

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 5092.

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 2013¹	Fall 2021	Increase	% Incr
Undergraduate	3697	4064	367	10%
Master's	120	239	119	99%
Doctoral	283	318	35	12%
Total Students	4100	4621	521	13%

As of fall 2021, the net increase in total enrollment of all WSU undergraduate plus graduate students in computer science and engineering programs was 521 students more than fall 2013. In fall 2021 relative to the prior academic year, WSU's total enrollment in computer science and engineering programs decreased approximately 4.3%, corresponding to 184 students. Enrollment numbers in Fall 2021 reflect the effects of the pandemic where the number of incoming graduate and undergraduate students decreased relative to Fall 2019.

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

Table 1: Undergraduate Program Enrollment Growth.

Bachelor's Program	2013	2019	2020	2021	Growth 2021-2013
Bioengineering	153	159	159	157	4
Chemical Engineering	267	204	178	158	-109
Civil Engineering	601	461	424	368	-233
Construction Engineering		57	63	47	47
Electrical Engineering	333	207	206	210	-123
Computer Engineering	148	119	110	126	-22
Computer Science (BA and BS)	415	696	737	781	366
Software Engineering		83	74	78	78
Data Analytics		63	74	76	76
Materials Science and Engineering	59	100	80	59	0
Mechanical Engineering	780	706	712	702	-78
Engineering-Undecided	187	102	85	69	-118
Data Analytics - Global Campus		56	85	81	81
Mechanical Engineering - Bremerton	26	61	64	48	22
Electrical Engineering - Bremerton		32	25	19	19
Mechanical Engineering - Everett	60	92	72	58	-2
Electrical Engineering - Everett		21	44	41	41
Software Engineering - Everett		58	63	56	56
Data Analytics - Everet		20	21	11	11
Civil Engineering - Tri-Cities	19	65	58	52	33
Engineering-Undecided - Tri-Cities			13	12	12
Electrical Engineering - Tri-Cities	71	66	74	65	-6
Computer Science - Tri-Cities (BA and BS)	49	105	92	91	42
Mechanical Engineering - Tri-Cities	92	125	111	93	1
Data Analytics - Vancouver		15	18	30	30
Engineering-Undecided - Vancouver		26	31	14	14
Electrical Engineering - Vancouver	125	119	103	99	-26
Computer Science - Vancouver	126	250	272	278	152
Mechanical Engineering - Vancouver	186	181	200	185	-1
Total Bachelor's	3697	4249	4248	4064	367

Table 1 summarizes the Fall 2013 baseline numbers for undergraduate students by discipline and campus and compares them to Fall 2019, Fall 2020, and Fall 2021 enrollment. The overall growth in undergraduate students enrolled in engineering or computer science programs at WSU from Fall 2013 to Fall 2021 is 367, or approximately 9.9%.

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

Table 2: Master's Program Enrollment Growth

Master's Program	2012	2019	2020	2021	Growth 2021-2012
Chemical Engineering	7	4	14	7	0
Civil Engineering	33	40	36	35	2
Computer Engineering	2	1	5	2	0
Computer Science	28	97	75	69	41
Electrical Engineering	28	76	59	52	24
Software Engineering		2	5	10	10
Engineering Science (Multidisciplinary)	2	0	0		-2
Environmental Engineering	7	19	9	7	0
Materials Science and Eng.	13	3	6	7	-6
Mechanical Engineering	40	70	54	50	10
Total Master's	160	312	263	239	79

Table 3: Doctoral Program Enrollment Growth

Doctorate Program	2012	2019	2020	2021	Growth 2021-2012
Chemical Engineering	44	49	43	42	-2
Civil Engineering	37	45	41	42	5
Computer Engineering					0
Computer Science	38	57	47	50	12
Electrical Engineering	51	73	56	55	4
Engineering Science (Multidisciplinary)	35	18	16	17	-18
Materials Science and Eng.	44	55	53	58	14
Mechanical Engineering	38	64	54	54	16
Total Doctorate	287	361	310	318	31

From Fall 2012 through Fall 2021 the total enrollment of graduate students increased by 110, as shown in Tables 2 and 3, with an increase of 79 Master's students and 31 Ph.D. students. Enrollment numbers in Fall 2020 and 2021 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.

Degrees Awarded

WSU Degree Awarded: Undergraduate and Graduate Computer Science and Engineering Programs				
	2007-2011 Baseline	FY 2022	Increase	% Increase
Undergraduate	411	823	412	100%
Master's and Doctoral	132	283	151	114%
Total Students	543	1106	563	104%

Funding provided under HB 2127 and SB 5034 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) 2022, WSU produced a total of 1,106 degrees (823 undergraduate and 283 graduate [217 Master’s and 66 Ph.D.]) in engineering and computer science. Thus, *269 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 2020, 2021, and 2022. Note that WSU’s official degrees conferred for the FY are updated in October of each year. The degrees conferred reported for FY 2022 are unofficial, based on a snapshot from August 18, 2022, and may differ slightly from the official degree counts in October.

Table 4: Undergraduate degrees awarded

Bachelor's Program	Degrees Awarded: FY 2020	Degrees Awarded: FY 2021	Degrees Awarded: FY 2022
Bioengineering	24	21	31
Chemical Engineering	57	44	25
Civil Engineering	97	130	101
Construction Engineering	4	19	6
Electrical Engineering	113	140	110
Computer Engineering	13	16	15
Computer Science (BS and B	177	186	185
Software Engineering	22	28	31
Data Analytics	17	19	34
Materials Science Engineeri	31	35	20
Mechanical Engineering	294	279	265
Total Undergraduate degree	849	917	823

Table 5: Master's degrees awarded

Master's Program	Degrees Awarded: FY 2020	Degrees Awarded: FY 2021	Degrees Awarded: FY 2022
Chemical Engineering	2	14	6
Civil Engineering	17	14	21
Computer Engineering	1	3	2
Computer Science	47	38	45
Electrical Engineering	19	20	24
Engineering Science	1	4	3
Environmental Engineering	12	3	5
Materials Science and Engin	3	4	6
Mechanical Engineering	33	27	31
Engineering and Technology	28	20	69
PSM in Electrical Power En	10	3	3
Software Engineering			2
Total Master's degrees	173	150	217

Table 6: Doctoral degrees awarded

PhD Program	Degrees Awarded: FY 2020	Degrees Awarded: FY 2021	Degrees Awarded: FY 2022
Chemical Engineering	12	7	8
Civil Engineering	3	9	5
Computer Science	13	9	5
Electrical Engineering	26	9	19
Engineering Science	4	3	3
Materials Science and	11	5	9
Mechanical Engineerin	13	12	17
Total Doctorate degre	82	54	66

Electrical Engineering at Bremerton & Software Engineering and Data Analytics

ESSB 6052 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 academic year 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 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 2021:

- Software Engineering: 134 (78 Pullman students and 56 Everett students)
- Data Analytics: 198 (76 Pullman students, 11 Everett students, 81 Global Campus students, and 30 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 2022, 5 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 pre-pandemic growth in this program was 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 18.9% of the fall 2021 computer science and engineering students fit this category, which is lower than the 32% Pell grant eligibility observed in fall 2012 and the 28.9% Pell grant eligibility observed in fall 2020. This is an indication that the pandemic disproportionately impacted low income students. 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 2021 Pell Grant Eligibility by Degree Program

Program	Students in Program	% Pell Eligible
Bioengineering	157	23.6%
Chemical Engineering	158	20.3%
Civil Engineering	420	19.3%
Computer Engineering	126	20.6%
Computer Science BA	60	20.0%
Computer Science BS	1090	17.0%
Construction Engineering	47	25.5%
Data Analytics	198	22.2%
Electrical Engineering	434	27.0%
Engineering	95	16.8%
Materials Science Engineering	59	11.9%
Mechanical Engineering	1086	15.7%
Software Engineering	134	20.9%
Total	4064	18.90%

Process changes and best practices implemented

In order to foster student success, we have implemented a number of 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 disciplines. The Voiland College of Engineering and Architecture (VCEA) is a strong supporter of this program that provides an array of academic, professional, and social programming. The LSAMP program conducts a) outreach to community colleges and high schools; 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 even 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 create the Team Mentoring Program. TMP supports 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. VCEA has the largest number of mentors and mentees in this campus-wide program, with 10 mentors being matched to approximately 200 sophomore and junior-level mentees.

VCEA continues to expand the Voiland Peer Network — a peer to peer mentorship program that matches an upper-class student with a first-year/transfer student to support a successful transition to college life. The Voiland Peer Network links students through a thorough and personal matching survey that focuses on academic and personal interests, lifestyle, and background. Participants can communicate with each other through text, social media platforms, in-person events, and one-on-one meetings, with the intent to create a more informal and natural peer to peer connection between students in our college. The 2021-2022 school year saw over 400 participants in the program, with 335 first-year/transfer students being matched to 65 volunteer peer mentors.

VCEA also expanded our efforts to understand the experience of our first-year students. We developed and piloted a first-year engagement survey, distributed to students in all VCEA first-year courses. The survey has allowed us to gain insight on which events and resources students are utilizing, how often they are being utilized, and how connected students feel to the college and their peers. We collected over 500 responses last year and are utilizing results to make informed decisions about promoting student engagement within the college. Additionally, we are using survey results to identify any potential differences in engagement based on race, gender, Pell-eligibility, and first-generation status and will use our findings to improve equity and engagement across all students.

We have also worked to improve the student experience in our first-year Innovation in Design course by adding several new course activities. Innovation in Design is intended to introduce incoming freshmen from several disciplines to various degree and career options, promote the development of teamwork and technical communication skills, and prepare students to be successful by introducing student success resources. The course has helped improve student retention since its redesign in 2018 and we continue to refine it. Last year, students were asked to develop their professional skills through new or updated course assignments related to resume creation, company research, and LinkedIn profile creation. Three simple, low-cost design projects and presentations were added to the course to encourage each student to participate in the engineering design process and develop their oral presentation skills. Two lab activities related to fluid mechanics and heat transfer, important topics in several disciplines, were added to increase the breadth of technical knowledge presented in the course. Innovation in Design continues to be a key tool for engaging first-year students and fostering high retention.

Committed to serving VCEA student clubs, the Club Hub provides tailored support to each WSU Registered Student Organization club affiliated with some form of engineering. Home to over 40 clubs, the Voiland College Club Hub delivers tailored assistance to our student clubs' needs: providing assistance with procurement and travel, connection to funding opportunities, and resources to complete professional development and project goals. A portion of our clubs focus their goals on project design, build, and implementation for use or to compete for further prestige and/or awards. Club foci are extensive and unique across our clubs, but social networking and professional development are at the base of every club. Traveling to nationally-organized conferences provides a platform for student club members to gain real-life experience with travel, networking with those in relevant or similar fields, opportunity discovery, to engage in competition against other university chapters on unique projects, and bring experience-gained back to residing club members, VCEA, and WSU. Our Voiland College "maker-clubs" (that mimic modern day industry processes) and professional societies, introduce students to industry, providing in-person opportunities to correlate relevant course or club content. Participation within our student clubs and engagement in activity positively impacts student retention, the undergraduate experience, connecting to peers, professional opportunities, and career decisions past graduation. VCEA student clubs are gearing up for student recruitment now that WSU is fully-operational on campus, following COVID-19 restrictions and mandates.

VCEA operates an open-access makerspace 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 hands-on, real-world application. Students of any level of expertise have the opportunity to go through the structured training sessions and gain access to all of the resources. This space provides hands on experience that is vital to enhancing the student learning process in their respective disciplines. The Frank Innovation Zone is fully operational this year and is monitoring guidance and adjusting operations to meet any requirements from the state and university related to COVID-19.

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. During COVID, VCEA Tutoring continued its services in online formats: first in Zoom and then in MS Teams. Due to continued outreach, Tutoring had the same number of tutorials during COVID as in pre-COVID times. Our program now supports online and in-person tutoring options, and we plan to continue this model into the future. Our services focus mainly 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 was granted national accreditation from the College Reading and Learning Association in 2019, and this accreditation has been renewed for the past three years. 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 the course of a semester in a credit-bearing class that includes information and resources regarding working with students from different backgrounds and abilities. We also work with faculty members to supplement class materials as needed.

VCEA's Internships and Career Services office facilitates internship and co-op experiences for its students through the Professional Practice & Experiential Learning (ProPEL) Program. In 2019 and 2020, ProPEL students were selected as National Intern of the Year by the American Society for Engineering Education's Cooperative & Experiential Education Division. While COVID-19 took us online, our office was still able to provide a host of other career services related activities, 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 2022 indicate that three months post-graduation, 71 percent of the 2021 graduating class was employed. To better service the growing cohort of VCEA students, the college has invested the resources needed to hire additional career professionals tasked with assisting VCEA students achieve their career goals.