Assessment Report

Yuba Community College District

YC - Engineering Program Recommendations

Year of Review: 2013-2014

Type of Review: Self-Study (4-year review)

Executive Summary (Include a list of team members): For the last three years, the engineering program at Yuba College has been instructed and strengthened by Dr. Davidson, who is on loan from the Mathematics Department, after he agreed to take on the engineering program as half of his teaching assignment. This situation was to serve as a bridge until a new full-time engineering instructor could be hired after the financial crisis of the District and college had improved. Dr. Davidson has made it clear to the acting Dean, District Human Resources, and the interim Vice President, that he does not intend to continue teaching the full (or perhaps any of the) engineering curriculum going forward after having done so for the last two and a half years. Therefore the highest priority is to rehire a full-time engineering faculty member to lead the program.

The engineering program at Yuba College also seeks to permanently end the debate, grumbling and resulting weak support that the District has demonstrated toward the engineering program has experienced. The engineering program was nearly canceled a decade ago when Steve Klein was the full-time faculty head. However, his detailed analysis that he shared with the Board in 2003 showed that the engineering program broadly drives enrollment in higher-level math, physics and chemistry classes to the extent that they likely would not be offered if engineering did not require them as prerequisites – a situation that exists currently at Woodland CC. Then, as now, ending the engineering program would cost the District more dollars in lost FTES than would be saved from 0.5-0.75 of a FTEF and the annual $1200 engineering expense budget. Beyond that, YCCD would become the ONLY multi-college district in the state without an engineering program and would join the ranks of just 6 small districts offering no engineering courses at all. Such a situation would be in sharp contrast to the District's statements regarding regional leadership.

The Engineering Program Review contains a multitude of references documenting the health of the program (such as the increasing enrollments and curriculum improvements) and the need for and value of engineering degrees (such as the US Census Bureau stating that engineering and computer science graduates earn more in their careers than any other major). For those readers who are data-driven decision makers, there should be no doubt that the Engineering Program at YC deserves and should receive the support from staffing, curriculum, and technology funding that is requested herein to ensure its robust health and continued growth.

Program Description : A1. Do students have access to curriculum-specific and/or program-specific support services? If so, describe this service(s). If not, explain why.

The MESA program has been at Yuba College for over a decade, and many students have benefited from the support that it has provided them. Students have transferred to four-year colleges and universities to major in a STEM discipline, and have won numerous NSF and other scholarships, as well as have attended many leadership workshops and camps. Recently, however, MESA has suffered from a drastic reduction in support by the College and the District. An apparent consequence of this is that MESA lost its State funding last year, and has been operating on a shoestring budget. The Director is now part-time, and the direction and the fate of MESA is unclear. Students in MESA populate engineering courses as well as their prerequisites (e.g., Math 1A, 1B, 1C, 2, and 3, PHYS 4A, 4B, and 4C, & CHEM 1A) and, thus, help us to continue to offer those courses.
Link to MESA program information: <http://ms.yccd.edu/mesa.aspx>

In addition, the College Success Center (CSC) will offer tutoring for upper-level engineering courses (ENGR 17, 35, and 45) if student tutors can be found. Many students who take those courses transfer and are no longer Yuba College students available to lead tutoring. However, in the past year all three of these courses did have student tutors available and so tutoring sessions were held

at the CSC.

A2. If services are available, how do they demonstrate an increase in student success?

The CSC collects metrics on student GPA, student success, and withdrawal rates and compares these between tutored and non-tutored students in each class. For the three engineering classes with CSC-sponsored tutoring sessions in the past year, tutored students exhibited a 7% increase in success rate, a 5% lower withdrawal rate, and a 14% higher GPA than their untutored classmates.

B3. How are current and previous program review data used to refine and improve program or department practices?
Prior to this year, program reviews for all programs consisted mainly of requests (or recommendations) with little data. Prior program review requests in the Engineering Program Reviews have been instrumental in improving lab safety for the engineering laboratory (Room 713) via addressing maintenance issues such as the leaky roof and improving equipment safety via the installation of knife switches for two of the universal testing machines. In addition, the Technology Committee selected a long-time request of Media Services last year and funded the installation of a document camera in Room 713. The document camera is used nearly every lecture now to display complicated problems and diagrams which improves communication of difficult concepts to engineering students. The document camera is also used for mathematics lectures which shares Room 713 with engineering. Examples related to curriculum included recommendations to create a new laboratory manual for Engr-45 and to revise the COR for Engr-10 so that it could become an option for the YC graduation requirements. Both of those recommendations were accomplished in the past year with great success based on student feedback.

Curriculum & SLO Assessment Summary :

D6. What has your program or department done to improve completion of degrees, certificates, or transfers? What are your future plans?
All of the courses have had revised CORs in the past two years to not only include the new SLOs for the courses, but also to better align with proposed engineering C-ID standards in the state. In addition, a new AS Engineering degree has been entered into CurricUNET where it sits (as it has for nearly a year) until the issues with the CurricUNET software are corrected and the Curriculum Committee has time to consider the new degree. The new AS Engineering degree would allow the college to begin tracking engineering majors for the first time so that accurate data can be collected for comparison to other programs and for guiding improvements to the engineering program. In addition, the AS Engineering Degree would lay important groundwork for a possible AS Engineering Technology Degree which is less academically demanding but still consistently ranked as one of the highest paying CC degrees. CC Engineering Technology programs can also seek ABET accreditation, something that is not possible for engineering programs at the CC level. Finally, the current head of the engineering program has been selected as a state reviewer for engineering COR submissions for compliance with the upcoming engineering C-ID standards.

D7. Do you have any courses, certificates, or degrees that should be in-activated or expanded? If yes, please identify and justify your recommendations with data.
Yes, Engr-33: Surveying a Parcel Boundary should be in-activated. It has not been offered since 2007 and at that time only had 10 students. It was scheduled to be offered in 2008 but was canceled and never rescheduled. The curriculum and any laboratory instructions that might have been developed for the course were lost with the prior instructor along with any insight into meaningful SLOs. Additionally, neither students nor local businesses have requested instruction on this topic for the past 3 years. Since it is a single-unit class, its format and content may be more applicable for an adult- or continuing-education course in the future if there is sufficient interest.

D8. Do all of your courses have current CORs? If not, what steps are you taking to ensure compliance?
All of the courses have had revised CORs in the past two years to not only include the new SLOs for the courses, but also to better

align with proposed engineering C-ID standards in the state. In addition, the current head of the engineering program has been selected as a state reviewer for engineering COR submissions for compliance with the upcoming engineering C-ID standards.

D9. If applicable, how are teaching methodologies in your program or department assessed?
Teaching methodologies are assessed via faculty evaluations and by trends in the course SLOs. In addition, when new methodologies are introduced (such as the use of Mastering Engineering and Piazza in Engr-17: Circuits), the students are invited to comment at the end of the semester on whether a methodology was helpful or not to their overall learning in the course. Also for every engineering class in general, students are requested to provide feedback (sometimes verbally but often in writing) on what was effective in the course, what they were hoping to see in the course and perhaps didn't, and what wasn't helpful to their learning in the course. This student feedback is retained by the department to inform future instruction.

D10. If applicable, how are the results of the assessment used to support, improve, and/or expand your current teaching methodologies?
As an example, after analyzing the student comments regarding the use of Piazza for online announcements and asynchronous discussions in Engr-17: Circuits in Spring 2013, the use of Piazza was expanded to both Engr-35: Statics and Engr-45: Properties of Materials in Fall 2013.

D11. If your program or department uses a DE modality to support instruction, how are you evaluating the effectiveness of that instruction?
There are currently no DE offerings in the engineering program. A conversion of Engr-35: Statics to an online course using CCCConfer (or a flipped-classroom course) is being considered if resources can be found to create the necessary online lectures.

D12. If your department offers DE courses, what support services does it provide for DE students? What can be done to improve support services for these students?
The department does not offer DE courses through the college infrastructure in part because that infrastructure has proven unstable on a number of occasions. If DE courses are created in the future they will make use of outside infrastructure such as CCCConfer, Piazza, Mastering Engineering, etc. or a combination of the above.

D13. How is your program or department applying sound principles of learning and teaching theory to its curriculum?
For the past two years, the principal faculty member has been invited to participate in the Summer Engineering Teaching Institute (SETI) which is hosted by Cañada College in the Bay Area in late May. The first year introduced many new technologies (e.g., CCCConfer) that can be applied in the classroom for both online and traditional settings. The second year, YC Engineering participation was as a presenter of technologies that had been used at Yuba College (Piazza and Mastering Engineering). Mastering Engineering associates each assigned homework problem with corresponding ABET learning outcomes and provides immediate feedback to the students on homework submissions. In addition, curriculum is discussed at SETI, including the draft engineering C-IDs and transfer degrees. The faculty at Yuba College has also applied concept maps (developed at Arizona State University) as a review aid for Engr-45: Properties of Materials after seeing a demonstration at an ASEE conference in June 2011.

D14. Which CSLOs (course student learning outcomes) and PLOs (Program learning outcomes) were assessed within the last year?
All of them (each SLO for each course offered, and each of the new PLOs) were assessed, and the results were posted in TracDat.

D15. For each of the above, how did the assessment data influence program, department and/or course improvement?
After each SLO assessment, the possible reasons for SLOs not meeting expectations are explored and the possible reasons for

exceeding expectations are considered. This has been used to modify SLOs in some cases (one SLO for Engr-35 was split into two different SLOs) or to modify the assessment question. Because the courses in engineering are typically only offered once per year, it will take some time to identify trends, but those will be examined once at least three data values are obtained for a particular SLO.

Industry Trends and Program Data Analysis : C4. How do program or department goals align with the education, diversity, demographic, and workforce needs of local communities?

First of all, the department believes this is a short-sighted question. To consider only the needs of local communities and businesses gives little opportunity to respond to the larger trends in our nation and in our world. Steve Jobs and Apple Computer did not develop the iPhone and iPad because someone told them to, but rather they extrapolated from the larger trends and innovated beyond what currently existed. If we only consider the workforce needs of our local communities, then we will limit our students to a variety of low-wage, agricultural and service jobs and thereby institutionalize the poverty inherent in our District.

Instead, the department believes that YC and the District should create opportunities for advancement for our best and brightest students that may indeed take them beyond our handful of counties. Doing so, however, also creates the opportunity that these students will bring back the higher wages and technologies to this region. In fact, if enough of our students are educated well, new industry would be attracted to our communities.

In looking at data from California Community Colleges Chancellor's Office, there are 72 community college (CC) districts in this state. Of those, 59 CC districts have engineering programs as noted by their college catalogs or by their membership in the Engineering Liaison Council (ELC) for engineering faculty in the state. It should be noted that there are NO multi-college CC districts in the state of California that do not have an engineering program. Even of the 13 single-college CC districts without formal engineering programs, six offer engineering courses of some type and one (Barstow) has an engineering technology degree in electronics. It is difficult to imagine how the YCCD district could show positive leadership by being the only multi-college CC district to allow its engineering program at Yuba College to wither and die. With regard to the needs of our students and communities, our Assemblyman, Dan Logue, spoke at Yuba College on October 10, 2013 and reinforced the need for quality, low-cost education in engineering. He stated in a press release that, "Jobs in STEM fields are good, high paying jobs of which many are currently filled by candidates from overseas due to the lack of American students graduating in those fields." His The Affordable College Act seeks to provide a bachelor's education at low cost – a goal that cannot be met without community colleges paving the way for transfer students.

The US News and World Report noted that the unemployment rate for engineers reached a maximum rate of 6.4% during the Great Recession and stood at a stunning 2% in March 2012. In June 2011, CNN reported that of the ten highest-paying careers, the top nine of them were in fields of engineering or computer science. In more recent news, in October of 2012 the Chronicle of Education (reporting on data released by the US Census Bureau) stated that engineering and computer science graduates earn more in their careers than any other major, averaging $4.1 million for those engineering majors who work in management. In August 2013, the American Society of Engineering Educators (ASEE) reported that enrollment continues to rise for undergraduate engineering majors. On September 9, 2013 National Public Radio (NPR) aired a story on its "All Things Considered" program that showed (again) nine of the top ten paying college majors were engineering or computer science (the other was pharmacy sciences/administration). Three days later, a finance blog reported, using data from the compensation-research firm Payscale, that nine of the top ten majors with regard to job satisfaction were types of engineering majors (the other was geology). Finally, on October 21, 2013 The Wall Street Journal reported on a recent study by Bayer Corp. stating that "half of the recruiters from large companies said they could not find enough job candidates with STEM degrees. The recruiters said the shortages were most acute in engineering and computer-related fields."

All that said, the engineering department is not ignoring local demand. On August 30, 2013 the California Department of Water Resources sent the department an email to advertise for 90 technical positions that they were trying to hire. The electronic letter stated that they were aware that YC offers technical training that they considered valuable. In the keynote address at the California MESA Student Leadership Conference on October 20, 2013 it was reported by noted labor researcher, Dr. Carlos Rodriguez, that the five main drivers for future job creation are: energy, health, communications, cyber security and autonomy – all technologies requiring significant numbers of engineering graduates. In addition, the YC Engineering program researched specific on engineering majors through the National Center for Educational Statistics (nces.ed.gov) that was collected from the cohort of 1993 graduating college seniors and then tracked through 2003. This data shows that 55% of engineering graduates had "high" salaries with another 40% in the "middle" salary category. This compares to 25% and 50% respectively for all graduates' majors. Additionally the college debt of engineering majors was lower than all graduates with 70% of engineering graduates owing less than $7000 as compared to only 50% for all majors.

C5. How is your program or department direction driven by empirical data?
Entirely so.

To be more specific, the Engineering Program is driven by data at every level perhaps because that is the nature of engineering – a constant drive to improve via informed decisions and actions.

At the class level, the program assesses and reviews course SLOs EVERY semester for EVERY class and EVERY course SLO. In addition for each engineering class in general, students are requested to provide feedback (sometimes verbally but often in writing) on what was effective in the course, what they were hoping to see in the course and perhaps didn't, and what wasn't helpful to their learning in the course. This student feedback is retained by the department in the binders of lecture notes for each course to inform future instruction. Finally, the department has invested time and both institutional (FLEX travel requests) and personal monies to attend conferences and meetings with colleagues to access data at other institutions about what techniques and technologies have increased their students' success in various courses. Details of these conferences are provided in responses to question D13 and section J of this program review.

At the program level, the engineering program annually examines the results of the five program SLOs and their relationships to the 21 course SLOs. For the prior year, all of the engineering program SLOs rate above satisfactory (A value of 1 means "satisfactory" or "meets expectations"). The Collaboration program SLO ("Students of engineering at Yuba College will function effectively as members of technical teams, including a respect for diversity, professional and ethical responsibilities") was above 1.5 indicating it exceeded expectations at a program level.

At the college level, the engineering program conducted an engineering survey in Spring 2013 to obtain better census data on engineering students at YC and the new engineering course, Introduction to Engineering & Science (Engr-10). Results of this survey were presented to the acting Dean, Counseling, and to counselors from local high schools at the Spring CARE Advisory meeting sponsored by Student Services. Among the findings were:
• Over 100 engineering or possible engineering majors were enrolled at Yuba College at that time in mathematics courses above trigonometry.
• There was very strong support for a new AS Engineering degree at Yuba College (90+ %).
• Engineering majors make up the bulk of enrollment in mathematics above Calculus 1A.
• The new Engr-10 course looked like it will become popular *IF* it can be advertised better.
The reason that the engineering program conducted the survey was because the college had stated for the last two years that there was no data on engineering students at Yuba College because the college does not have an engineering degree or certificate that students can identify with as a major or educational goal when they become YC students. However, this year data WAS provided by

the college for the engineering program review, and it included historical data for four prior years! A significant issue is that the data supplied by the college seems to underreport engineering students by over 50% (comparing the YC-supplied value of 40 engineering students in the program last year to 100+ students identified in the engineering program's survey). That said, the YC-supplied data is useful for trending purposes, and it shows that the engineering program had the highest ever level of student retention ever last year at 88%. Additionally it shows that last year was also the program's second highest year for student success (80%), enrollments (75), students per section (12.5), and program headcount.

At the state level and beyond, the engineering program participates in the Engineering Liaison Council which facilitates communication engineering curriculum, articulation and transfers between the CCC and the UC/CSU system. Participation is supported via a grant based at Cañada College. The ELC also informally tracks CCC engineering enrollment statewide. In addition, the head of the engineering program was selected as a COR evaluator for the engineering discipline at the state level in preparation for the engineering C-ID alignment effort that will commence once the draft C-IDs are approved. Finally the head of the engineering program also assists the American Society of Engineering Educators in reviewing proposed papers for its annual conference. All of the state and national organizations share data that informs the YC Engineering Program.

Future Goals and Program Direction:

K27. Based on Program Review, what are your plans for future department/program improvements?

First and foremost, the department must hire a full-time instructor for engineering. There is great potential for the enrollment to expand, and for the engineering faculty member to fulfill load by teaching across disciplines such as computer science, chemistry, physics or mathematics. Of secondary priority, the department should continue the process to establish an AS Engineering degree at Yuba College. The proposal is already completed in CurricUNET and simply awaits submission. Along with that, the entire engineering curriculum needs to be aligned with the state engineering C-IDs as soon as these are finalized. This is not expected to require a great deal of department resources, but it will take time since it is an involved process including review and approval by both the YC Curriculum Committee and the state.

In lesser curricular matters, the department intends to move Statics (Engr-35) to a flipped classroom or online modality. This should improve student learning and potentially increase enrollment. As mentioned before in question F19, the department recommends incorporating 3D printing technology in Engineering Graphics & Design (Engr-4) to strengthen that course and provide a beneficial tie-in to advanced manufacturing and CTE, in general. The department is also interested in evaluating the change of Plane Surveying (Engr-3) to a lecture-only format to reduce equipment costs as some CCCs have done. It is believed the new C-ID for Plane Surveying will allow this option. The department would like to consider offering Engr-10 at the Sutter County Campus (SCC), and the SCC interim executive dean has expressed support for this idea. Also, when Engr-10 is offered again in Fall 2014, the local high school counselors have advised to have a mid-late afternoon start time so that more high school students could take the course for college credit. Other curricular plans may be considered if the engineering enrollment increases sufficiently such as: offering the Engr-10 class each semester (Engr-10 has the highest average enrollment of 19 students currently), and using a multi-lab session per single lecture class format to expand engineering lab classes without a dramatic increase in faculty staffing requirements.

With regard to improving the student experience, the department will continue incremental upgrades to engineering lab equipment -- several specific recommendations have been made in this regard. If there was more time and resources available, the department believes that the YC engineering program could easily qualify for technology grants to replace the aging equipment. Also, the cheap robots used in Engr-10 for a single class, may be replaced with more expensive, but higher quality robots that could be reused for multiple classes. Finally, the department would like to see greater investment in student work-study or a part-time instructional assistant to help prepare laboratory spaces for the various engineering lab activities. This would free up limited instructor time to focus on lecture, curriculum and grant-writing for the department, as well as the struggling engineering club.

Course Content and Statistical

This required text box was not explained in the new program review guidelines.

Analysis:

Are you ready to submit your final program review?: Yes

Goal	Recommendations	Plan of Action & Budgetary Impact / Tasks	Status	Feedback & Follow-Up
YC Goal 1 - How do program or department goals align with stated Yuba College goals? The Engineering faculty established 11 goals for its program for the 2011-2012 year using TracDat. Each of these goals has been updated to reflect their linkage of each to multiple Yuba College goals and at least two of the YCCD District Board of Trustees' Vision Statements. For each program goal, the primary Yuba College goal has been noted as the "Goal Type," and the 11 program goals are aligned with six of the nine Yuba College goals (1, 3, 5, 6, 7, & 9) at this level. In addition, three of the 11 program goals have been completed: 1. Complete a set of SLOs for each Engineering course that is regularly scheduled. 2. Create a new laboratory instructional manual for ENGR-45 (Properties of Materials). 3. Update the Course Outline of Record for each of the regularly scheduled courses in Engineering. And two others are on-going and currently have evidence of success: 1. Assess the SLOs in all Engineering courses offered each semester beginning in Fall 2011. 2. Increase the size of the Engineering Program at YC based on FTES.				

Goal	Recommendations	Plan of Action & Budgetary Impact / Tasks	Status	Feedback & Follow-Up
YCCD VS 1 - How does the program support the YCCD District Vision Statement? Specifically, how does the program meet the needs of our students and communities? The engineering program goals are each linked to one or more of the five District Vision Statements. Specifically, the engineering program is aligned with “Providing an innovative, world-class learning environment” and “Providing educational, economic, cultural, and civic leadership for our communities and region” because engineering programs are essential to the “world-class” and “leading” institutions that the Board of Directors is trying to foster. Of the 72 community college (CC) districts in the state of California, 59 have engineering programs as noted by their college catalogs or by their membership in the Engineering Liaison Council for engineering faculty in the state. There are NO multi-college CC districts in the state of California that do not have an engineering program. Even of the 13 single-college CC districts, six offer engineering courses of some type and one (Barstow) has an engineering technology degree in electronics. It is difficult to imagine how the YCCD district could show positive leadership by being the only multi-college CC district to allow its engineering program at Yuba College to wither and die. With regard to the needs of our students and communities, our Assemblyman, Dan Logue, spoke at Yuba College on October 10, 2013 and reinforced the need for quality, low-cost education in engineering. He stated in a press release that, “Jobs in STEM fields are good,				

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high paying jobs of which many are currently filled by candidates from overseas due to the lack of American students graduating in those fields." His The Affordable College Act seeks to provide a bachelor's education at low cost – a goal that cannot be met without community colleges paving the way for transfer students.				

Goal	Recommendations	Plan of Action & Budgetary Impact / Tasks	Status	Feedback & Follow-Up
YC Goal 5 - Save the Engineering Program at Yuba College, and then make it the best such program in the region.				

Goal	Recommendations	Plan of Action & Budgetary Impact / Tasks	Status	Feedback & Follow-Up
YC Goal 1 - Assess the SLOs in all Engineering courses offered each semester beginning in Fall 2011.				

Goal	Recommendations	Plan of Action & Budgetary Impact / Tasks	Status	Feedback & Follow-Up
YC Goal 7 - Improve the quality of the laboratory experience for YC engineering students.				

Goal	Recommendations	Plan of Action & Budgetary Impact / Tasks	Status	Feedback & Follow-Up
YC Goal 6 - Create a new laboratory instructional manual for ENGR-3 (Plane Surveying)				

Goal	Recommendations	Plan of Action & Budgetary Impact / Tasks	Status	Feedback & Follow-Up

Goal	Recommendations	Plan of Action & Budgetary Impact / Tasks	Status	Feedback & Follow-Up
YC Goal 3 - Create an annual replacement list for laboratory samples, materials and equipment maintenance.				

Goal	Recommendations	Plan of Action & Budgetary Impact / Tasks	Status	Feedback & Follow-Up
YC Goal 9 - Establish an Engineering Technology program to attract students interested in the STEM fields but which may not have the capability or commitment to become full engineers at this time.				

Goal	Recommendations	Plan of Action & Budgetary Impact / Tasks	Status	Feedback & Follow-Up
YC Goal 3 - Appropriately staff the engineering courses at YC, particularly ENGR-3 (Plane Surveying) and ENGR-4 (Engineering Graphics).				

Goal	Recommendations	Plan of Action & Budgetary Impact / Tasks	Status	Feedback & Follow-Up
YC Goal 9 - Increase the size of the Engineering Program at YC based on FTES.				

Goal	Recommendations	Plan of Action & Budgetary Impact / Tasks	Status	Feedback & Follow-Up
YC Goal 1 - Complete a set of SLOs for each Engineering course that is regularly scheduled.				

Goal	Recommendations	Plan of Action & Budgetary Impact / Tasks	Status	Feedback & Follow-Up
YC Goal 6 - Create a new laboratory instructional manual for ENGR-45 (Properties of Materials)				

Goal	Recommendations	Plan of Action & Budgetary Impact / Tasks	Status	Feedback & Follow-Up
YC Goal 6 - Update the Course Outline of Record for each of the regularly scheduled courses in Engineering.				