cast by the National Academy of Engineers at the turn of the 21st Century, the vision simultaneously highlights technical proficiency, broad education, global citizenship, ethical grounding, and the ability to lead in business and public service (NAE 2004) – defining the holistic engineer or whole person engineer. This vision is practically evident in the National Association of Colleges and Employers (NACE) annual job surveys, and is echoed by the National Academies of Sciences, Engineering and Medicine (NASEM 2017). In the NACE’s Job Outlook Survey for 2020, over 70% of the responding employers said they seek candidates who demonstrate first problem-solving skills, second the ability to work in a team, third strong work ethic, fourth analytical/quantitative
skills, fifth written communication skills and sixth leadership. Similarly, one of five key priorities of the Institute’s Creating the Next in Education (CNE) Initiative is whole person education (WPE) entailing whole human development and flourishing emphasizing the multidimensional character of learning experiences, and the culture of the whole person. WPE emphasizes cognitive, intrapersonal and interpersonal dimensions. The cognitive dimension includes competencies such as problem-solving, innovation, critical thinking, information literacy, and reasoning. The intrapersonal dimension recognizes the importance of skills such as metacognition (that is, the ability to reflect on one’s own learning and to make adjustments accordingly), resilience, adaptability, initiative, and appreciation for diversity. And the interpersonal domain includes abilities such as communication, collaboration, responsibility, and conflict resolution (Georgia Tech 2018). Clearly, all of these initiatives speak to the importance of developing the holistic engineer and emphasize the importance of whole person education, which is the foundation for the GELM.

The Global Engineering Leadership Minor was designed to develop holistic engineers with a global outlook, an understanding of 21st Century grand challenges, and competencies to lead in and contribute to solving them - working effectively across cultures as needed. The GELM is a curriculum-based and experiential-based program developing WPE skills and mindset. To graduate with the Minor, students must complete 15 credits of academic and experiential work and a global experience (work-based, research-based or study-based), and attend a leadership seminar series. Figure 1 presents the GELM curriculum.

![Figure 1: Global Engineering Leadership Minor - Curriculum](image)

All GELM students are required to take the Foundations of Leadership (general leadership) course and Global Engineering Leadership course (engineering leadership), as well as three grand challenge courses. The grand challenge courses are designed to address global grand
challenges of the 21st Century including climate change, the increasing frequency, duration and intensity of disasters, declining air quality, water scarcity, infrastructure renewal and metropolitan congestion. They focus on problem-solving in a global context, engaging students to cultivate technical, leadership and cross-cultural skills and mindset. Five of the courses have an integrated study abroad experience, and all have global components. These courses are also designed to develop interpersonal skills - including communication, and team leadership and engagement - in an integrated manner that supports the achievement of technical course objectives. **Table 1** summarizes the descriptions of a subset of the Global Engineering Leadership Minor courses. The full list of course descriptions can be found on the Minor website at: [https://ce.gatech.edu/academics/undergraduate/leadership-minor](https://ce.gatech.edu/academics/undergraduate/leadership-minor).

**Table 1: Short Descriptions of a Subset of Courses in the Global Engineering Leadership Minor**

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
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</table>
| **Foundations of Leadership** (PUBP 4140)  
Dr. Wes Wynens  
[General Foundations] | Introduces students to different ways of exercising leadership, their own strengths and weaknesses, and how they can best work with others in leadership context. Emphasizes application in actual leadership settings and situations. Students learn hands-on practical leadership skills. |
| **Global Engineering Leadership** (CEE 4000)  
Dr. Rudy Bonaparte & Dr. Lisa Rosenstein  
[Engineering Leadership] | Introduces students to a range of skills necessary to succeed as a global engineer-leader. Topics include global grand challenges, creating an engineering firm, expansion of firm oversees, strategic planning, engineering ethics, intellectual property, communication and collaboration. |
| **Environmental Technology in the Developing World** (CEE 4350)  
Dr. Joe Brown  
[Grand Challenge] | Hands-on course on air and water quality studies in low-technology environments. Practical skills to evaluate environmental impacts in developing countries. Understandings key linkages between environmental quality and health. Embedded study abroad in Bolivia. Develops communication (graphical, data display) and team development skills, and fosters cultural awareness, and leadership in the context low-technology environments. |
| **International Disaster Reconnaissance Studies** (CEE 4460)  
Dr. David Frost  
| **Sustainable Transportation Abroad** (CEE 4660)  
Dr. Kari Watkins  
[Grand Challenge] | Planning, design and operations of transportation systems in countries known for a sustainable, multimodal approach to transportation. Embedded study abroad in the Netherlands including executive level transportation professionals. Students develop awareness of how culture influences infrastructure development, and develop skills on giving feedback effectively. |
| **Origami Engineering** CEE 4560  
Dr. Glaucio Paulino  
[Grand Challenge] | Applications of Origami Engineering to solve, societal, engineering and science challenges. Introduction to state-of-the-art algorithms to design origami structures. Team building and communication skills development, development of individual awareness. Optional travel to Japan for an Origami Engineering/Art immersive experience. |
| **Smart and Sustainable Cities** CEE 4160  
Dr. John Taylor  
[Grand Challenge] | Introduction to how cities function by examining various infrastructure systems: transportation, power, water, buildings. Key challenges and emerging solutions in urban environments. Effective communication with urban stakeholders about smart solutions to sustainability challenges. Written and oral communication and team development. |
In AY 2017/18 and 2018/19, the leadership minor courses were integrated into the major. Thus, the CEE minor courses are now also technical electives in the CEE major, and students may double count up to six credits of coursework in the minor as technical electives in the major.

**Linkages with the Grand Challenge Scholars Model:** In 2007, the National Academy of Engineering (NAE), with the support of the National Science Foundation (NSF), convened a panel of leading thinkers from academia, policy, and business to identify a small number of grand challenges for the 21st Century (Katosouleas, Miller & Yortsos 2013). Motivated by the NAE’s 14 grand challenges, the Engineering Schools of Duke University, Olin University, and the University of Southern California proposed a new education model to prepare engineers to be change leaders: the Grand Challenges Scholars (GCS) Program. Endorsed by the NAE in 2009, the GCS Program aims to equip engineering undergraduates with the skills and mindset to tackle the grand challenges during their careers. In addition to completing the engineering requirements for their degrees, GCSs create a portfolio with the following five competencies (NAE n.d.): (1) talent competency (that is, mentored research/creative experience on a grand challenge-like topic); (2) Multidisciplinary (that is, understanding the multidisciplinarity of engineering systems solutions developed through personal engagements); (3) Business/Entrepreneurship (that is, understanding, preferably developed through experience, the necessity of viable business model for solution implementation); (4) Multi-Cultural (that is, understanding different cultures, preferably through multicultural experiences, to ensure cultural acceptance of proposed engineering solutions), and (5) Social Consciousness (that is, understanding that the engineering solutions should primarily serve people and society reflecting social consciousness). All GCS Programs have these five elements in common but differ in their implementation. Over 120 schools in the U.S. and over 30 schools internationally either have or are implementing GCS Programs (NAE, n.d.).

The Global Engineering Leadership Minor has been approved as a GCS Program because it fulfills the Grand Challenge Scholars Program requirements. Therefore, when students graduate with the GELM, they receive the Grand Challenge Scholar’s Designation in addition to the Minor in Leadership Studies Designation on their transcripts. **Table 2** shows how the Minor curriculum maps to the five categories of the Grand Challenge Scholars Program.

### 2. Academic Program Innovation

*Model Design, Program Development & Implementation:* A survey of undergraduate engineering leadership programs in the U.S. and Canada in the peer-reviewed literature shows a continuum of pedagogic models for engineering leadership education (ELE) from **integrated** to **separate**. Integrated ELE models intertwine leadership with engineering science and design while separate models teach leadership outside of technical engineering courses. The majority of models found today are separate, with programs operating outside the formal engineering curriculum (Klassen et al. 2016; Graham et al. 2009). Recent work on ELE pedagogies has
however highlighted a key benefit of the integrated model. Models that embed leadership development within the professional and academic context of engineering lead to the graduation of engineers that view leadership as part of their professional identity (as they do problem-solving, for example - an intrinsic rather than extrinsic capability) (Rottmann et al. 2014). However, grounding leadership development in the technical engineering curriculum can be a challenging endeavor for engineering schools and departments for reasons clearly documented in the literature and explained below.

Table 2: GELM-Grand Challenge Scholars Program Mapping

<table>
<thead>
<tr>
<th>Courses/Domain</th>
<th>Foundations of Leadership (Course: CRE 4240)</th>
<th>Global Engineering Leadership (Course: CRE 4250)</th>
<th>Environmental Technology in the Developing World (CRE 4340)</th>
<th>Construction Management &amp; Their Implications (Course: CRE 4136)</th>
<th>International Disaster Resilience/Reconstruction Studies (Course: CRE 4360)</th>
<th>Aviation Transportation (Course: CRE 4060)</th>
<th>Smart &amp; Sustainable Cities (Course: CRE 4240)</th>
<th>Origion (Engineering) (Course: CRE 4240)</th>
<th>Intro to Innovations for GELM (CRE 3050)</th>
<th>Nurturing the Innovator (Course: CRE 4310)</th>
<th>Global Engineering Practicum (Experiential Learning)</th>
<th>Impact Leadership (Seminar)</th>
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<tbody>
<tr>
<td>Grand Challenge Competency</td>
<td>Research and support on a range of skill and action challenges</td>
<td>Water and air Quality</td>
<td>Water and air Quality</td>
<td>Water and air Quality</td>
<td>Water and air Quality</td>
<td>Water and air Quality</td>
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<td>Water and air Quality</td>
</tr>
<tr>
<td>Leadership Competency</td>
<td>Overview of leadership theory, applications and measurement</td>
<td>Leadership, collaboration and interpersonal skills</td>
<td>Leadership in a global context</td>
<td>Leadership in a global context</td>
<td>Leadership in a global context</td>
<td>Leadership in a global context</td>
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<td>Table 2: GELM-Grand Challenge Scholars Program Mapping</td>
<td>Multi-context leadership</td>
<td>Leadership Competency</td>
<td>Leadership Competency</td>
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<tr>
<td>Engineering Leadership Education experts have expressed concern about the ability of current engineering faculty to deliver effective leadership programs, and the difficulties in identifying external and suitably qualified staff, as well as resources to support such external staff (Graham et al. 2009). Thus, to create an effective integrated model, ELE instruction must necessarily include engineering faculty and leadership professionals. However, this required integration of knowledge and skills may introduce tensions between technical and leadership content in the curriculum. Of primary concern to engineering faculty is preserving and enhancing technical depth in the curriculum. Simultaneously, a primary concern of leadership professionals is ensuring adequate leadership development instruction and outcomes.</td>
<td>Leadership Competency</td>
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Engineering Leadership Education experts have expressed concern about the ability of current engineering faculty to deliver effective leadership programs, and the difficulties in identifying external and suitably qualified staff, as well as resources to support such external staff (Graham et al. 2009). Thus, to create an effective integrated model, ELE instruction must necessarily include engineering faculty and leadership professionals. However, this required integration of knowledge and skills may introduce tensions between technical and leadership content in the curriculum. Of primary concern to engineering faculty is preserving and enhancing technical depth in the curriculum. Simultaneously, a primary concern of leadership professionals is ensuring adequate leadership development instruction and outcomes. Leadership
professionals view the introduction of one or two leadership lectures within an engineering course as generally inadequate for satisfactory leadership education instruction and outcomes, and aim to ensure there is sufficient room created within the course syllabus to guarantee adequate leadership instruction and outcomes. Achieving successful integration therefore entails **ensuring or augmenting technical depth while enhancing interdisciplinary breadth within the curriculum**, which involves a process of change rather than a one-time-and-done event. In essence, the embedded leadership development model involves **cultural change** where engineering faculty and leadership professional work increasingly closely together to deliver these dual objectives. The embedded leadership development model thus takes on more of a marathon than a sprint approach to implementation, and is increasingly synergistic.

Aiming to develop engineers who view leadership as part of their professional identity, we have designed the GELM using the **integrated model**: specifically, the model **embeds leadership development within grand challenge problem-solving and the technical course objectives**. The GELM Model is thus an **embedded engineering leadership model**: a competency-based model, grounded in the leadership literature. Drawing from the **Skills-based Model of Leadership** (Katz 1955; Mumford et al. 2000), it embeds leadership development contextually within grand challenge problem-solving in engineering courses (Amekudzi-Kennedy et al. 2016). The Program thus brings together engineering faculty and leadership professionals to work together in order to develop both technical and non-technical leadership skills and mindset in Georgia Tech undergraduates.

The core competencies of the Global Engineering Leadership Minor were informed by the Skills Model of Leadership, a competency-based model developed based on empirical evidence that effective leadership performance in the workplace is associated with the simultaneous presence of **technical skills, interpersonal skills** and **conceptual skills (i.e., systems skills)** (Katz 1955; Mumford et al. 2000). We have thus adopted these skills as core competencies for the GELM, and introduced a fourth core competency: **cross-cultural awareness/skills**, based on our observations that cross-cultural skills are increasingly important for high performance in the engineering workplace. This is also supported by the Vision for Engineering in 2020 (NAE 2004). The core competencies of the global engineer-leader, depicted in **Figure 3**, are the foundation of the Global Engineering Leadership Minor (Amekudzi-Kennedy et al. 2016). These core competencies drove the curriculum design and continue to drive its advancement and assessment.

The GELM grand challenge courses were developed by several outstanding members of the CEE faculty in conjunction with engineering practitioner leaders and leadership professionals from the Institute’s Office of Leadership Education and Development (LEAD) and CEE Engineering Communications. For several courses, I facilitated working meetings between the engineering faculty and leadership professionals to develop appropriate content for leadership development, and to contextually integrate this content in new or existing courses to cultivate the global engineer-leader core competencies (**Figure 3**) appropriate for the technical course...
objectives. The courses thus aim to have integrated technical and leadership development and application for problem-solving around a particular global grand challenge. The courses have a real-world focus, and are designed to cultivate a breadth of leadership skills, simultaneously with technical applications commensurate with the technical maturity levels required by the courses - thus fostering the development of holistic engineers.

Nine engineering faculty, including five chaired professors in CEE, currently offer courses in the Global Engineering Leadership Minor, together with leadership professionals: a professor of the practice and member of the National Academy of Engineering (Dr. Rudy Bonaparte), the CEE Director of Engineering Communications (Dr. Lisa Rosenstein, who holds a Ph.D. in English with over 20 years of experience using the embedded model for engineering communications instruction - written, oral and visual), and the Institute’s Director of Leadership Education and Development (Dr. Wes Wynens, who holds a Ph.D. in Public Administration with over 20 years of experience in leadership development). The embedded model for engineering communications was first adopted by CEE over 20 years ago (Meyer and Jacobs 2000). It has become clear over the years that students consider communications more of an intrinsic component of their work when a percentage of their grade in an engineering course is allocated to communications, and space is created within the course syllabus for communications instruction to occur – with relevance to the technical course objectives. And while this approach alone may not be sufficient for comprehensive communication skills development (based on the space allotted for communications development in the engineering curriculum), we have found it to be essential for cultivating communication effectiveness as part of the professional identity of engineering students and graduates.

![Figure 3: Global Engineer-Leader Core Competencies](image-url)
3. Evaluation

Evaluation of the Global Engineering Leadership Minor has both short-term and long-term elements. Here, I evaluate the innovation from the standpoint of the following: (1) its short-term impacts; (2) what students say about the program; (3) initial efforts toward the formal program assessment; and (4) the interdisciplinary culture and infrastructure being developed around the program, which will continue to fuel innovation in the future.

**Short-Term Impacts:** As a result of the work done to create and establish the Global Engineering Leadership Minor over the past five to six years, college of engineering students now have access to ten new engineering leadership courses and a global practicum experience that provides a pathway for them to gain internship-abroad, research-abroad or study-abroad experience (Figure 1). Essentially, our students can advance their engineering, leadership, inter-personal and intra-personal, and cross-cultural mindset and skills in an integrated manner. **Nine CEE faculty (five with chaired professorships)** teach in the program. In the 2014/15 and 2015/16 academic years, over 100 students per year took engineering leadership courses. Currently, over 200 students per year take engineering leadership courses. Approximately 30 students are enrolled in the Minor at the beginning of each academic year (meaning that they have declared the Minor and are working toward graduating with both the Leadership Minor Designation and Grand Challenge Scholar Designation) and 10 students per year graduate with the Leadership Minor designation and Grand Challenge Scholar designation. The engineering leadership courses enroll students from several Colleges in the Institute, including the College of Engineering, College of Sciences and the College of Design. The large and growing number of students taking engineering leadership courses is in part because the Minor courses have been integrated into the CEE Major and thus also serve as technical electives in the Major.

**What Students Say About the Minor:** GELM students have described the value of their experiences in the Leadership Minor in various ways. **Table 3** provides feedback from various students in GELM courses and in the Global Practicum. These excerpts were taken from the students’ Global Practicum Reports, interviews conducted by the CEE Communications Office, and student exit interviews.

**Program Assessment:** In April 2018, the School of CEE conducted the first 360-degree assessment of the Global Engineering Leadership Minor, entailing the assessment of the program by GELM student, faculty and staff. In the review and planning meeting, a panel of four students reviewed the positive impacts of the Minor on their undergraduate education and identified areas for enhancement. Faculty discussed best practices and identified areas for improvement. And staff reviewed programmatic support and identified actions to better support faculty and students administratively. The students were unanimous in their agreement that they had taken some of their best courses, done some of their best learning, and had some of their best experiences at Georgia Tech in the Leadership Minor. Among several comments offered, one student noted that she had found it valuable to learn leadership tools in the classroom and use these tools in other classes to do group work more effectively.
Another noted his appreciation for engineering education in a global setting which he felt had given him the confidence to work in global settings in the future. Students noted their appreciation of mentorship by leading practitioners in the Global Engineering Leadership course and the opportunity to work closely with practitioners who are leading engineering firms in the U.S. and internationally.

Table 3: GELM Students’ Feedback on Experiences in the Program

<table>
<thead>
<tr>
<th>Student: Margaret Gwinn</th>
<th>Major: BS EnvE (Class of 2016)</th>
<th>Course/Program: Global Engineering Leadership Minor</th>
</tr>
</thead>
<tbody>
<tr>
<td>“The courses I took associated with the minor were some of the most valuable I had during my undergraduate career.”</td>
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</table>

<table>
<thead>
<tr>
<th>Student: Rebecca Yoo</th>
<th>Major: BS EnvE (Class of 2017)</th>
<th>Course/Program: Environmental Technology in the Developing World (Professor Joe Brown)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“I know this class is not going to end when this class ends. It’s going to say in my mind probably for a very long time. It’s been a very defining moment in my life.”</td>
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<table>
<thead>
<tr>
<th>Student: Ramiro Santana</th>
<th>Major: BSCE (Class of 2017)</th>
<th>Course/Program: International Disaster Reconnaissance Studies (Professor David Frost)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“It’s an experience we’ll never forget. I’d never been to an area where an earthquake or tsunami had come by. It made me conscious of how much damage a natural disaster can cause.”</td>
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<table>
<thead>
<tr>
<th>Student: Lauren Gardner</th>
<th>Major: BSCE (Class of 2016)</th>
<th>Course/Program: Sustainable Transportation Abroad (Professor Kari Watkins)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Because this trip incorporated so many professionals with great insight both from abroad and Atlanta, I feel this trip has firmly cemented my desire to become a transportation engineer. I could not see myself doing anything else.”</td>
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<tr>
<th>Student: Christian Zeigler</th>
<th>Major: BSCE (Class of 2018)</th>
<th>Course/Program: CEE London (Professor Lauren Stewart &amp; Professor Lisa Rosenstein)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“I need to see things, so being able to see it immediately after I learned, I automatically can attach what I learned in a class to a monument. So learning about tire rods and going to the London Eye and seeing six tie rods right there – it’s like, OK I got this. I understand this now.”</td>
<td></td>
<td></td>
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<tr>
<td>“You have lots of projects. You’re not going to sleep a lot. You’re going to just have to suck it up.”</td>
<td></td>
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</tbody>
</table>
“My internship in Kathmandu was a tremendous time of growth. Being on my own in a foreign country really pushed me outside of my comfort zone and natural boundaries.”

“As a future engineer, this experience helped me gain a better technical understanding of how to design for earthquakes, allowed me to observe structural damage and better know what that means for why a building failed, and experience how the reconstruction and seismic strengthening process works in a foreign developing country.”

As a leader, this experience taught me how important it is to be adaptable, to fully immerse myself into new experiences, to ask questions, to build relationships, to know the mission and reason for the work I am doing, and to take each challenge I face one step at a time.”

Student: Maggie Lindsey

Major: BSCE (with COOP Plan) | Course/Program: Global Practicum | Internship at Miyamoto Engineering, Katmandu, Nepal, Spring 2017

Earthquake sites in Katmandu, Nepal

Temple being supported by plans to prevent collapse (Lindsey 2017)

“For six months of 2017, my home was across the ocean, which was once a terrifying and thrilling realization. Those six months proved to be a time of both obstacles and triumphs, of deep personal growth, and of developing my perspective as a global citizen.”

“The semester I spent in Spain has permanently altered my perspective on travel, engineering, and the world as a whole.”

“I can confidently claim that after my semester abroad, I have a fuller idea of the world, a more mindful approach to engineering, and greater belief in my ability to adapt to unforeseen challenges.”

Student: Abigail Bruning

Major: BSCE (Class of 2019)

Course/Program: Global Practicum, Study Abroad at Universidad de Carlos III, Madrid, Spain, Spring 2017

Madrid, Spain (Bruning n.d.)

With respect to enhancements, students noted the importance of continuing to ensure that the program is staffed by quality professors “who exemplify what it means to be engineering leaders, and who are interested in forming relationships with students and being good communicators; not just being very good technically.” One student requested that faculty ensure students face ethical challenges in the classes they take because it is important for them
to learn how to navigate ethical issues. Several students noted they would like to have more opportunities to get to know and develop stronger relationships with other students, as well as faculty, in the Leadership Minor. Faculty with study-abroad elements in their courses noted that one size does not fit all and it would be important to have flexibility in the future to support different models to accomplish different goals. The GELM review and planning meeting generated about a dozen action items, a key one being the reduction of the administrative burden on faculty during the study abroad application process. GELM staff also noted the importance of expanding strategies for recruiting students into the Minor, expanding funding resources for international travel, developing a formal assessment approach for the program, and working to expand course offerings, including courses based in other units within the College of Engineering.

Faculty and students in the School of Civil and Environmental Engineering and staff from Leadership Education and Development are working to develop a formal program assessment approach involving both qualitative and quantitative assessment. The initiative will identify appropriate validated instruments in the literature to assess program core competencies. The assessment results will be used formatively to refine the program design to enhance leadership education outcomes, and summatively to report on progress being made, from year to year, toward achieving the leadership program objectives.

*Development of Cross-Disciplinary and Engineering Leadership Culture and Infrastructure:* An interdisciplinary culture and infrastructure around engineering leadership education is emerging surrounding the Global Engineering Leadership Minor socio-system. It is evident in the development of cross-cutting engineering education grant proposals involving several engineering schools, the school of public policy, the leadership education and development program, the Office of International Education, the Center for Serve-Learn-Sustain and others. It is also evident in the development of a cross-cutting community and an emerging culture of leadership driving innovation. A recent example - two leadership minor graduates, Danny Rosborough and Aubrey Awe recently founded a student chapter of *Engineers in Action – Bridges to Prosperity*, overcoming several structural obstacles within and beyond the Institute to found the chapter. Danny Rosborough, a fall 2019 graduate of the BS/MS Program in Civil Engineering (Structures), co-led the effort to found the chapter. Aubrey Awe, a Masters student in Civil Engineering (Structures) currently serves as the project manager for the travel team of the organization. The student organization takes Georgia Tech students on trips around the world to build physical bridges that enhance social and economic conditions for local communities. Beyond the Institute, the Global Engineering Leadership Minor has gained recognition in the engineering education community, in particular for its integrated model. In June 2019, Georgia Tech was invited to participate in the first Rapid Fire Panel Session for Big 10 Plus Universities on Engineering Leadership Education hosted by the American Society for Engineering Education (ASEE). Subsequently, Georgia Tech has become an inaugural member of the *Big 10 Plus Leadership Alliance* convened for the first time at Northwestern University in Evanston, IL in October 2019.
4. Significance and Potential for Wider Adoption

This integrated engineering leadership education model fills a gap in the engineering leadership literature and practice (see Klassen et al. 2016; Graham et al. 2009). The GELM approach has the potential for adoption on a wider scale because it provides a solution to an existing need in engineering education, well-articulated in the literature. A study by Graham, Crawley & Mendelsohn (2009) on engineering leadership education in the U.S. and internationally notes that a large number of the identified programs operate outside the formal engineering curriculum, in part due to lack of resources and/or engagement in the field of engineering leadership by the core engineering faculty. In almost all cases reviewed in the study, engineering leadership programs were found to be hosted within engineering programs. However, in most cases, leadership education is not integrated with technical education (Klassen et al. 2016; Graham et al. 2009). The process of embedding leadership development within engineering curricula is not without its challenges, as discussed in depth above; however, it also comes with multiple and enduring benefits for our students. This GELM approach to engineering leadership education is therefore innovative in the sense that it provides a solution to existing gaps and needs in engineering education by addressing and progressively overcoming notable challenges, well documented in the literature, and by providing multiple important and enduring benefits to engineering leadership education.

First, the GELM integrates the development of technical and non-technical leadership skills. Research on engineering leadership shows empirical evidence that cultivating leadership skills within the academic and professional contexts of engineering students leads to the development of engineers who embrace leadership as part of their professional identity (Rottmann et al. 2014). The integrated approach is more likely to graduate engineers who consider leadership as an intrinsic (rather than extrinsic) competency.

Second, the approach used in developing the GELM derives from the Skills-based Model (Katz 1955; Mumford et al. 2000), and supports leadership education in an engineering context (Amekudzi-Kennedy et al. 2016). The Skills-based Model of Leadership is a capability model focused on problem-solving - the main business of engineering - and offers opportunities to integrate both engineering and non-engineering leadership capabilities (i.e., cognitive, intrapersonal and interpersonal) for a holistic engineering leadership approach. Research on the Skills-based Model shows empirical evidence that there is higher leadership performance when technical, human (interpersonal) and conceptual (systems) skills are simultaneously present (Katz 1955; Mumford et al. 2000), supporting the viability of an approach that integrates technical and non-technical skills and mindset development.

Third, the approach offers a balance between curriculum and real-world experiential leadership development opportunities. The literature and practical experiences show that females and minorities in particular do much better when they are doing work associated with real content, real people and real outcomes (Weber & Custer 2005; Metghalchi et al. 2013).
Fourth, the approach offers a platform for developing collaborative partnerships between engineering faculty and leadership practitioners. The model adopted helps to ease the noted lack of suitably qualified engineering staff to engage in formal leadership development well documented in the literature (Graham et al., 2009).

Fifth, the approach offers increasing opportunities for integrated engineering education and research innovation. This happens naturally as engineering faculty and leadership professionals work more closely and more synergistically together to develop integrated content and pedagogies for engineering leadership education.

Finally, the GELM approach offers an evidence-based approach for the development of Grand Challenge Scholars, based on empirical observations that there are higher levels of leadership performance when professionals have good technical, interpersonal and conceptual skills (Katz 1955; Mumford et al. 2000). The National Academy of Engineering recognizes students who graduate with the Global Engineering Leadership Minor as Grand Challenge Scholars. The grand challenge scholar model for leadership education is a promising one for integrating leadership education in engineering curricula. Over 120 schools in the U.S. and over 30 schools abroad have developed or are in the process of developing a grand challenge scholars program (NAE n.d.). Collectively, they plan to educate more than 20,000 formally recognized “grand challenge engineers” over the next decade (NAE 2015). The GELM provides an evidence-based approach grounded in the engineering education and leadership literature to develop Grand Challenge Scholars, with multiple and enduring benefits. While institutional contexts and constraints vary, the GELM approach has strong potential for adoption where there is interest in formally incorporating leadership education in the engineering curriculum and creating engineer-leaders who view leadership as part of their professional identity and are equipped to tackle complex societal grand challenges.

5. References


February 25, 2020

Dr. Joyce Weinsheimer, Director
Center for Teaching and Learning

Dear Dr. Weinsheimer,

Subject: Nomination of Dr. Adjo Amekudzi-Kennedy for CTL Curriculum Innovation Award

I am writing to enthusiastically nominate Dr. Adjo Amekudzi-Kennedy for the CTL Curriculum Innovation Award for the leadership role she has played in the development of engineering leadership education within the Institute, and specifically for leading the creation of the Global Engineering Leadership Minor (GELM).

Beginning in 2014, Dr. Amekudzi-Kennedy has worked creatively and innovatively to design, develop, and implement an effective approach for engineering leadership education within our engineering curricula. This has required working effectively with our faculty, students and alumni, the Registrar, the Director of Leadership Education and Development, the Director of International Education, and the Assistant Dean for Academic Innovation in the College of Engineering. The approach aims to develop global engineer-leaders, graduates and postgraduates with a global outlook, an understanding of 21st Century global grand challenges, and the competencies to lead and contribute to solving them – working effectively across cultures as necessary.

A curriculum, and experiential-based approach, the GELM aims to develop a holistic engineer with professional skills. The GELM is designed to cultivate technical problem solving, inter- and intra-personal, systems, and cross-cultural skills simultaneously while students develop global competencies to address some of societies largest challenges. The GELM focus aligns closely with the National Academy of Engineering’s Vision for Engineering in 2020, and the skillset for Grand Challenge Scholars. It also supports the National Association of Colleges and Employers’ (NACE) 2017 desired skills set for employees, and dovetails with Institute’s focus on whole person development and flourishing, articulated as one of the priorities in the report from the Creating the Next in Education (CNE) Commission.

As a result of the work done to develop the Global Engineering Leadership Program, Georgia Tech students can augment their educational experiences by selecting from ten engineering leadership courses and a global practicum capstone experience to gain internship-abroad, research-abroad, or study-abroad experience. Over ten engineering and leadership faculty, including four chaired professors, teach in the program on a regular basis with several guest lecturers participating from multiple colleges. The program has the regular involvement of two Professors of the Practice with experience in global engineering leadership, both of whom is a member of the National Academy of Engineering (NAE). Currently, over 200 students per year take engineering leadership courses. On average, approximately 30 students are enrolled in the Minor (meaning that they completely fulfill the requirements to graduate with the Minor designation) at the beginning of the academic year and 10 students graduate with the Minor designation and Grand Challenge Scholar designation each year.
With the global engineering leadership education program have come opportunities for institutional innovation. Increasingly, we are seeing interdisciplinary groups form around engineering leadership education to pursue major external grant opportunities for further innovations. Dr. Amekudzi-Kennedy has led multiple integrated-education-and-research grant proposals involving faculty from the College of Engineering and the Ivan Allen College of Liberal Arts. Grant proposals have been submitted to the National Science Foundation to support the development of graduate leadership education, and international research sites around the world to provide meaningful research experiences for our students. Dr. Amekudzi-Kennedy is also working with colleagues at Penn St. and Univ. of Maryland to publish descriptions, with similarities and differences, of their respective minor programs.

I am delighted to see these ongoing innovations in our Institute! The work we are doing on this front is gaining national and international recognition for its contributions to the development of holistic engineers and their potential impacts on solving societal grand challenges, locally and globally.

This letter comes with my highest level of support for Dr. Amekudzi-Kennedy to receive this year’s Curriculum Innovation Award. It will be well deserved and timely. It will also recognize and publicize the ongoing innovations in engineering leadership education within the Institute and their broader impacts beyond. Dr. Amekudzi-Kennedy is very well deserving of this award: for the innovations in engineering education that this program has introduced within the Institute and externally; for the impacts of the Engineering Leadership Program on our students; and for the interdisciplinary culture and infrastructure these ongoing efforts in are generating within our Institute.

Sincerely,

[Signature]

Donald R. Webster
Karen & John Huff School Chair and Professor
February 26, 2020

RE: Adjo A. Amekudzi-Kennedy

Dear CTL Awards Committee,

It is my great pleasure to support the nomination of Dr. Adjo A. Amekudzi-Kennedy for the 2020 CTL Curriculum Innovation Award. Over the last couple of years, I have worked with Dr. Amekudzi-Kennedy on two NSF education-related proposals, on linking the Grand Challenge Scholars Program with her overseas work and most recently, on the inaugural Japan Program in Sustainable Development. In all of these interactions, I have seen her commitment to designing and offering exceptional learning opportunities to GT students. What I will address in this letter is her curricular innovation: The Global Engineering Leadership Minor (GELM).

GT students have many opportunities to undertake interesting minors but what makes this curricular innovation worthy of recognition and celebration is the truly interdisciplinary nature of the program. Too often our GT students get terribly siloed in their respective majors due to onerous major requirements, infrequent and spotty advisement and lack of information about the many exciting curricular and co-curricular activities. What this program offers is an integrated experience that brings together leadership, the challenges of an expanded notion of sustainability and the global perspective. This bundling of very different skills, knowledge, abilities and attitudes into a single strand of related, but expansive learning opportunities is unique. Students who take advantage of this program will work with Wes Wynens, an expert trainer in leadership awareness and skills, Dr. Rudy Bonaparte, a former CEO with a formidable record in industry, and Joe Brown, who has consistently made it possible for GT students to be immersed in another cultural setting facing significant environmental challenges. Graduates of this program will have expanded personal horizons, augmented cultural and disciplinary perspectives and a first-hand window on industry from the global perspective. While the courses that constitute the minor bring forth different disciplinary perspectives, the common thread through all is the infusion of global challenges and opportunities. It is critically important that our students be helped to move beyond an ethnocentric, even possibly xenophobic set of assumptions about America’s technological superiority to one that embraces the successes and seeks out the best ideas and approaches no matter where they are. The GELM program does that.
I enthusiastically support Dr. Amekudzi-Kennedy’s nomination confident that she is a groundbreaker in reimagining higher education.

Respectfully,

[Signature]

Assistant Dean, Educational Research and Innovation
March 1, 2020

Dear the Curriculum Innovation Award Committee:

I had the great fortune of graduating as one of the first students of the Global Engineering Leadership Minor. I cannot imagine fulfilling a well-rounded education without participating in GELM and regularly use the skills I learned through GELM in my current role as a staff engineer. I am grateful for Dr. Kennedy’s creativity and leadership in intentionally designing this curriculum and hope GELM can continue to provide GT students with an opportunity to enhance and complement their education.

The greatest obstacle in my engineering education was my ignorance of context. Lacking a sense of where, when, or how technical concepts would apply not only frustrated my computations, but also caused my courses to be extremely unrelatable and dull. Though Georgia Tech strived at offering robust technical classes, I was not primely interested in learning equations. I, like many of my peers, yearned to learn how engineering played a role in society today. This understanding of engineering context was the biggest missing piece of my educational puzzle during my first few years at Georgia Tech.

After participating in the first courses of GELM, I immediately recognized its value in understanding engineering context. The GELM courses greatly complemented my theoretical courses, proved applicable in professional practice, and most importantly, engaged my curiosity and excitement. The Global Engineering Leadership and Management and Foundations of Leadership courses enhanced my major-related courses. While technical classes taught me how to solve problems, the unmentioned truth was that the world was full of infinite problems. Through the GELM courses, I learned to prioritize problems with the greatest risk to our communities, those that have reasonable opportunities, and those with viable solutions. I learned to navigate these considerations which govern equations and view all my technical classes through a new lens of relevancy. This further enhanced my communication of engineering concepts and calculations because I was able to identify possible audiences receiving such calculations, consider the context of application, and judge the significance of variables.

In addition to the foundational leadership courses, the hands-on and international requirements of GELM greatly enhanced my preparation for professional practice. In the Environmental Technologies in Developing Countries course, I was challenged to design a research project and implement it in a foreign country, collaborating with a variety of students and interdisciplinary professionals. While I strengthened highly relevant skills such as water quality testing and data analysis in unpredictable environments, I also developed invaluable skills such as navigating ethical considerations of engineering and communicating with an interdisciplinary and cross-cultural team. Now, as I work as a Staff Engineer at an environmental firm that works with Native American tribes, I regularly use the skills I learned in GELM to navigate discussions involving complex cross-cultural and ethical implications with different stakeholders. I can confidently attest to the relevance and necessity of the skills taught through the GELM courses.

Lastly, if I recall a single memory of GELM, I remember having fun. There is no greater compliment to be given about a learning experience. While the courses were certainly challenging, what once was work became play in light of experiencing true engineering rather than merely spectating its concept.

Roy T. Bennett once wrote: “To learn something new, you need to try new things and not be afraid to be wrong.” I am profoundly grateful to Dr. Kennedy for making such a leap of faith in “trying new things” through GELM so that students might “learn something new.” Her creative efforts of marrying our highly technical school with participatory global leadership is, without a doubt, the final and indispensable puzzle piece for equipping technically distinguished, ethically exceptional, and context-driven engineers.

Sincerely,

Rebecca Yoo
Dear Awards Committee,

I would like to give my strong support to Dr. Adjo Amekudzi-Kennedy for the Curriculum Innovation Award for her work in developing the Global Engineering Leadership Minor within the School of Civil and Environmental Engineering. This is a minor that truly stands out, as there is no other quite like it at Georgia Tech. People are fascinated by it whenever I bring it up. Beginning with civil engineers, it has expanded to include other majors, including industrial engineering and mechanical engineering, which speaks to its ability to capture the interest of students across campus. I am fortunate to be one of the early participants in this minor, and have been able to see it evolve and grow over the years thanks to the vision of and hard work by Dr. Kennedy. Through this minor, my peers have been able to work in Nepal, study clean water in Bolivia, and observe the bike infrastructure while traveling to the Netherlands.

The minor has certainly been a meaningful experience for me personally as well. During my first year, I was looking for something to supplement my major, whether that be a minor, research, a co-op. It happened that this minor was just starting up at that time, and by my second year, I had decided it was something that I wanted to pursue. I valued the way that the minor could provide engineering education in a global setting, something that will continue to become more and more important. I also see the ways in which civil engineering solutions can be applied in countries all over the world, and I wanted to learn more about that work and how I can be part of it in the future. Having completed both my undergraduate and graduate degrees at Georgia Tech and receiving the minor, I can say that the program built by Dr. Kennedy has educated me in those ways, confirming my reasons for selecting to take on this minor.

There are many things that I can discuss with regards to how the minor has positively impacted my learning experience at Georgia Tech, so I will just highlight a few aspects. One of the courses that is required for the minor is titled Global Engineering Leadership and Management. This was perhaps the most unique course I have taken at Georgia Tech. The course taught me about engineering management both domestically and globally, and it did so by giving us the opportunity to create a business plan for an engineering consulting firm, and then assess whether to expand that firm into an international city. We heard from prominent civil engineering faculty and graduates, and studied the differences in business across cultures. I am confident that I will be more successful in international engineering work because of this course.

Additionally, the minor gave me the opportunity to study abroad in London, focusing on structural engineering. London’s history provided the perfect environment to learn about the evolution of structural engineering and construction. Structures such as St. Paul’s Cathedral, Tower Bridge, the London Eye, and Emirates Stadium were discussed in class prior to a field trip to the structures to observe what was discussed. This trip was a perfect combination of hands-on and global learning.

Last summer I had the incredible opportunity to participate in an international internship, and without this minor I would not have considered that as an option. I traveled to Nicaragua, working for an organization that provided engineering and architecture services to local ministries and organizations. It was truly incredible to engage with the culture and learn how the concepts that I had learned in courses applied in another cultural context. The growth in engineering skills was only part of the amazing learning experience I received.
As I have begun my full-time job in structural engineering and am constantly reminded of the challenges facing our world today, I see the potential engineering has to truly make an impact on communities all over the globe. But to reach this potential, students must be educated in such a way that exposes them to engineering in the global context. The engineering field needs more professionals who are globally educated and experienced, and this program created by Dr. Kennedy is leading the way in producing graduates with those skills. I fully endorse her for this award, knowing the impact that the Global Engineering Leadership Minor has made on myself and my fellow engineering students.

Sincerely,

Daniel Rosborough
MSCE, 2019
February 27, 2020

Dear Selection Committee,

My name is Spencer Maddox, and I am a 1st year Master’s student and Global Engineering Leadership (GELM) minor alum. Last May, I graduated from Georgia Tech with a Bachelor’s of Science in Civil Engineering and the Global Engineering Leadership Minor. My first interaction with Dr. Kennedy was during my first semester here, which almost unbelievably was over 4 years ago. Dr. Kennedy came to the GT 1000 class I took and spoke about GELM. Immediately, the program and its offerings blew me away: embedded classes with study abroad opportunities, classes dedicated to sustainability, global perspectives, and leadership.

While the program interested me, I was only a freshman and unsure if I was cut out for it. Throughout my next year, I struggled to find a passion for my classwork. My grades were fine, but I failed to engage in the classroom and with my professors. I became comfortable and lazy with school. By spring of last year, I knew that needed to change.

By happenstance, I took Civil Engineering Systems with Dr. Kennedy that spring. After she went over the minor in class, I knew I needed to apply. Not only did Dr. Kennedy inspire me to apply, but also taught a complex, dense topic knowledgeably and effectively. The passion Dr. Kennedy demonstrates for multiple subjects, along with conducting research and traveling frequently, impressed (and still does impress) me greatly.

About a month after I applied, I was accepted into GELM. I never could have imagined the immediate impact the program would have on me. In the introductory GELM meeting, Dr. Kennedy mentioned a class going abroad that summer: Sustainable Transportation Abroad. This class sounded like the perfect class for me. Growing up in Atlanta’s suburbs, I had never experienced an effective transit system and know Atlanta’s traffic too well. I have always wanted to try and fix Atlanta’s gridlock, and Sustainable Transportation Abroad provided me with firsthand experience of what effective transit looks like in the Netherlands. I had no idea as a mere 2nd year the impact this class would have on me.

The small group that took the class allowed me to develop relationships with the other students as well as Dr. Watkins. It took me two years, but I finally interacted with a professor outside of the classroom. While this fact may seem small, without GELM, I would have never traveled abroad or gotten to know Dr. Watkins.

After the class, GELM continued to push me. Rather than be complacent, I began to pursue every opportunity that interested me. Without GELM or Dr. Kennedy’s passion for it, I would have never possessed this mindset. With this mindset, I wrote an article about the Netherland’s transportation system which got published in ENO Transportation.

The impact GELM had on me continued throughout my academic career. In fall 2017, I began to work as an undergraduate research assistant for Dr. Watkins to code surveys. Without the relationship I built during Sustainable Transportation Abroad, I likely would not have pursued the opportunity. Each following semester GELM provided me with a new challenge and opportunity. In spring of 2018, I worked for Georgia Tech Parking and Transportation because of the self-confidence and leadership abilities my classwork gave me.
In the summer of 2018, I interned in Budapest, Hungary for two months to satisfy GELM’s study, work, or research abroad requirement. As a freshman, I would have never imagined immersing myself for two months, alone, in another country. GELM not only provided me with the funding to take this trip, but also the fundamental knowledge and skills to thrive. Without a doubt, all the classes I took to fulfill the minor are among my favorite. Each course has a dedication to sustainability. This dedication differs from most other courses in the undergraduate civil engineering curriculum. Technical classes, while important, are more concerned with problem solving than sustainability. GELM’s focus on sustainability and global challenges allows students to learn about real world challenges we will all face.

Sustainable Transport Abroad, Smart and Sustainable Cities, Megaprojects, Global Engineering Leadership, and Foundations of Leadership all have sustainability and real world components embedded into their classes. Structuring classes this way allows us students to be more engaged than regular, major required, classes.

These classes also have global components imbedded in them as well. The global components allow us students to think outside our usual frame of reference. Learning about other cultures allows us engineers to communicate effectively and consider the background of the people we will work with.

I will be forever indebted to Dr. Kennedy and her development and establishment of the Global Engineering Leadership Minor. The impact this minor has had on me cannot be understated. Because of the self-confidence GELM gave me, I applied for the BS/MS program my 3rd year. This May, I will graduate with my Master’s degree from Georgia Tech with Dr. Watkins as my thesis advisor. This June, I will move to Miami and start my career as a transportation engineer focused on pedestrian, bicycles, and transit planning and design. Without GELM, I cannot imagine where I would be currently; I likely would not have taken Sustainable Transport Abroad. Without Sustainable Transport Abroad, I would not have found my passion for pedestrians, bicycles, and transit. I truly cannot understate the impact GELM has had on my life. Without a doubt, Dr. Kennedy is deserving of the CTL Curriculum Innovation Award. If you have any questions, do not hesitate to contact me. I can be reached at

Sincerely,

Spencer Maddox