Graduate Program Review
Texas Tech University

Program Reviewed: Civil and Environmental Engineering

Onsite Review Dates: April 28, 2015

Name of Reviewers

Internal:
Please include name, title, and Department

External:

Dr. Shannon Bartelt-Hunt, P.E.
Associate Professor and Chair of Graduate Programs
Department of Civil Engineering
University of Nebraska-Lincoln
Please include name, title, and Department

I. Academic Unit Description and Strategic Plan

Please evaluate the following by marking an X in one of the blanks for each item:

Vision, Mission and Goals

_X_ Excellent ___ Very Good ___ Good ___ Needs Improvement

Strategic Plan

___ Excellent ___X_ Very Good ___ Good ___ Needs Improvement

Please comment on the positive components and suggested areas of improvement.

The goal of the department with respect to graduate education is to be ranked within the top 50 programs nationally. At a current ranking of 68 and because many CEE programs across the nation are also trying to achieve this same goal, their goal is a stretch goal, but it is realistic. Other stated goals for the graduate program are to grow the faculty to 33 T/TT faculty; $6 million in annual research expenditures; 66 PhD students and 100 refereed publications per year. Based on data provided, reaching these goals involves the addition of 4-5 faculty lines; increasing faculty research expenditures to $180,000 per year, increasing PhD students by approximately 30; and increasing publications by between 40-60 publications per year.

The strengths of the department lie in the quality of the existing faculty and students. After meeting with the faculty and reviewing their CVs, it is clear that the faculty are research active while maintaining a high level of instructional
quality and service activities. The quality of the existing graduate student population appears to be very good, and the students we met (approximately 20 students from across the department) were engaged and generally very satisfied with their graduate experience. This is a significant strength of the department and the faculty members in the Department should be commended for their efforts in graduate student training and retention.

Despite these very positive components, the Department faces some challenges in meeting their strategic goals. These challenges will be described in more detail below, but in summary they include:

- The lack of a permanent chair, which has lead to a slowing of faculty hiring in the department.
- A lack of teaching FTE, especially in the areas of structural engineering, water resources, transportation and geotechnical engineering. Due to a lack of teaching FTE and constraints on maximum class size, the faculty are unable to offer elective graduate courses on the schedule needed to maintain a vibrant and effective graduate program, especially at the PhD level.
- The need to renovate existing laboratory spaces for both graduate teaching and research
- The reliance on center funding for key staff positions such as lab technicians and grant management staff.
- The need to develop endowed funds to support graduate student fellowships

II. Program Curriculum

Please evaluate the following:

Alignment of program with stated program and institutional goals and purposes
___ Excellent  _X_ Very Good  ___ Good  ___ Needs Improvement

Curriculum development coordination and delivery
___ Excellent  ___ Very Good  __X_ Good  ___ Needs Improvement

Program learning outcomes assessment
___ Excellent  _X_ Very Good  ___ Good  ___ Needs Improvement

Program curriculum compared to peer programs
_X_ Excellent  ___ Very Good  ___ Good  ___ Needs Improvement

Please evaluate the following by marking an X in one of the blanks for each item:

The department offers MS and PhD degrees in Civil Engineering with specializations in environmental, geotechnical, structural, transportation and water resources engineering. The department also offers a 5 year BS/MS in environmental engineering. The department has recently merged with construction management and offers a certificate program in construction management, with discussions of expanding this to offer MS and PhD degrees as well. The curriculum plans provided by the department are consistent with other CEE departments across the country. There are no concerns with the curriculum, other than the need to offer more of the upper level MS/PhD courses that are on the books, but are not regularly offered due to constrains with teaching FTE and the need to deliver the undergraduate courses. The department teaches many undergraduate courses that are utilized as service courses by other departments, notably petroleum engineering and industrial engineering. The cap set by the college for 49 students per section imposes a limitation that requires faculty to teach more sections of these undergraduate courses, which limits their ability to offer graduate courses. The faculty in the department are largely already teaching an overload of 2 classes
per semester, when the stated department goal is 2:1 for tenured research active faculty. Hiring new T/TT faculty will help in the long term, but because untenured faculty are only required to teach 1:1, the teaching relief that can be realized from hiring new faculty is 5+ years in the future.

To cover their undergraduate teaching requirements and allow T/TT faculty to teach the core graduate courses, the department has hired a set of instructors that teach approximately 4 courses per semester. The faculty expressed that there is uncertainty in their ability to hire these instructors as they don’t always have information on when the funds will be available until very close to the start of the fall semester. Also, the funds for these instructors are coming from unfilled T/TT faculty lines, and when those lines are filled, the funds for instructors will not be available, but the newly hired untenured faculty will not be able to fill the teaching duties of the instructors. We recommend that the college allow the department to hire instructors on a multiple-year basis (2 year rolling contract, at a minimum) to provide some ability for the department to plan ahead for the next academic year. These instructors teach a significant number of undergraduate courses and are critical to the department’s ability to successfully deliver their graduate curriculum. In addition, the addition of new T/TT lines will also allow the department to offer more elective graduate courses on a more regular basis, which was cited by the students as being one limitation of their current graduate program.

III. Faculty Productivity

Please evaluate the following by marking an X in one of the blanks for each item:

Qualifications
_X_ Excellent ___ Very Good ___ Good ___ Needs Improvement

Publications
__X_ Excellent ___ Very Good ___ Good ___ Needs Improvement

Teaching Load
___ Excellent ___ Very Good ___ Good ___X_ Needs Improvement

External Grants
__X_ Excellent ___ Very Good ___ Good ___ Needs Improvement

Teaching Evaluations
_X_ Excellent ___ Very Good ___ Good ___ Needs Improvement

Professional Service
_X_ Excellent ___ Very Good ___ Good ___ Needs Improvement

Community Service
__X_ Excellent ___ Very Good ___ Good ___ Needs Improvement

Please comment on the positive components and suggested areas of improvement.

In general, the faculty in the department are excellent and are involved actively in research, teaching and service. The review of graduate course evaluations indicates a high level of instruction and graduate student satisfaction with
courses in the department, which speaks well of the faculty. Students also expressed strong opinions in our meeting that faculty are very engaged in graduate student mentoring. The teaching load of the faculty as rated as ‘needs improvement’ as many research active tenured faculty are teaching 2 courses per semester, when the departments stated goal is a teaching load of 3 courses per year. This teaching overload will negatively impact the faculty’s ability to conduct research, write peer-reviewed publications and submit additional grant applications. These research activities are necessary to meet the department’s stated goals of 100 peer reviewed publications, $6 million in extramural research funding and 66 PhD students.

IV. Students and Graduates

Please evaluate the following by marking an X in one of the blanks for each item:

**Time to degree**

| __X_ Excellent | ___ Very Good | ___ Good | ___ Needs Improvement |

**Retention**

| ___ Excellent | ___X Very Good | ___ Good | ___ Needs Improvement |

**Graduate rates**

| ___ Excellent | __X Very Good | ___ Good | ___ Needs Improvement |

**Enrollment**

| ___ Excellent | ___ Very Good | __X Good | ___ Needs Improvement |

**Demographics**

| ___ Excellent | __X Very Good | ___ Good | ___ Needs Improvement |

**Number of degrees conferred annually**

| ___ Excellent | __X Very Good | ___ Good | ___ Needs Improvement |

**Support Services**

| __X_ Excellent | ___ Very Good | ___ Good | ___ Needs Improvement |

**Job Placement**

| ___ Excellent | __X Very Good | ___ Good | ___ Needs Improvement |

**Student/ Faculty Ratio**

| ___ Excellent | __X Very Good | ___ Good | ___ Needs Improvement |

Please comment on the positive components and suggested areas of improvement

The time to achieve the degree for the MS and PhD in Civil Engineering are appropriate at <2 years and <5 years, respectively. The reported time to achieve the MS in Environmental Engineering is <1 year, but that number is cited as being erroneous. It appears as though the MS ENVE student achieve their degree in approximately 1 year, which is the planned time frame.
Quantitative data on retention of graduate students was not provided, but no graduate students expressed concerns regarding retention during the meeting, and the department maintains graduate advisors to assist non-thesis students. Thesis MS students and PhD students appear to be well-mentored by their graduate advisors. There are no concerns with retention.

No data was provided on graduation rates, however, because there are no concerns with retention or time to degree, it is assumed that graduation rates for the CEE graduate programs are high. Approximately 38 students graduated in 2013 between CIVE and ENVE graduate programs in the department.

In order to maintain current graduate student levels and achieve growth in the graduate program, the department needs to enroll more graduate students. Current data indicates that the department is moderately selective, admitting approximately 2/3 of the applicants to the program, however less than half of the admitted students are enrolling in courses as new graduate students. It appears as though a significant number of students are selecting another university for their graduate degree. Currently, the number of new admissions is not meeting the number of graduating students, indicating that the graduate program will shrink instead of grow. One concern that was identified during the external visit was the college minimum required stipend of $27,500 per year with additional funding required for tuition remission. With the university overhead rate of 49%, this makes the cost of a single graduate student to be approximately $60-65K per year. With funding levels capped (for example, in the environmental engineering program at NSF, annual grant amounts are capped at $110K), this makes hiring more than 1 student per year a challenge as the grant cannot support the student(s) in addition to materials and supplies and faculty summer salary. Based on the data provided in the self-study report, there seems to be a decreasing trend, or possibly a leveling off of new graduate students from 2011 through the present, despite generally consistent external funding during this period. The department needs to enroll more graduate students to meet their stated growth goals with a focus on both MS and PhD students. Some recommendations to achieve this include:

- Submission of more extramural proposals. Currently, the department submits approximately 2.5 proposals per T/TT faculty member. The number of extramural proposals submitted should be increased to the extent possible (3-5 per year).

- Recruitment of 150 hr MS students. The faculty in the department indicated that they have just developed curriculum for a 150 hr MS program in CIVE, similar to the existing ENVE BS/MS program. Advertising and recruiting for this program will allow them to retain their own undergraduates for a 1 year MS degree. Increasing the number of MS student is important to provide a student cohort for graduate courses and to increase overall graduate student enrollment.

- Increased emphasis on graduate student recruitment. The department did not appear to have a comprehensive recruitment plan. They face some challenges in keeping their own students as their own undergraduates are recruited by other state schools such as UT and A&M. However, TTU can develop their own set of feeder schools by looking at other four-year colleges within the state or region. They are clearly already doing a very good job with recruiting and retaining students without undergraduate CIVE degrees as a number of the students we spoke with during the meeting did not have an undergraduate engineering degree. The department should identify feeder schools and recruit from those schools to help ensure a consistent pool of applicants and continue their high level of support for students who need to take leveling classes prior to enrolling in graduate engineering courses.
• Development of $1,000 graduate scholarships. The department indicated that in the past, they could offer MS students a $1,000 scholarship, which would then allow them to pay in state tuition, which was a significant recruiting advantage. The department should engage in fundraising to create an endowed fund to allow them to offer these recruitment fellowships for MS students. Focusing on MS students as well as PhD students will allow them to increase their overall graduate student numbers. In addition, good quality MS students can serve as a pool of potential PhD students.

• Timing of GTA funding. The department expressed concerns that decisions regarding GTA funding from the college were not often made until very late in the summer, which does not allow them to recruit new graduate students as GTAs. Instead, they can only select GTAs from their existing student pool. The college should provide information on GTA funding as early as possible (January) so that the department can compete to recruit students in the March/April timeframe when other universities are making funding offers.

• Development of PhD fellowships. The department currently has no sources of fellowship funding for top PhD applicants. This should be developed to allow the department to recruit top students to TTU without the reliance on grant funding or GTA funding.

The gender demographics in the department are approximately 20% female in the CIVE graduate programs and approximately 50% female in the ENVE MS program. The CIVE graduate program is approximately 50% international students, and 50% domestic students with relatively few Black, Hispanic or Asian domestic students. The mix of international and domestic students is largely comparable to similar institutions. The department can work to improve gender and ethnic diversity in the department, although I find their current demographics to be similar to that of their peer institutions.

The department is conferring approximately 30-40 graduate degrees per year between CIVE and ENVE graduate programs. This is a very good number of degrees and is consistent with peer institutions to the best of my knowledge. As the graduate student population grows, this number will also rise.

Graduate students indicated that they felt very supported by staff within the department. This was expressed as a particular strength of the department, both in terms of administrative staff and research technician support. They also expressed that the college and university have sufficient resources on career development, teaching and other academic resources.

Based on the list of former students and their employers, there seem to be no issues with job placement after graduation.

The student to faculty ratio of 3.8:1 (84 graduate students to 22 faculty) in 2013 appears to be very good. Students appear to receive very good mentoring and advising based on the meeting with students. The student to faculty ratio may need to increase slightly to meet stated departmental goals (100 PhD students + 50 MS to 34 faculty). This would increase the ratio to 4 to 5 students: 1 faculty member.

V. Facilities and Resources

Please evaluate the following by marking an X in one of the blanks for each item:

Facilities
___ Excellent   ___ Very Good   ___ Good   _X_ Needs Improvement
Facility Support Resources
___ Excellent     ___ Very Good     ___ Good     X Needs Improvement

Financial Resources
___ Excellent     ___ Very Good     ___ Good     X Needs Improvement

Staff Resources
___ Excellent     X Very Good     ___ Good     ___ Needs Improvement

Please comment on the positive components and suggested areas of improvement

The department has adequate space in terms of square footage of laboratories. Unfortunately much of the laboratory space is in need of major renovations to continue to be functional. The addition of lab spaces being renovated for Dr. Reible will partially help the environmental and water resources faculty, but facilities for the structures, geotechnical and transportation faculty as well as the existing environmental engineering and water resources labs need to be updated. Issues observed in the environmental/water resources labs included: a lack of storage space, which can lead to safety concerns, very old benchtops, insufficient bench space and sample prep spaces and fume hoods in need of replacement. On the ‘dry side’ (structures, geotechnical and transportation), many of these same issues appeared to exist.

The technicians in the department are excellent and showed a strong desire to support graduate and undergraduate education. They were also very cognizant of laboratory safety issues and are proactive about ensuring a safe laboratory environment. They had a very positive attitude and are essential to the research productivity of the department. One concern related to this is that the water resources lab technician is funded from the water resources center, and if that funding source is not available, the department would need to pick up this salary. The insecurity of this funding situation is the reason staff resources are marked as very good instead of excellent.

There appear to be adequate spaces for graduate student offices and computers are provided to all students.

Another concern is the lack of funds available to replace equipment for either graduate teaching or research. The only current source of funding for equipment appears to be faculty start-up and research grants. It is very difficult if not impossible to request significant resources for routinely-used equipment on extramurally funded grants. Routinely-used equipment is also very hard to secure via external equipment funding mechanisms like the NSF MRI program. The department and college are encouraged to identify funding sources for routine equipment upgrades for graduate research and education. Some of this equipment can also be used for undergraduate education, which may open up alternative funding options within the university or college.

VI. Overall Ranking

Please provide summative conclusions based on the overall review.

Overall, I found that the CEE department at TTU is on the right track with respect to both graduate education and research. The goals to grow the department in terms of faculty, external dollars and students are credible. The faculty are productive in all areas of research, teaching and service and the greatest resource in the department is their
excellent graduate student population. The main threats the department currently faces in expanding their graduate program and improving the quality of the program are the limitations in graduate course delivery due to course size limitations and pressures to offer undergraduate service courses to other departments; the lack of certainty associated with having an interim chair and the slow pace of faculty hiring; and the need to upgrade laboratory facilities for graduate education and research.

**Please provide summative recommendations based on the overall review.**

As described above, the primary recommendations stemming from this review are (not described in any particular order):

- Submission of more extramural proposals. Currently, the department submits approximately 2.5 proposals per T/TT faculty member. The number of extramural proposals should be increased to the extent possible (3-5 per year).
- Recruitment of 150 hr MS students. The faculty in the department indicated that they have just developed curriculum for a 150 hr MS program in CIVE, similar to the existing ENVE BS/MS program. Advertising and recruiting for this program will allow them to retain their own undergraduates for a 1 year MS degree. Increasing the number of MS student is important to provide a student cohort for graduate courses and to increase overall graduate student enrollment.
- Increased emphasis on graduate student recruitment. The department did not appear to have a comprehensive graduate recruitment plan. They face some challenges in keeping their own undergraduates as they are recruited by other state schools such as UT and A&M. However, TTU can develop their own set of feeder schools by looking at other four-year colleges within the state or region. They are clearly already doing a very good job with recruiting and retaining students without undergraduate CIVE degrees as a number of the students we spoke with during the meeting did not have an undergraduate engineering degree. The department should identify feeder schools and recruit from those schools to help ensure a consistently high quality pool of applicants and continue their high level of support for students who need to take leveling classes prior to enrolling in graduate engineering courses.
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