Engineering Expansion at Washington State University

Washington State University (WSU) respectfully submits the following report as required by Section 607(2) of Engrossed Substitute Senate Bill 5187 (2023).

Enrollment

The following table illustrates the total number of students enrolled in computer science and engineering degree programs. This provides a comprehensive picture about the size of the program and student enrollment.

WSU Enrollment: Undergraduate and Graduate Computer Science and Engineering Programs				
	Fall 2013[1]	**Fall 2022**	**Increase**	**% Incr**
Undergraduate	3697	3853	156	4%
Master's	120	174	54	45%
Doctoral	283	280	-3	-1%
Total Students	**4100**	**4307**	**207**	**5%**

As of Fall 2022, the net increase in total enrollment of all WSU undergraduate plus graduate students in computer science and engineering programs was 207 students more than Fall 2013. In Fall 2022 relative to the prior academic year, WSU's total enrollment in computer science and engineering programs decreased approximately 6.6%, corresponding to 305 students. Enrollment numbers in Fall 2022 reflect the effects of the pandemic where the number of incoming graduate and undergraduate students decreased relative to Fall 2019 (pre-pandemic).

[1]*Total enrollment data for Fall 2012 are not available. Fall 2013 is used as baseline for illustrative purposes.*

Table 1: Undergraduate Program Enrollment Growth.

Bachelor's Program	2013	2020	2021	2022	Growth 2022-2013
Bioengineering	153	159	157	128	-25
Chemical Engineering	267	178	158	145	-122
Civil Engineering	601	424	368	325	-276
Construction Engineering		63	47	51	51
Electrical Engineering	333	206	210	180	-153
Computer Engineering	148	110	126	122	-26
Computer Science (BA and BS)	415	737	781	830	415
Software Engineering		74	78	71	71
Data Analytics		74	76	77	77
Materials Science and Engineering	59	80	59	61	2
Mechanical Engineering	780	712	702	675	-105
Engineering-Undecided	187	85	69	45	-142
Data Analytics - Global Campus		85	81	97	97
Mechanical Engineering - Bremerton	26	64	48	32	6
Electrical Engineering - Bremerton		25	19	20	20
Mechanical Engineering - Everett	60	72	58	43	-17
Electrical Engineering - Everett		44	41	28	28
Software Engineering - Everett		63	56	50	50
Data Analytics - Everet		21	11	8	8
Civil Engineering - Tri-Cities	19	58	52	42	23
Engineering-Undecided - Tri-Cities		13	12	17	17
Electrical Engineering - Tri-Cities	71	74	65	57	-14
Computer Science - Tri-Cities (BA and BS)	49	92	91	88	39
Mechanical Engineering - Tri-Cities	92	111	93	89	-3
Data Analytics - Vancouver		18	30	29	29
Engineering-Undecided - Vancouver		31	14	9	9
Electrical Engineering - Vancouver	125	103	99	97	-28
Computer Science - Vancouver	126	272	278	268	142
Mechanical Engineering - Vancouver	186	200	185	169	-17
Total Bachelor's	**3697**	**4248**	**4064**	**3853**	**156**

Table 1 summarizes the Fall 2013 baseline numbers for undergraduate students by discipline and campus and compares them to Fall 2020, Fall 2021, and Fall 2022 enrollment. The overall growth in undergraduate students enrolled in engineering or computer science programs at WSU from Fall 2013 to Fall 2022 is 156, or approximately 4.2%.

[1]Total enrollment data for Fall 2012 are not available. Fall 2013 is used as baseline for illustrative purposes.

Table 2: Master's Program Enrollment Growth

Master's Program	2012	2020	2021	2022	Growth 2022-2012
Chemical Engineering	7	14	7	3	-4
Civil Engineering	33	36	35	21	-12
Computer Engineering	2	5	2	2	0
Computer Science	28	75	69	59	31
Electrical Engineering	28	39	39	30	2
Engineering	2	5	4	1	-1
Environmental Engineering	7	9	7	9	2
Materials Science and Engineering	13	6	7	3	-10
Mechanical Engineering	40	54	50	37	-3
Software Engineering		5	10	9	9
Total Master's	**160**	**248**	**230**	**174**	**14**

Table 3: Doctoral Program Enrollment Growth

Doctoral Program	2012	2020	2021	2022	Growth 2022-2012
Chemical Engineering	44	43	42	45	1
Civil Engineering	37	41	42	41	4
Computer Science	38	47	50	40	2
Electrical Engineering	51	56	55	54	3
Engineering Science (Multidisciplina	35	16	17	12	-23
Materials Science and Eng.	44	53	58	38	-6
Mechanical Engineering	38	54	54	50	12
Total Doctorate	**287**	**310**	**318**	**280**	**-7**

From Fall 2012 through Fall 2022 the total enrollment of graduate students increased by 7, as shown in Tables 2 and 3, with an increase of 14 Master's students and decrease of 7 Ph.D. students. Enrollment numbers in Fall 2020, 2021 and 2022 reflect the effects of the pandemic where the number of incoming graduate students in general and international graduate students in particular decreased relative to Fall 2019, when total doctoral program enrollment was 361 students.

Degrees Awarded

WSU Degree Awarded: Undergraduate and Graduate Computer Science and Engineering Programs				
	2007-2011 Baseline	**FY 2023**	**Increase**	**% Increase**
Undergraduate	411	754	343	83%
Master's and Doctoral	132	165	33	25%
Total Students	**543**	**919**	**376**	**69%**

Funding provided under HB 2127 (2012) and SB 5034 (2013) brought with it expectations of an increase in undergraduate and graduate degree production of 190 and 104 degrees, respectively, over the 2007–2011 baseline for a total target of 294 new degrees. WSU's 2007-2011 baseline was 543 degrees (411 undergraduate and 132 graduate). In Fiscal Year (FY) 2023, WSU produced a total of 919 degrees (754 undergraduate and 165 graduate [96 Master's and 69 Ph.D.]) in engineering and computer science. Thus, 82 *graduates were produced above the target associated with the additional funding*. The 2015-2016 Academic Year was the first year where degree production could be reported owing to the lag between when students start and when they graduate. WSU has thus exceeded the target degree-creation value for each of the past five years.

Tables 4, 5, and 6 summarize the number of computer science and engineering undergraduate degrees (BS and BA), master's degrees (MS) and doctoral (PhD) degrees awarded in FY 2021, 2022, and 2023. Note that WSU's official degrees conferred for the FY are updated in October of each year. The degrees conferred reported for FY 2023 are unofficial, based on a snapshot from August 10, 2023, and may differ slightly from the official degree counts in October.

Table 4: Undergraduate degrees awarded

Bachelor's Program	Degrees Awarded: FY 2021	Degrees Awarded: FY 2022	Degrees Awarded: FY 2023
Bioengineering	21	31	17
Chemical Engineering	44	25	35
Civil Engineering	130	101	86
Construction Engineering	19	6	16
Electrical Engineering	140	110	71
Computer Engineering	16	15	11
Computer Science (BS and E	186	185	208
Software Engineering	28	31	25
Data Analytics	19	34	49
Materials Science Engineering	35	20	15
Mechanical Engineering	279	265	221
Total Undergraduate degre	**917**	**823**	**754**

Table 5: Master's degrees awarded[1]

Master's Program	Degrees Awarded: FY 2021	Degrees Awarded: FY 2022	Degrees Awarded: FY 2023
Chemical Engineering	14	6	3
Civil Engineering	14	21	15
Computer Engineering	3	2	1
Computer Science	38	45	32
Electrical Engineering	20	24	14
Engineering	4	3	1
Environmental Engineering	3	5	6
Materials Science and Engineerin	4	6	4
Mechanical Engineering	27	31	16
Software Engineering		2	4
Total Master's degrees	**127**	**145**	**96**

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[1] Self-supporting programs like Engineering and Technology Management and Professional Science Masters have not been included here, since they are outside the scope of this report.

Table 6: Doctoral degrees awarded

PhD Program	Degrees Awarded: FY 2021	Degrees Awarded: FY 2022	Degrees Awarded: FY 2023
Chemical Engineering	7	8	13
Civil Engineering	9	5	12
Computer Science	9	5	8
Electrical Engineering	9	19	10
Engineering Science	3	3	3
Materials Science and Engineerin	5	9	17
Mechanical Engineering	12	17	6
Total Doctorate degrees	**54**	**66**	**69**

Electrical Engineering at Bremerton & Software Engineering and Data Analytics

ESSB 6052 (2015) provided additional funding to WSU for creation of an Electrical Engineering program in Bremerton and Software Engineering and Data Analytics in Everett. The late enactment date of the budget (6/30/2015) prohibited WSU from enrolling students in these programs in AY 2015-16. Further, a change in policy by the Northwest Commission of Colleges and Universities (NWCCU), the agency that accredits Washington State University, forbade us from advertising or announcing these new degree programs until after NWCCU had granted permission to offer these programs. This did not occur until the summer of 2016.

Funding provided under ESSB 6052 and SSB 5883 (2015) brought with it the following expectation for the software engineering and data analytic programs: "At full implementation, the university is expected to enroll 50 students per academic year."

As reported in Table 1 of this report, following are total students enrolled for Fall 2022:

- Software Engineering: 121 (71 Pullman students and 50 Everett students)
- Data Analytics: 211 (77 Pullman students, 8 Everett students, 97 Global Campus students, and 29 Vancouver students).

Thus, WSU has significantly surpassed the target enrollment of 50 students per academic year. Funding provided under ESSB 6052 and SSB 5883 brought with it the following expectation for the electrical engineering program located in Bremerton: "At full implementation, the university is expected to increase degree production by 25 new bachelor's degrees per year."

During FY 2023, 9 bachelor's degrees were awarded from the electrical engineering program located in Bremerton. The effects of the pandemic have significantly affected this program. While this is relatively modest, the growth in this program is consistent with trends that have been experienced with the prior creation of new programs. Further, as described above, there is an expected lag in degree production due to the time between when students start the program and when they graduate.

Low income students enrolled in each program

Using Pell grant eligibility as an identifier of low-income students, approximately 25.0% of the Fall 2022 computer science and engineering students fit this category, which is lower than the 32% Pell Grant eligibility observed in Fall 2012 but higher than the 18.9% Pell grant eligibility observed in Fall 2021. The percentage of Pell Grant eligible undergraduate students broken down by major is shown in Table 7. The second column represents the total number of students in each program whereas the third column shows the percentage of students who are Pell eligible. These numbers could understate the actual number of low-income students owing to Pell eligibility being a discernable attribute only for those students who complete the Free Application for Federal Student Aid (FAFSA).

Table 7: Fall 2022 Pell Grant Eligibility by Degree Program

Program	Students in Program	% Pell Eligible
Bioengineering	128	21.1%
Chemical Engineering	145	20.0%
Civil Engineering	367	26.4%
Computer Engineering	122	23.8%
Computer Science BA	67	25.4%
Computer Science BS	1119	26.5%
Construction Engineering	51	25.5%
Data Analytics	211	28.4%
Electrical Engineering	382	30.6%
Engineering	71	23.9%
Materials Science Engineering	61	14.8%
Mechanical Engineering	1008	21.8%
Software Engineering	121	28.1%
Total	3853	25.0%

Process changes and best practices implemented

In order to foster student success, we have implemented several best practices designed to increase student retention, including retention of members of underrepresented minority groups. One example is the NSF-funded Pacific Northwest Louis Stokes Alliance for Minority Participation (LSAMP) program, which aims to increase the recruitment, retention, and graduation rate of underrepresented students in STEM (Science, Technology, Engineering, and Mathematics) disciplines. The Voiland College of Engineering and Architecture (VCEA) is a dedicated supporter of this program that provides an array of academic, professional, and social programming. The LSAMP program conducts a) outreach to community colleges; b) offers financial support and mentoring for students by STEM Faculty Research Mentors; and c) offers fieldtrips, academic and career advising, support for conferences, and a series of STEM related workshops, such as graduate school preparation and undergraduate research information sessions, plus fun social activities to allow opportunities for students to network and meet peers.

Similar to the LSAMP program, VCEA partners with the College of Arts and Sciences, College of Veterinary Medicine, College of Agriculture, Human, and Natural Resource Sciences and the Office of Student Equity to support the Team Mentoring Program. TMP promotes underrepresented groups in the pursuit of STEM degrees through research opportunities and mentorship with faculty, connection with industry and alumni partners, and financial support for research, study abroad, and other academic endeavors. Included in the set of underrepresented student populations are females pursuing degrees in engineering or computer science. One of the key aspects of the TMP program is the peer to peer mentoring program which matches upperclass mentors with sophomore and junior-level mentees. VCEA has the largest number of mentors and mentees in this campus-wide program, with 10 mentors being matched to close to 200 sophomore and junior-level mentees.

VCEA continued to see strong engagement with our Voiland Peer Network program in 2022-2023. This mentoring program matches an upperclassman engineering or computer science student with an incoming first-year or transfer student. Students are paired through a detailed matching survey based on their interests, lifestyle, and background. Students build meaningful peer-to-peer relationships with mentors who help to support them through their first year. In 2022-2023, 38 volunteer upperclass mentors were matched with 255 incoming students, for a total of 293 participants. Over 475 unique conversations occurred and over 2100 text messages were exchanged between mentors and their mentees. Additionally, we are now seeing former mentees return as mentors after having a positive experience with the program during their own first year.

For the past two years, VCEA has implemented a college-wide survey of first-year students in five of our introductory-level courses during the fall semester to help us better understand the experience of our students. This survey has allowed us to gain insight on how our new students engage with college events and student resources and how connected they are to their peers and professors, as well as evaluate their sense of belonging. Additionally, we have paired survey responses with demographic information such as race, gender, Pell-eligibility, first-generation status, degree program, and transfer status to evaluate and work to improve engagement across various student groups. In 2022-2023, we collected over 250 responses from first-year students

pursuing VCEA majors. Analysis has shown that a majority of students engage with VCEA events, are aware of resources, feel welcome in VCEA, and feel connected to their peers and the university at-large.

Our introductory, multi-disciplinary engineering course, Innovation in Design, continues to evolve and provide a positive experience for incoming engineering students. Over 340 students enrolled in this course last year and engaged in a number of activities including hands-on experiments to build basic conceptual knowledge, professional development assignments including resume creation and virtual mock interviews, and design activities and presentations. This course continues to be very well-received by students and effectively introduces them to various career opportunities in engineering fields. Since the course was redesigned in 2018, we have seen the average one-year retention rate in VCEA improve by 6.1% overall and by 9.3% and 7.3% for women and minority students, respectively.

Home to over 40 registered student organizations (RSOs), the Voiland College Club Hub provides training to the RSO for: various procurement needs and travel coordination; connecting to funding opportunities; guidance to complete professional development and project goals. Club interests are extensive and unique across our clubs, with social networking and professional development at the base of every club. A portion of our clubs focus their goals on project design, building, and implementation for personal use or to compete for further prestige and/or awards. These "maker-clubs" mimic current industry processes to provide students with hands-on experience as they enter the work force. Our professional societies encourage in-person opportunities to network with industry representatives, as well as provide connections with peers that prove useful post-graduation. Travel to nationally organized conferences and competitions provides a platform for RSO members to gain real-life experience with travel and networking with those in relevant or similar fields. Opportunities for discovery and engaging in competition against other university chapters on unique projects benefits club members directly. This also places VCEA and WSU, into national spotlights, bringing attention to the outstanding work being done by our undergraduates. The VCEA Club Hub enhances interpersonal, communication, and team building skills that are immediately applicable to their academic experience, and translates into success in their engineering career. Paired with the technical knowledge gained through projects and classes, students are well-versed with a variety of professional skills to put them at the top of many industry hiring lists.

VCEA operates an open-access fabrication space called the Frank Innovation Zone (The FIZ). This space was created to serve all undergraduate students, support senior capstone design classes, clubs and other organizations that make "things", as well as provide a place for students to build their own projects. Our mission is to provide a safe and well-maintained space for students to bring what they learn in their courses and have a hand on real-world applications. Students of any level of expertise can go through the structured training sessions and access all the resources. This space provides hands-on experience vital to enhancing the student learning process in their respective disciplines.

The VCEA Tutoring Services provides a great deal of out-of-class and tutoring support, providing over 130 hours of drop-in tutoring per week covering all disciplines in the college and providing students with thousands of free tutorials each year. Our services focus on foundational

courses (100-200 level) in our disciplines, including areas outside of our college (math, chemistry, and physics; however, our team works closely with teaching assistants and instructors in all engineering/computer science courses to provide tutorials and other support resources for students in need). Our team also works closely with other tutoring services within the university to provide VCEA students with alternative resources that may fit their academic needs more appropriately.

Tutoring Services works under accreditation through the College Reading and Learning Association and VCEA tutoring just submitted our renewal application for the next 3 years in July 2023. We provide additional services to students such as workshops on the utilization of specific software they need for their disciplines, study skills and more. All tutors are trained over a semester in a credit-bearing class, including information and resources about working with students from diverse backgrounds and abilities. We also work with faculty members and as an example a partnership between one of the faculty members and the tutoring director has developed over the past academic year. This professor teaches a core class that traditionally has a high rate of failure and withdraws. The faculty member has hired/recruited about 6 tutors that work closely with the faculty member to understand the pedagogical framework for the material in the course. What makes this partnership unique is that the tutors hold special recitations in the tutoring space as well as during class time. This provides exposure of first year students to the tutoring space which allows them to see themselves as well as other students engaged and using this space. This reduces barriers to access to this valuable resource and helps to reduce the stigma that tutoring is only for students that are failing. This model shares not only the financial responsibility of the tutors, but also the training opportunities for the tutors.

VCEA's Internships and Career Services office facilitates internship and co-op experiences for its students through the Professional Practice & Experiential Learning (ProPEL) Program. Prior to the COVID-19 pandemic, two ProPEL students were selected in 2019 and 2020 as National Intern of the Year by the American Society for Engineering Education's Cooperative & Experiential Education Division. While the pandemic took us 100 percent online, our office was still able to provide a host of career services activities and engagement such as co-sponsoring the online WSU Career Expo and Technical Fair (Fall), School of Design + Construction Career Fairs (Fall and Spring), offering online professional development workshops throughout the year, hosting virtual industry tours, engaging students in the Boeing Mentorship Program, and working with over 800 employers to connect them with our students for engagement and networking activities. The WSU First Destination Placement survey reports for 2019-2023 indicate that at graduation, 74.5 percent of graduates are employed. To better serve the growing cohort of VCEA students, the college has invested the resources needed to hire additional career professionals, graduate interns and peer mentors tasked with assisting VCEA students to achieve their career goals.