The University of Georgia

University Council
Athens, Georgia 30602

November 21, 2008

UNIVERSITY CURRICULUM COMMITTEE – 2008-2009
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Dr. Rodney Mauricio (Sciences)
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Public Health – Dr. Phaedra S. Corso
Social Work - Dr. Patricia M. Reeves
Veterinary Medicine - Dr. K. Paige Carmichael
Graduate School - Dr. Malcolm R. Adams
Undergraduate Student Representative – Ms. Jamie Beggerly
Graduate Student Representative – Ms. Amrita Veliyath

Dear Colleagues:

The attached proposal to offer a major in Civil Engineering under the B.S.C.E. degree will be an agenda item for the December 5, 2008, Full University Curriculum Committee meeting.

Sincerely,

David E. Shipley, Chair
University Curriculum Committee

cc: Dr. Arnett C. Mace, Jr.
Professor Jere W. Morehead

The University of Georgia

Faculty of Engineering

November 24, 2008

Dr. Arnett Mace
Sr. Vice President for Academic
Affairs and Provost
Administration Building
Campus

Dear Dr. Mace:

The Faculty of Engineering has prepared the following proposals to establish three new engineering degree programs:

1. B.S. in Civil Engineering
2. B.S. in Electrical and Electronics Engineering
3. B.S. in Mechanical Engineering

The Engineering Council of the Faculty of Engineering has approved each of these proposals. The first two proposals have been reviewed by the Senate of the Franklin College of Arts and Sciences and by the Faculty Council of the College of Agricultural and Environmental Sciences. The dean of each of those colleges has verbally advised me that their respective faculty governance bodies had no objections and they will provide written confirmation which I will forward when received. The third proposal was prepared much later than the first two proposals and will be reviewed by those two colleges at the next available time. Letters from the respective deans regarding the outcome of those reviews will be forwarded when received.

I approve these three proposals and request that they be reviewed by the University Curriculum Committee. Please let me know if additional information is needed in this regard.

Sincerely,

E. Dale Threadgill, Director
Faculty of Engineering

Driftmier Engineering Center • Athens, Georgia 30602-4435 • (706) 542-1653 • Fax (706) 542-8806

The University of Georgia

Franklin College of Arts and Sciences
Office of the Dean

December 1, 2008

Dr. E. Dale Threadgill
Director, Faculty of Engineering
Driftmier Engineering Center
Campus Mail

Dear Dale,

The Franklin College of Arts and Sciences Faculty Senate reviewed the proposals for a Bachelor of Science in Electrical and Electronics Engineering and Bachelor of Science in Civil Engineering at the November 18, 2008 Faculty Senate meeting. The Faculty Senate voted unanimously to support these two proposals. The proposal for the Bachelor of Science in Mechanical Engineering did not reach the Senate in time to be reviewed. Given the strong support of the Franklin Faculty Senate in favor of the two initial proposals, I am confident of the Franklin College Faculty Senate's support for the third proposal for a Bachelor of Science in Mechanical Engineering.

The Franklin College of Arts and Sciences Dean's Office is pleased to provide this favorable assessment of the three proposed degree programs in engineering. Best wishes for your success in moving the proposals forward.

Sincerely,

Garnett S. Stokes
Dean

1785

The University of Georgia®

College of Agricultural and Environmental Sciences
Office of the Dean and Director

December 4, 2008

Dr. Dale Threadgill
Director, Faculty of Engineering
Driftmier Engineering Ctr.

Dear Dale:

I am writing this letter to express my strong support for three new majors:

- BS in Civil Engineering
- BS in Electrical and Electronics Engineering
- BS in Mechanical Engineering

As I have said a number of times, UGA will never be a top 10 public university without a major engineering program. More importantly, since engineering is that discipline which moves technologies into the real world, we are at a disadvantage in meeting our land grant mission. We have so many outstanding hard and soft sciences at UGA; engineering is critical to achieve implementation and practice of those technologies coming from Agriculture, Arts and Sciences and all other colleges that generate intellectual property and new ideas.

My only concern, as expressed to you as well as the Advisory Committee, is one of funding. Beginning new programs during times of difficult funding is problematic. As long as the new programs do not have a negative impact on existing programs in Biological and Agricultural Engineering and other majors within CAES, I remain fully supportive of the proposals as outlined. Indeed, a reduction in funding of our existing majors could jeopardize accreditation status of Biological and Agricultural Engineering majors. Redirection of funds will also jeopardize the viability of other majors in CAES and our ability to train graduates to meet the needs of agribusiness and environmental industries. We can not support new funding initiatives that impair our ability to support the larger CAES mission in teaching, research and service. Hence the availability of new appropriated funding is critical to our endorsement and to the success of these new majors.

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My endorsement is also based on the recommendation of our College Curriculum Committee. The full College Council met on December 4th and similarly endorsed the proposal with similar comments to that noted above.

Thank you for leading this program critical to the elevation of UGA on the international stage. I wish you much success.

Sincerely,

J. Scott Angle
Dean and Director

JSA/alc

cc: Dr. Josef Broder

University of Georgia

Formal Proposal

for

Bachelor of Science in Civil Engineering

Institution: University of Georgia **Date:** November 21, 2008

College/Unit: Faculty of Engineering

Name of the Proposed Program: Bachelor of Science in Civil Engineering

Degree: B.S.C.E. **Major:** Civil Engineering

Starting Date: Fall 2010

Prepared by the Faculty of Engineering:
Tom Lawrence, Faculty of Engineering, Biological and Agricultural Engineering
Sid Thompson, Faculty of Engineering, Biological and Agricultural Engineering (Chair)
John Schramski, Faculty of Engineering, Biological and Agricultural Engineering

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1. PROGRAM ABSTRACT

Provide in a one or two page abstract a summary of the proposed program. This section should be written in a manner suitable for presentation to the Board of Regents and should briefly state the objectives of the program, identify the needs which the program would meet, and include information related to costs, curriculum, faculty, facilities, desegregation impact, enrollment, etc.

At the beginning of this new century, the development of a Comprehensive Engineering Program was identified as one of the critical areas of the Strategic Plan for UGA. Progress has been made in this area with the strengthening of the existing engineering programs as well as the initiation of several new degree programs. Civil engineering, being one of the core engineering disciplines, will be another step in the process.

The proposed Civil Engineering degree program at UGA will supplement and complement the other existing engineering programs at UGA, in particular the environmental engineering and agricultural engineering programs. Civil engineering addresses the infrastructure needs of society and is becoming increasingly more interconnected and global in nature. Population growth and increasing environmental concerns all put pressure on the built environment we depend on. Not only are new facilities and structures needed, but we must also be able to take care of existing infrastructure that is in serious need of repair and rebuilding.

In Georgia, as reported by a *Washington Advisory Group commissioned by the Board of Regents* in 2002, nearly half of all engineering jobs in the state of Georgia are filled by graduates of out-of-state and foreign institutions. Civil engineering is a very desirable career path, with a projected annual production rate in Georgia of over 200 new jobs in the field. However, only 156 students graduated with a degree in Civil Engineering in the state during the last academic year, and typically about one-third of the engineering students are non-residents.

The UGA Faculty of Engineering is uniquely prepared to develop a Civil Engineering degree program that meets the expectations of the NAE report. Engineering graduates in the 21st Century must be technically competent and dedicated to the improvement of humankind. UGA is probably the only university among top ranked public research universities in the nation having the opportunity to design a brand new civil engineering degree program at the dawn of the 21st Century without having to restructure engineering departments or an existing college of engineering. The proposed Civil Engineering academic program will be organized to educate engineers for careers devoted to the integration of discoveries from multiple fields and take advantage of multiple disciplines available in the University's liberal arts environment. UGA, as one of the premier liberal arts institutions in the region, provides an enriching environment in this regard.

The University of Georgia offers a unique opportunity for the development of engineering in general, and Civil Engineering in particular, with complementary programs in Biological, Agricultural and Environmental Engineering; Ecology and Environmental Sciences; Environmental Design (including urban design and planning) and Environmental Health Sciences. The proposed Civil Engineering degree will provide students with a fundamentally sound engineering education within a strong liberal arts and sciences backdrop. Current University of Georgia faculty and academic resources will support many of the needs for the degree; however, 6 to 7 new faculty and eighteen new courses in the targeted Civil Engineering areas will be needed. Especially important to this program are UGA's strong programs in physical sciences, bio-sciences, bio-based applied sciences and engineering. The approach for building this degree proposal has been to leverage UGA resources and complement engineering programs of other institutions to meet Georgia's needs for practicing engineers. The new civil engineering program will bridge a wide variety of application domains especially for the future bio-based economy. The degree program will require approximately 12,000 sq. ft. of additional teaching laboratory space as well as the addition of appropriate support staff. This new B.S. degree is projected to have 200 majors in its fourth year.

The degree will include core requirements in humanities, languages, social sciences, mathematics, natural sciences (e.g., chemistry, biology, physics), engineering sciences (statics, fluid mechanics, materials), upper-level civil engineering courses (foundation design, concrete design, design of large steel structures, and others) and a capstone engineering design project which will provide a "hands-on" experience in designing for the real built environment problem. ABET (formerly the Accreditation Board for Engineering and Technology) is stressing the need to broaden and deepen the exposure of engineering graduates to more liberal arts topics. With its expanding role in engineering education, UGA will be among a limited number of universities providing engineering education in a liberal arts environment.

The addition of this degree program will require additional sections in existing engineering fundamental courses, and it is expected that the faculty members in this new program will be integrated with the existing programs in the Department of Biological and Agricultural Engineering and in the Faculty of Engineering to supplement the additional sections. In addition, some of the elective courses for this new degree will be developed in conjunction with other newly initiated and interrelated degree programs, particularly the Environmental Engineering degree program.

The University of Georgia has a very strong commitment to recruiting students from underrepresented groups. Under the leadership of President Michael Adams the University has made significant progress. This program will actively recruit students and faculty from the underrepresented groups and build partnerships with historically Black Colleges and Universities to advance this mission. UGA already has more than 50 percent women students who will be targeted for this degree program, especially for bio-based sustainable systems that are generally attractive to them.

2. OBJECTIVES OF THE PROGRAM

List the program objectives and indicate how they are related to the mission and strategic plan of the institution, as filed with the Office of the Vice Chancellor for Research and Planning.

The proposed Bachelor of Science in Civil Engineering is one of several engineering degree programs being developed in UGA's comprehensive engineering initiative, one of the university-level strategic initiatives in UGA's current strategic plan: "Strategic Institutional Initiative for the First Decade of the 21st Century." Civil Engineering is a fundamental engineering discipline essential to a comprehensive engineering program. The proposed program has the following specific objectives, which are to:

- Emphasize geotechnical, hydraulic, structural systems, infrastructure and urban planning while excluding programs in transportation engineering. Additional emphases in coastal and architectural engineering will be considered at a later date;
- Supplement and complement the other existing engineering programs at UGA, in particular the environmental engineering and agricultural engineering programs;
- Provide the capacity to educate the engineering professionals needed within this discipline in Georgia that is not currently being fulfilled;
- Provide a well-rounded engineering education experience to students by offering rigorous technical training balanced within a world-class liberal arts environment;
- Provide students the skills, understanding and exposure to address 21st century challenges, such as the need for sustainable design, global environmental concerns, an ever expanding population and materials scarcity;
- Increase the graduation rate in engineering at the University of Georgia;
- Increase USG's competitiveness for federal research funds by increasing the presence of engineering on the UGA campus;
- Serve the needs of local, regional and national employers; and
- Provide students with an education that contains exposure to and experience with actual problems and situations that practicing engineering professionals face in their careers.

The proposed degree will graduate students ready for successful careers as practicing engineers as well as entering graduate programs for advanced research degrees and will increase Georgia's enrollment capacity to meet needs of additional students seeking careers in engineering.

The University of Georgia is a land-grant and sea-grant university with state-wide commitments and responsibilities for higher education. It has a unique social contract with the citizens of Georgia to provide educational opportunities and conduct studies in engineering for improving the quality of life, while committing to extend knowledge and technology through its public service and outreach mission.

An important component of UGA's Strategic Plan for the first decade of the 21st Century was the creation of a new engineering unit with the characteristics that does not pursue a "boilerplate" model with pigeonholed departments, but rather implements an evolutionary approach which is primarily driven by and focused on meeting societal needs. In this approach, engineering programs should demonstrate two attributes: 1) the needs being addressed are real, and 2) the desired excellence for potential success is achievable.

The UGA Faculty of Engineering models this approach and was established on October 1, 2001, and in accordance with the Strategic Plan, new academic degrees have been added progressively to meet Georgia's needs in engineering education. This proposal for a Civil Engineering degree is also inspired by the same goals, and it not only meets UGA's Strategic Plan, but also serves USG Strategic Goals as follows:

USG Strategic Goal 1. Excellence in undergraduate engineering education is achieved by educating UGA engineers in a liberal arts environment, while simultaneously all UGA students will have an enhanced undergraduate experience as they will understand and interact with students in a profession who are likely to be a part of their life-long work environment.

USG Strategic Goal 2. The proposed BSCE degree will add enrollment capacity to meet the increasing enrollment demand in USG institutions, and it will fulfill the need for additional U.S.-educated engineers in Georgia as well as in the nation.

USG Strategic Goal 3. The BSCE graduates will be prepared as practicing engineers who will create technology and solutions that contribute to economic development. Graduates also will be ready for advanced graduate work leading to research careers. The graduates of this program will position Georgia to be more competitive globally.

USG Strategic Goal 4. By selecting the areas within civil engineering with great demand and not directly duplicating other engineering programs, the proposed degree will complement and create an environment for forging partnerships with the state's other education agencies.

UGA has an extensive network of partnerships with governmental agencies, private industries, businesses and USG institutions. This program will leverage these partnerships for enhancing the educational experiences of students and faculty.

3. JUSTIFICATION AND NEED FOR THE PROGRAM

a. Indicate the societal need for graduates prepared by this program. Describe the process used to reach these conclusions, the basis for estimating this need, and those factors that were considered in documenting the program need.

In the increasingly interconnected and global society of the 21st century, the world's built infrastructures will be subjected to greater pressures than in the past. Population increases, economic growth, environmental concerns, and new technologies will present unprecedented challenges for finding new and creative solutions that preserve, enhance, and construct society's built environment.

Broadly addressing society's future infrastructure, *The Vision for Civil Engineering in 2025* states that:

> "… shifting demographics and population growth continue to strain the overburdened infrastructure… In the developed world, infrastructure is aging and maintenance or replacement has not kept pace with deterioration. In the developing world, the need for new infrastructure outstrips society's ability to put it in place. Influenced by civil engineering leadership, people now better understand the crucial link between infrastructure and quality of life, which has caused a major public policy shift in favor of improved infrastructure maintenance and accelerated infrastructure growth." [The Summit on the Future of Civil Engineering—2025, June 21–22, 2006, American Society of Civil Engineering]

Societal needs in this area are increasing dramatically and the breadth of future activity offers one of the greatest opportunities for a personally motivating, financially rewarding, long-term profession where Civil Engineers with bachelor's degrees commanded an average starting salary in 2006 of $48,509 (National Association of Colleges and Employers).

One recent national estimate, a partnership of the American Society of Civil Engineers, U.S. Conference of Mayors and the American Public Works Association, valued the backlog of U.S. infrastructure needs at $1.6 trillion. Looking ahead, the increasing global population and its shift towards urban areas will require expanding demands for even the most basic infrastructure development where Civil Engineers alone currently represent 46% of the national engineering employment of all engineering specialties employed in these types of architectural, engineering, and related services. According to the U.S. Department of Labor's Bureau of Labor Statistics, Civil Engineers are expected to see national employment growth up to 17% through 2014 due in part

> "… to the increased emphasis on infrastructure security where more civil engineers will be needed to design and construct safe and higher capacity transportation, water supply, and pollution control systems, as well as large buildings and building complexes."

Fields which traditionally employ civil engineers are projected to grow through 2014 including, for example, professional, scientific and technical services (28.4%); water, sewage and other related utilities (21%); and trade, transportation, and other related utilities (10.3%) (U.S. Dept. of labor). Locally, Georgia's civil engineers operating in the architectural, engineering, and related services sector can expect to see 21% growth in their employment positions from 2004 through 2014 (Georgia Dept. of Labor).

Societal infrastructure problems are complex and opportunities for successful solutions will be greatest where diverse fields of study intersect leading to new technologies. The Association of American Colleges reports:

> "So many technical problems are now also social problems – or ethical, or political, or international problems – that some ability to deal with

> them as such is just part of the essential professional equipment of engineers." (Wiedenhoft, Ronal V., Liberal Arts & International Studies, Colorado School of Mines, Journal of Engineering Education, January 1999.)

Today, water availability, its quality, and its distribution in the state of Georgia are excellent examples of this complexity. State initiatives on water management with neighboring states are evidence that broad scale water and natural resource management strategies are highly complex and will require new technological advances. There is an increasing demand for civil engineers educated to develop solutions for infrastructure problems in a climate of growth with significant environmental pressures. Unlike the past, the ability to design new products, processes and systems for modern industries that prevent rather than control environmental problems will be in demand.

The 1998 Board of Regents report on Engineering Education in Georgia identified that fewer than two-thirds of Georgia high school graduates with over 1100 SAT scores who had declared engineering as their first choice for college enrolled in an engineering degree program in Georgia; over one-third went out of state for their higher education. In the following nine years while USG total enrollment increased from nearly 200,000 to 270,000 students, a nearly 33% increase, there was only a 15% increase in the number of new students admitted to engineering programs at USG institutions. Now USG is strategically preparing to expand its capacity by up to 40% to serve an additional 100,000 students by 2020. Additionally, the 1998 BOR report accurately projected a substantial increase in graduating high school students from 1998 through 2007 which has only exacerbated the situation. These trends suggest that as many as one-half of Georgia high school graduates interested in and qualified for an engineering degree either currently do not or soon will not have the opportunity to enroll in an engineering degree program at a USG institution. The dilemma for us on how to provide additional engineering educational opportunity for the increasing number of high school graduates and provide engineers for high-paying and high-impacting jobs in a technology-savvy future can be addressed by adding capacity at the University of Georgia for educating engineers. The proposed BSCE degree will greatly benefit Georgia high school graduates by providing them with the opportunity to obtain their engineering education in Georgia and also add to the number of individuals practicing engineering in Georgia's workforce in such promising areas as structural systems, infrastructure and urban planning.

The overall justification for graduates of an undergraduate Civil Engineering program is the need for engineers with the ability to deal with the increasingly complex dynamics between society's infrastructure and its environment, and the need for local solutions that can be integrated into state and regional growth management plans. At the University of Georgia, such a program is particularly justified in light of the University's rich liberal arts educational environment and the existing academic programs in environmental engineering, ecology, biological sciences, environmental design, health sciences, marine sciences, resource management and law. The University of Georgia is committed to providing an education that is a unique synthesis of these diverse disciplines.

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b. Indicate the student demand for the program in the region served by the institution. What evidence exists of this demand?

Georgia needs engineers and currently relies on in-migration from other states and other countries to fill nearly half of all engineering jobs in the state. As stated in the previous section, fewer than two-thirds of Georgia's 1998 high school graduates with over 1100 SAT scores who had declared engineering as their first choice for college enrolled in an engineering degree program in Georgia; over one-third went out of state for their higher education. In the following nine years while USG total enrollment increased from nearly 200,000 to 270,000 students, a nearly 33% increase, there was only a 15% increase in the number of new students admitted to engineering programs at USG institutions. Now USG is strategically preparing to expand its capacity by up to 40% to serve an additional 100,000 students by 2020. The recent and projected substantial increase in the number of Georgia high school graduates portends an even greater demand. These trends suggest that as many as one-half of Georgia high school graduates interested in and qualified for an engineering degree either currently do not or soon will not have the opportunity to enroll in an engineering degree program at a USG institution.

Nationwide, the U.S. Department of Labor, Bureau of Statistics, reported that civil engineers held about 256,000 jobs in 2006 and projected an 18% (46,000 jobs) increase in employment of civil engineers for the period of 2006-2016. Whereas, in the state of Georgia only 156 students (usually about one-third of these are enrolled as non-residents) graduated with a degree in civil engineering during the last academic year. Civil Engineering is specifically listed by the Georgia Department of Labor as one of Georgia's most desirable career paths with a current availability of over 200 annual job openings throughout Georgia. The availability of jobs both locally and nationally and the higher than average starting salaries will continue to drive high student demand for this area of engineering practice.

The University of Georgia's strengths as a comprehensive university and its extensive leadership in many issues affecting this state will provide a unique opportunity for students enrolled in the proposed degree program. They will have an opportunity to learn to integrate many different disciplines in ways that provide a proactive design for the built environment. With infrastructure solutions and regulations moving toward more comprehensive and holistic environmental/social standards, graduates will be in demand to practice under a new regulatory framework. The graduates of the proposed degree program will meet an important need in civil engineering services in this region. More importantly, the proposed degree program will provide yet another avenue for the growing number of Georgia students uniquely interested in the environmentally connected infrastructure to acquire an education that qualifies them for an increasingly meaningful career.

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c. Give any additional reasons that make the program desirable (for example, exceptional qualifications of the faculty, special facilities, etc.

The University of Georgia is the only public or private institution in the state of Georgia with programs of study in Biological Engineering, Agricultural Engineering, Environmental Engineering, Ecology, Environmental Sciences, Environmental Design (including urban design and planning), and Environmental Health Sciences. Additionally, UGA has growing programs in Biomedical and Health Sciences and Environmental Engineering. A Civil Engineering education integrated across these disciplines will spawn a novel civil engineer prepared to address and solve the difficult issues at the interface of society and its built environment fundamentally integrated in the greater ecosystem. The graduates of this proposed program will be prepared to develop new technologies that prevent rather than control environmental problems.

Currently the University of Georgia offers several environmental science related degrees in Environmental Engineering, Ecology, Environmental Health Sciences, Environmental Soil Science, Marine Science, Environmental Economics and Management and Forest Environmental Resources. All of these programs include coursework and research fundamentally focused on society's built infrastructure and its integration with the greater ecosystem. The ABET-accredited B.S. engineering degree programs in Biological Engineering and Agricultural Engineering, and the recently initiated B.S. degree program in Environmental Engineering, provide research and coursework in structures, urban systems, comprehensive water management, solid waste management, coastal and marine design, and sustainable design, to name only a few. The existing engineering facilities provide initial resources to launch this proposed engineering degree program. The academic setting of the University of Georgia is comprehensive of the geographic, social, environmental, and economic diversity within the State of Georgia, and represents a cross section of people that reflects diversity in cultures and disciplines.

The civil engineering degree will provide students with an education in engineering sciences, environmental sciences, liberal arts and engineering design, and prepare them to integrate knowledge for developing new technological solutions for the increasingly complex built environment and infrastructure problems. The graduates of the program will have career opportunities in structural engineering, geotechnical engineering, sustainable infrastructure design, architectural systems, water resources engineering, solid waste management, urban systems, and coastal systems.

The degree will include core requirements in humanities, languages, social sciences, mathematics, natural sciences (e.g., chemistry, biology, physics), engineering sciences (e.g., statics, fluid mechanics, strength of materials); upper-level civil engineering courses (e.g., foundation design, concrete design, design of large steel structures, and others); and a capstone engineering design project which will provide a "hands-on" experience in designing for a real built environment problem.

The addition of the B.S. in Civil Engineering degree program will make UGA a more effective public university. The civil engineering students and faculty will be able to contribute to programs in mathematics and the sciences in areas such as bioenergy, environmental design and environmental health sciences and the research work of these areas will be more readily transformed for use in the development of the state.

ABET (formerly the Accreditation Board for Engineering and Technology) is stressing the need to broaden and deepen the exposure of engineering graduates to more liberal arts topics. With its expanding role in engineering education, UGA will be among a limited number of universities providing engineering education in a liberal arts environment.

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d. Include reports of advisory committees and supporting statements of consultants, if available.

Georgia needs more engineers. While Georgia's growth and stature among states rose in the decade of the 90's (for example, 4^{th} in population growth, 8^{th} in venture capital investment, 8^{th} in start-up companies), it ranked 40^{th} in the nation in percentage of engineers and scientists in its workforce [From the 2000 Report of the U.S. Council of Competitiveness]. According to a February 2002 report by the Washington Advisory Group [Commissioned by the USG Board of Regents], Georgia relies on in-migration from other states and other countries to fill nearly half of all engineering jobs in the state.

There is also a need to increase the state of Georgia's capacity for engineering education. Another USG-commissioned report on engineering education needs, published in 1998, presented data showing that fewer than two-thirds of the qualified Georgia high school graduates (SAT scores of 1100 to 1600) with an expressed interest in majoring in engineering were enrolled in engineering in Georgia's institutions of higher education. The same report projected a 25% increase in the number of Georgia high school graduates from 1998 to 2007. The Georgia Financial Commission recognized the need for Georgia to graduate more engineers when it created, under the HOPE Scholarship Program, a "Scholarship for Engineering Education (SEE)" with the objective "To provide service-cancelable loans to Georgia residents who are engineering students at private accredited engineering universities in Georgia and retain them as engineers in the State."

The University of Georgia organized an engineering symposium, *Towards 2010: Faculty of Engineering at UGA*, held in April 2002. Prominent invited leaders from industry, business, agency and academia expressed a need for engineers in the development of the state. They identified three major opportunity areas: bio-based products and industries, information systems, and management of the environment and natural resources. They observed that the UGA Faculty of Engineering is uniquely structured to develop engineering research, outreach and academic programs in ways that foster advances at the interfaces of disciplines. This degree program is proposed to be an integral contribution to the management of the built environment and how it interacts with the natural environment. This program will add new dimensions to the University of Georgia's existing programs, enhance the quest for use-inspired research and reduce the time between knowledge discovery and use.

e. List all public and private institutions in the state offering similar programs. If no such program exists, so indicate.

Georgia Institute of Technology currently offers a Bachelor of Science in Civil Engineering from their School of Civil & Environmental Engineering. This degree can be obtained through their Atlanta and Savannah campuses. They awarded 156 BSCE degrees in 2006. There are no other public or private institutions in the State of Georgia offering a B.S. in Civil Engineering.

The Civil Engineering program at Georgia Tech provides educational and research opportunities in five disciplines of Civil Engineering, including structural engineering, mechanics and materials, geo-systems engineering, transportation systems engineering, environmental fluid mechanics and water resources and environmental engineering. In contrast, the primary focus of the UGA Civil Engineering degree program is on geotechnical, hydraulic, structural systems, infrastructure and urban planning. Courses offered in the UGA Civil Engineering program build around the needs of these focus areas.

4. PROCEDURE USED TO DEVELOP THE PROGRAM

Describe the process by which the institution developed the proposed program.

This proposal for a new degree is a result of a deliberate process initiated in 1999 in response to the University's Strategic Plan for the First Decade of the 21st Century.

In February 2000, the Department of Biological and Agricultural Engineering submitted a position paper prepared by Professors Brahm Verma and Dale Threadgill entitled "Comprehensive Engineering at UGA" to the Vice President for Strategic Planning with the request that Engineering be included as a Strategic Issue in the University's Strategic Plan. The "Comprehensive Engineering at UGA" paper identified areas of engineering opportunity and a strategic approach to build the institution's capacity. It demonstrated that advancing Engineering will add new dimensions to the University in related fields for meeting the needs of the state of Georgia. The University Strategic Planning Advisory Board included Engineering as a new Strategic Institutional Initiative and it is now a part of the Plan for the first decade of the millennium.

In April 2001, a Symposium, *Towards 2010: Comprehensive Engineering at UGA*, was held to engage UGA faculty from across campus in a daylong effort to identify engineering initiatives of significance and to articulate ways in which Comprehensive Engineering will strengthen a range of the University of Georgia programs. More than 100 faculty members from 9 Colleges/Schools participated in the Symposium. Thirteen faculty members highlighted engineering opportunities in research, graduate and undergraduate studies and outreach. Their perspectives represented the disciplines of physics, chemistry, pharmacy and health sciences, biochemistry and molecular biology, veterinary sciences, computer science, mathematics, ecology, marine sciences, environmental sciences, textile science, food science, business and engineering. They identified the important dimensions in which the University's current programs are unable to grow due to lack of Comprehensive Engineering at UGA and shared experiences on how the University has been handicapped in capitalizing on opportunities for meeting the needs of the state of Georgia. At that time (i.e., in 2001) the UGA faculty identified the following nine engineering program areas as high priority needs and opportunities: nanotechnology, sensors and controls, ecological/environmental engineering, pharmaceutical engineering, information/computer systems engineering, marine engineering, metabolic engineering, engineering management and bioprocess/biochemical engineering. A task committee with membership including UGA faculty from diverse but related disciplines was formed for each of these program areas and charged with further developing the needs and opportunities. Another task committee was charged with proposing ideas to create an innovative approach for organizing Comprehensive Engineering at UGA. The concept of a Faculty of Engineering originally proposed in the "Comprehensive Engineering at UGA" document was recommended. The UGA Faculty of Engineering was formally established on October 1, 2001, with Dr. E. Dale Threadgill appointed as its Director.

To gain insight from state and national leaders about building programs in the UGA Faculty of Engineering, a second daylong Symposium, *Towards 2010: Faculty of Engineering at UGA*, was organized with invited leaders from industry, business, government agencies and academia participating. The Symposium, held in April 2002, was open to the UGA faculty. More than 100 individuals attended the Symposium. UGA President Michael Adams in his opening remarks explained the needs for engineers in the state of Georgia. He cited a February 2002 report, prepared by a Washington Advisory Group commissioned by the Board of Regents, conclusively stating that Georgia relies on in-migration from other states and other countries to fill nearly half of all engineering jobs in the state. President Adams further stated, "UGA has a social and charter responsibility as Georgia's flagship institution to provide innovative services for the economic development of the state. Engineering is a key linchpin in this effort." Dean Kristina Johnson from Duke University stated that a "modern research university is incomplete and obsolete without comprehensive engineering." Discussions during breakout sessions reinforced the need for engineering in the program areas identified at the 2001 Symposium as well as identified new opportunities with biomedical engineering.

At the conclusion of the April 2002 Symposium, the UGA Faculty of Engineering established several task groups and charged them with developing academic programs and other recommendations for meeting the identified engineering needs.

In the continuing development of the Faculty of Engineering and Comprehensive Engineering at UGA, the need for civil engineering at UGA was recognized in 2007 by UGA faculty and administrators, and a committee was formed and charged with the task to develop a curriculum and proposal for the B.S. degree in Civil Engineering.

A Civil Engineering Degree Program Proposal Committee comprised of faculty with a diverse industry and academic background and input from the greater engineering faculty developed this proposal. Programs from other institutions were studied to determine possible course content and curriculum. The philosophy of engineering on the UGA campus was also taken into account. The proposal was prepared with the support of the UGA engineering faculty and the faculty in related UGA Colleges/Schools. The proposal was then submitted for approval following the established procedures of the University of Georgia and the Board of Regents for approving new degree proposals.

5. CURRICULUM

List the entire course of study required and recommended to complete this degree program. Give a sample program of study that might be followed by a representative student. Indicate also the existing courses and any new courses that will be added. Append a course description for existing courses as well as new courses that will be added.

Two different example curriculums are shown on the following pages. The first curriculum (Example 1) allows students to select 11 different engineering electives during their junior and senior years. In this model the student could potentially specialize in only one or two areas of Civil Engineering. The second curriculum (Example 2) allows students to select six different engineering electives while requiring courses in each area of study within the scope of this proposal (geotechnical, structures, infrastructure engineering, and hydraulics). Example 2 is consistent with the scope of other UGA engineering degrees in that it educates the student in a broad manner in all areas of the program while still allowing some specialization based on the student’s interests. This curriculum also draws on courses taught currently in other engineering degree programs at the University of Georgia.

CURRICULUM – BACHELOR OF SCIENCE IN CIVIL ENGINEERING (BSCE)
Proposed Program Requirements

BSCE GENERAL EDUCATION CURRICULUM REQUIREMENTS

Course #	Course Name	Hours
I. Foundation Courses		
	(9 hours with a minimum grade of "C" in each course)	
ENGL 1101	English Composition I	3
ENGL 1102	English Composition II	3
MATH 2250	Calculus I for Science and Engineering	4
II. Sciences		
Physical Sciences (3-4 hrs.)		
CHEM 1211	Freshmen Chemistry I	3
CHEM 1211L	Freshmen Chemistry Lab. I	1
Life Sciences (3-4 hrs.)		
BIOL 1104	Organismal Biology	3
III. Quantitative Reasoning (3-4 hrs.)		
MATH 2260	Calculus II for Science and Engineering	4
IV. World Languages and Culture, Humanities and the Arts: (12 hrs.)		
World Language and Culture (9 hrs.)		
World Language and Culture		3
World Language and Culture		3
World Language and Culture		3
Humanities and the Arts (3 hrs.)		
Take either a CMLT or ENGL course from the approved list		3
V. Social Sciences (9 hrs.)		
Social Science taken from the approved list of courses		3
Social Science taken from the approved list of courses		3
Social Science taken from the approved list of courses		3

Entrance Requirements

Grade of "C" or better in each of the following courses and a 2.5 GPA for this pool of courses: MATH 2250; MATH 2260; MATH 2500; MATH 2700; PHYS 1211-1211L; PHYS 1212-1212L; CHEM 1211, CHEM 1211L; BIOL 1104. Overall GPA 2.5.

Courses Related to the Major (19 hours)

PHYS 1211-1211L	Introductory Physics for Science and Engineering Students-Mechanics, Waves, Thermodynamics	4
PHYS 1212-1212L	Introductory Physics for Science and Engineering Students-Electricity and Magnetism, Optics, Modern Physics	4
MATH 2500	Multivariable Calculus	3
MATH 2700	Elementary Differential Equations	3
ENGR 1120	Engineering Graphics and Design	3
ENGR 1140	Computational Engineering Methods	2

Requirements in the Major (36 hours)

ENGR 2110	Engineering Decision Making	3
ENGR 2120	Engineering Statics	3
ENGR 2130	Dynamics	3
ENGR 2140	Strength of Materials	3
ENGR 2170	Electrical Circuits	3
ENGR 3140	Thermodynamics	2
ENGR 3150	Heat Transfer	3
ENGR 3160	Fluid Mechanics	3
ENGR 2920	Engineering Design Methodology	2
XXXX 2XXX	Engineering Project Management	2
XXXX 3XXX	Construction Estimating	2
ENGR 4230/6230	Sensors and Transducers	3
ENGR 4920	Engineering Design Project	4

Electives in the Major (33 hours)

Geotechnical:		
ENGR 3420	Introduction to Soil Mechanics	3
XXXX 4XXX	Design of Foundations	3
XXXX 4XXX	Ground Improvement Engineering	3
XXXX 4XXX	Fundamentals of Designing with Geosynthetic Materials	3
Hydraulics:		
ENGR 3410	Introduction to Natural Resource Engineering	3
ENVE 3460	Groundwater Hydrology for Engineers	3
ENGR 3440	Water Management	3
WASR 4500/6500	Quantitative Methods in Hydrology	3
XXXX 4XXX	Open Channel Hydraulics	3

<u>Infrastructure Engineering:</u>

ENGR 3120	Spatial Data Analysis	3
ENGR 4650/6650	Control of Structural Environments	3
ENGR(LAND) 4660/6660-4660L/6660L	Sustainable Building Design	3
ENVE 4240	Sustainable Energy Systems in a Global Economy	3
ENVE 4620	Sustainable Design in Urban Systems	3
ENVE 4720	Urban Infrastructure, Planning and Dev.	3
XXXX 4XXX	Life Cycle Analysis	3
XXXX 4XXX	Building Information Modeling (BIM)	3
XXXX 4XXX	Commercial Building Systems	3
ENVE 4710	GIS for Urban Engineering, Planning and Development	3
XXXX 4XXX	Construction Estimating	3

<u>Structures:</u>

ENGR 3610	Structural Design	3
ENGR 4350/6350	Introduction to Finite Element Analysis	3
ENGR 4610	Design of Light Steel Structures	3
ENGR 4630	Engineering Design of Residential Structures	3
XXXX 4XXX	Structural Design of High-Rise Bldgs.	3
XXXX 4XXX	Design of Bridges	3
XXXX 4XXX	Reinforced Concrete Design	3
XXXX 4XXX	Cold-Formed Steel Design	3
XXXX 4XXX	Timber Design	3
XXXX 4XXX	Masonry Design	3
XXXX 4XXX	Pre-stressed Concrete Design	3
XXXX 4XXX	Matrix Structural Analysis	3

The following distribution of hours will require 130 hours for completing the degree requirements:

Foundation Courses	10 hours	
Sciences:		
Physical Science	4 hours	
Life Science	3 hours	
Quantitative Reasoning	4 hours	
World Languages and Culture, Humanities and the Arts		
World Languages and Culture	9 hours	
Humanities and the Arts	3 hours	
Social Sciences	9 hours	
Total GENERAL EDUCATION Hours		42 hours
Courses Related to the Major		19 hours
Requirements in the Major		36 hours
Elective in the Major		33 hours
TOTAL FOR THE DEGREE		130 hours

New Undergraduate Courses for B.S. in Civil Engineering

Course Name:	Proposed Credit Hours
Engineering Project Management	2
Open Channel Hydraulics	3
Structural Design of High-Rise Buildings	3
Life Cycle Analysis	3
Design of Bridges	3
Building Information Modeling (BIM)	3
Commercial Building Systems	3
Reinforced Concrete Design	3
Cold-Formed Steel Design	3
Timber Design	3
Masonry Design	3
Pre-stressed Concrete Design	3
Design of Foundations	3
Ground Improvement Engineering	3
Fundamentals Of Designing with Geo-synthetic Materials	3
Matrix Structural Analysis	3
Construction Estimating	2
Construction Planning and Scheduling	3

A detailed description of each course is shown in Appendix A.

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Civil Engineering Curriculum (Example #1) – 130 Semester Hours

1ST Year– 33 hours

ENGR 1120 - Engr. Graphics & Design	3	ENGR 2110 – Engr. Decision Making	3
BIOL 1104 – Organismal Biology	3	Social Science Elective	3
MATH 2250– Calculus I for Sci. & Eng.	4	PHYS 1211-1211L – Intro. Physics	4
ENGL 1101 – English Comp. I	3	MATH 2260–Calculus II for Sci. & Eng.	4
ENGR 1140 – Comp. Engr. Methods	2	ENGL 1102 – English Comp. II	3
	15		17

2nd Year– 32 hours

CHEM 1211 & CHEM 1211L Chem. I	4	ENGR 2140 – Strength of Materials	3
ENGR 2120 - Engineering Statics	3	ENGR 2170 – Electrical Circuits	3
Humanities and the Arts	3	ENGR 2920–Eng. Design Methodology	2
MATH 2500 – Multivariable Calculus	3	ENGR 3140 – Thermodynamics	2
PHYS 1212-1212L – Intro. Physics	4	ENGR 3160 – Fluid Mechanics	3
	17	MATH 2700 – Elem. Differential Equat.	3
			16

3rd Year – 34 hours

ENGR 2130 – Dynamics	3	XXXX XXXX – Engineering Elective	3
ENGR 3150 – Heat Transfer	3	XXXX XXXX – Engineering Elective	3
ENGR 4230/6230–Sensors & Transduc.	3	XXXX XXXX – Engineering Elective	3

XXXX XXXX – Engr. Project Manage.	2	XXXX 4XXX - Construction Estimating	2
Social Science Elective	3	World Language and Culture	3
World Language and Culture	3	World Language and Culture	3
	17		17

4th Year – 31 hours

XXXX XXXX - Engineering Elective	3	XXXX XXXX - Engineering Elective	3
XXXX XXXX - Engineering Elective	3	XXXX XXXX – Engineering Elective	3
XXXX XXXX – Engineering Elective	3	XXXX XXXX – Engineering Elective	3
XXXX XXXX – Engineering Elective	3	XXXX XXXX – Engineering Elective	3
Social Science Elective	3	ENGR 4920 – Engineering Design Proj.	4
	15		16

Electives in the Major (33 hours)

Geotechnical:		
ENGR 3420	Introduction to Soil Mechanics	3
XXXX 4XXX	Design of Foundations	3
XXXX 4XXX	Ground Improvement Engineering	3
XXXX 4XXX	Fund. Of Designing with Geosynthetic Materials	3
Hydraulics:		
ENGR 3410	Intro. to Natural Resource Engr.	3
ENVE 3460	Groundwater Hydrology for Engr.	3
ENGR 3440	Water Management	3
WASR 4500/6500	Quantitative Methods in Hydrology	3
XXXX 4XXX	Open Channel Hydraulics	3
ENVE 4710	GIS for Urban Engineering, Planning and Development	3
XXXX 4XXX	Construction Planning and Scheduling	3
Infrastructure Engineering:		
ENGR 3120	Spatial Data Analysis	3
ENGR 4650/6650	Control of Structural Environments	3
ENGR(LAND) 4660/6660-4660L/6660L	Sustainable Building Design	3
ENVE 4240	Sustainable Energy Systems in a Global Economy	3
ENVE 4620	Sustainable Design in Urban Systems	3
ENVE 4720	Urban Infrastructure, Planning and Dev.	3
XXXX 4XXX	Life Cycle Analysis	3
XXXX 4XXX	Building Information Modeling (BIM)	3
XXXX 4XXX	Commercial Building Systems	3
Structures:		
ENGR 3610	Structural Design	3
ENGR 4350/6350	Intro. to Finite Element Analysis	3
ENGR 4610	Design of Light Steel Structures	3
ENGR 4630	Engineering Design of Residential Structures	3
XXXX 4XXX	Structural Design of High-Rise Bldgs.	3
XXXX 4XXX	Design of Bridges	3
XXXX 4XXX	Reinforced Concrete Design	3
XXXX 4XXX	Cold-Formed Steel Design	3
XXXX 4XXX	Timber Design	3
XXXX 4XXX	Masonry Design	3
XXXX 4XXX	Pre-stressed Concrete Design	3

DRAFT
Civil Engineering Curriculum (Example #2) – 130 Semester Hours

1st Year – 33 hours

ENGR 1120 - Engr. Graphics & Design	3	ENGR 2110 – Engr. Decision Making	3
BIOL 1104 – Organismal Biology	3	Social Science Elective	3
MATH 2250–Calculus I for Sci. & Eng.	4	PHYS 1211-1211L – Intro. Physics	4
ENGL 1101 – English Comp. I	3	MATH 2260– Calculus II for Sci. & Eng.	4
ENGR 1140 – Comp. Engr. Methods	2	ENGL 1102 – English Comp. II	3
	15		17

2nd Year – 32 hours

CHEM 1211 & CHEM 1211L – Chem. I	4	ENGR 2140 – Strength of Materials	3
ENGR 2120 - Engineering Statics	3	ENGR 2170 – Electrical Circuits	3
Humanities and the Arts	3	ENGR 2920–Engr. Design Methodology	2
MATH 2500 – Multivariable Calculus	3	ENGR 3140 – Thermodynamics	2
PHYS 1212-1212L – Intro. Physics	4	ENGR 3160 – Fluid Mechanics	3
	17	MATH 2700 – Elem. Differential Equat.	3
			16

3rd Year – 34 hours

ENGR 2130 – Dynamics	3	ENGR 3120 – Spatial Data Analysis	3
ENGR 3150 – Heat Transfer	3	ENGR 3420 – Intro. to Soil Mechanics	3
ENGR 3410 – Intro. to Nat. Res. Engr.	3	ENGR 4650/6650–Control of Struc. Env.	3
ENGR 3610 – Structural Design	3	XXXX XXXX – Construction Estimating	2
XXXX XXXX – Engr. Project Manage.	2	World Language and Culture	3
Social Science Elective	3	World Language and Culture	3
	17		17

4th Year – 31 hours

ENGR 4230/6230–Sensors & Transduc.	3	XXXX XXXX - Engineering Elective	3
XXXX XXXX - Engineering Elective	3	XXXX XXXX – Engineering Elective	3
XXXX XXXX – Engineering Elective	3	XXXX XXXX – Engineering Elective	3
World Language and Culture	3	XXXX XXXX – Engineering Elective	3
Social Science Elective	3	ENGR 4920 – Engineering Design Proj.	4
	15		16

<u>Requirements in the Major</u> (37 hours)

ENGR 1120	Engineering Graphics	3
ENGR 2110	Engineering Decision Making	3
ENGR 2120	Engineering Statics	3
ENGR 2130	Dynamics	3
ENGR 2140	Strength of Materials	3
ENGR 2170	Electrical Circuits	3
ENGR 3140	Thermodynamics	2
ENGR 3150	Heat Transfer	3
ENGR 3160	Fluid Mechanics	3
ENGR 2920	Engineering Design Methodology	2
XXXX 2XXX	Engineering Project Management	2
ENGR 4230/6230	Sensors and Transducers	3
ENGR 4920	Engineering Design Project	4

Advanced Engineering Courses:

The following five courses are required in the major:

ENGR 3120	Spatial Data Analysis	3
ENGR 3410	Intro. to Natural Resource Engr.	3
ENGR 3420	Introduction to Soil Mechanics	3
ENGR 3610	Structural Design	3
ENGR 4650/6650	Control of Struc. Environments	3

Choose 6 Courses from the Following List (18 hours)
Choose 18 hours consistent with a declaration of interest in geotechnical, hydraulics, structures, or infrastructure engineering.

<u>Geotechnical:</u>

XXXX 4XXX	Design of Foundations	3
XXXX 4XXX	Ground Improvement Engineering	3
XXXX 4XXX	Fund. Of Designing with Geosynthetic Materials	3

<u>Hydraulics:</u>

ENVE 3460	Groundwater Hydrology for Engineers	3
ENGR 3440	Water Management	3
WASR 4500/6500	Quantitative Methods in Hydrology	3
XXXX 4XXX	Open Channel Hydraulics	3

<u>Infrastructure Engineering:</u>

ENGR(LAND) 4660/6660-4660L/6660L	Sustainable Building Design	3
ENVE 4240	Sustainable Energy Systems in a Global Economy	3
ENVE 4620	Sustainable Design in Urban Systems	3
ENVE 4720	Urban Infrastructure, Planning and Dev.	3
ENVE 4710	GIS for Urban Engineering, Planning and Development	3
XXXX 4XXX	Construction Planning and Scheduling	3
XXXX 4XXX	Life Cycle Analysis	3
XXXX 4XXX	Building Information Modeling (BIM)	3
XXXX 4XXX	Commercial Building Systems	3

<u>Structures:</u>

ENGR 4350/6350	Introduction to Finite Element Analysis	3
ENGR 4610	Design of Light Steel Structures	3
ENGR 4630	Engineering Design of Residential Structures	3
XXXX 4XXX	Structural Design of High-Rise Bldgs.	3
XXXX 4XXX	Design of Bridges	3
XXXX 4XXX	Reinforced Concrete Design	3
XXXX 4XXX	Cold-Formed Steel Design	3
XXXX 4XXX	Timber Design	3
XXXX 4XXX	Masonry Design	3
XXXX 4XXX	Pre-stressed Concrete Design	3
XXXX 4XXX	Matrix Structural Analysis	3

6. INVENTORY OF FACULTY DIRECTLY INVOLVED

The University of Georgia offers ABET-accredited undergraduate degrees. All required courses in arts and sciences are already available from the UGA Franklin College of Arts and Sciences. Nine engineering faculty members currently offer all core engineering science courses required for this degree program. The need for additional faculty is presented in Section 15.

The faculty who will be directly involved with the proposed degree program are listed below. Additional data on these faculty is provided in Appendix B.

Dr. Sidney Thompson, Faculty of Engineering, Biol. & Agri. Engineering Dept.

Dr. Ernest W. Tollner, Faculty of Engineering, Biol. & Agri. Engineering Dept.

Dr. Tom Lawrence, Faculty of Engineering, Biol. & Agri. Engineering Dept.

Dr. John Schramski, Faculty of Engineering

Dr. E. Dale Threadgill, Faculty of Engineering, Biol. & Agri. Engr. Dept.

7. OUTSTANDING PROGRAMS OF THIS NATURE IN OTHER INSTITUTIONS

List three outstanding programs of this nature in the country, giving location and name of official responsible for each program. Indicate features that make these programs stand out.

Georgia Institute of Technology:

Dr. Joseph B. Hughes
School Chair and Professor
Civil and Environmental Engineering
Georgia Institute of Technology
790 Atlantic Drive, NW
Atlanta, GA. 30332-0355
joseph.hughes@ce.gatech.edu

The Civil Engineering program at Georgia Institute of Technology administers through the school of Civil Engineering three degrees; Civil Engineering, Environmental Engineering and Engineering Science and Mechanics. The School of Civil Engineering was ranked #6 among all departments and schools of Civil Engineering in the country by *U.S. News and World Report*. The Engineering programs at GIT are ranked #4 in the country by *U.S. News and World Report*.

Purdue University:

Dr. M. Kathy Banks
Bowen Engineering, Head and Professor of Civil Engineering
School of Civil Engineering
550 Stadium Mall Drive
Purdue University
West Lafayette, IN. 47907-2051
kbanks@purdue.edu

The School of Civil Engineering at Purdue University has 57 faculty and over 530 undergraduate and 300 graduate students. The School of Civil Engineering is ranked #7 in the country by *U.S. News and World Report* at the undergraduate level and #5 at the graduate level. The Engineering programs at Purdue University are ranked #9 in the Country by *U.S. News and World Report*. Undergraduate programs offer sub-disciplines of study of geomatics, construction engineering management, geotechnical engineering, hydraulics and hydrology, structural engineering, environmental engineering, materials engineering and transportation engineering.

Lehigh University:

Dr. Stephen Pessiki
Chairperson
Department of Civil and Environmental Engineering
201 Fritz Lab
Lehigh University
Bethlehem, PA 18015

The department of Civil and Environmental Engineering at Lehigh University has 17 faculty members and 177 undergraduates. The department of Civil Engineering is ranked #26 in the country by U.S. News and World Report. The department of Civil Engineering has world-class experimental facilities in Advanced Technology for Large Structural Systems and a NSF supported facilities in Network for Earthquake Engineering Simulation. Students in this program can choose technical electives in structural engineering, environmental engineering, hydraulic engineering and geotechnical engineering.

8. INVENTORY OF PERTINENT LIBRARY RESOURCES

Indicate in number of volumes and periodicals, available library resources (including basic reference, bibliographic, and monographic works as well as major journal and serial sets) which are pertinent to the proposed program. What additional library support must be added to support the program?

The University of Georgia Library has several campus units. It has a comprehensive collection in arts, sciences and professional subjects and has an archival section that holds special historical documents. The Library has been a member of the Association of Research Libraries, a nonprofit organization of 122 of the largest research libraries in the U. S. and Canada, since 1967. In 2006, UGA was ranked 32nd in the total number of volumes, 38th in the total library material and 9th in total number of government documents owned.

UGA Library is the largest in the state with over 4.4 million volumes. On-line access to full text journals and serials is available both through a consortium of UGA, Emory, Georgia Tech, Georgia State and Medical College of Georgia, and directly to the University of Georgia libraries. In addition, UGA is a leader nationally in offering electronic access to a wide range of electronic resources, including journal articles in full text. The statewide GALILEO system provides electronic access to hundreds of databases, including

Chemical Abstracts, Engineering Index, Bioengineering Abstracts, Current Contents, *etc.* The University subscribes electronically to over 1000 Elsevier titles and to all titles published by Academic Press, Marcel Dekker, Spring Verlag, and Wiley Interscience.

The University Libraries have excellent print and electronic resources, particularly in chemistry, biological sciences, physics, mathematics and computer sciences, ecology and environmental sciences, agricultural sciences and earth sciences. The University of Georgia Science Library would provide the primary resource and support for the proposed program. Some relevant Science Library inventory and operational information is listed below.

a) Total volumes - 750,000 and its catalog is available over the Internet.
b) Volumes pertaining to the engineering and technology – nearly 100,000 and materials accessible via the Internet.

Generally, basic texts and references are available; however, some expansion will be needed as described in the following section.

State of Faculty Instructional Support and Additional Support Needs

State of collections in engineering sciences for the proposed degree programs is as follows:

• Reference Collection	Adequate, but update will be required
• General Book Collection	Additional book on engineering will be needed
• Periodicals, current	Additional engineering periodical will be needed
• Serials	Adequate
• Documents	Adequate

Projection

The Science Library has made steady progress in upgrading technical holdings. With modest designated funding increases, the library should provide good support for the proposed program. Ongoing improvement in the science library holdings will complement the engineering resources.

Additional Information on Library Resources

The Science Library provides reference help, interlibrary loan, circulation and collection development. It has 26 full-time staff, including 7 librarians. It has about 750 seating capacity and is open 107.5 hours per week.

The University of Georgia Libraries' fiscal year Total Expenditures show a steady growth.

FY2006: $23,014,039
FY2000: $20,083,453
FY1997: $17,333,876

Georgia Institute of Technology library would also be available to supplement the University's resources in engineering.

9. FACILITIES

Describe the facilities available for the program. What new facilities and equipment are required?

The University of Georgia has extensive facilities available for the proposed degree program. The following is a selected list of facilities most related to the proposed program and gives the range and quality of facilities available for both undergraduate and graduate engineering education.

Analytical Laboratory – This laboratory provides analytical support for general ecological engineering teaching and research projects. Major pieces of equipment include: fluorometer, liquid chromatograph (HPLC), gas chromatograph (GC), UV/vis spectrophotometer and GC-mass spectrometer (GC-MS).

Applied Electrostatics Laboratory – Specialized high-voltage and low-current instrumentation make this laboratory unique nationally within the field of electrostatics instruction and research for agricultural and biological applications. Other major equipment items include electric-discharge generators of ozone and UV-based monitors for investigating ozone's beneficial usages at the bench-top, pilot-plant and field-scales.

Bioassessment Laboratory – Identification and characterization of benthic macroinvertebrates to support the watershed assessment research program. This laboratory is equipped with superb sampling equipment, D-frame and kick nets, and high resolution light microscopes.

Biochemical Engineering Laboratory – This laboratory is equipped to conduct research and teaching projects in general biochemical engineering which require facilities to culture and study microorganisms, plants, and mammalian cells and to analyze metabolites and purify and characterize enzymes. For the large-scale cultivation of microorganisms, we also have access to the University's fermentation plant. Molecular biology techniques are also routinely used in this laboratory. Major equipment items include: refrigerated circulators, ultra-low temperature freezer, biological safety and laminar flow hoods, incubators/shakers, bench-top fermentors, an anaerobic fermentor and carbon dioxide incubator, high speed centrifuges, ultra-centrifuges, multiple electrophoresis systems for nucleic acids and proteins, and extensive ultrafiltration and column chromatography equipment.

Biomechanics Laboratory – Two facilities exist for biomechanical research. Basic mechanical properties of tissue can be determined by material testing machines (Instron 4201 and Vetrogyne VT 1000) and use of vibration analysis equipment. Tensile, compression, bending and torsional tests as well as cyclic loading tests can be used to calculate the strength and loading responses of various materials. A second lab houses equipment for motion analysis, ground reaction forces and EMG data for gait analysis. Software allows determination of load and moments that are in place on various bodily joints.

Biosensor and Biophysics Laboratory – This laboratory is equipped to perform intracellular and patch clamp recording studies (measurement of very small electrical signals from living cells or cell membranes), phase-contrast/Hoffman modulation microscopic examinations, and cell/tissue culture. Major equipment items include: and Olympus inverted research microscope, patch and intracellular preamplifiers, micropipette puller, HiFi VHS PCM recorder, storage oscilloscope, beveler, image analysis equipment, carbon dioxide incubator and laminar hood.

Computer Laboratories – These areas serve as computer and graphics laboratories for all engineering disciplines. The rooms include 40 Pentium stations, plotters, laser printers and workstations. Software includes AutoCAD, WordPerfect, Microsoft Word, Excel, PowerPoint, Matlab, Mathcad, finite element analysis, ArcView and GIS analytical software. Computers and peripherals are part of a Local Area Network. A computer-aided design facility is available for the design and development of any equipment to carry out ecological engineering projects.

Environmental Physiology Laboratory – Two controlled environment rooms allow investigation of animal respiratory health problems resulting from airborne concentrations of particular and gases.

Enzyme Laboratory – State-of-the-art, computer-controlled instruments are used for the analysis, purification, characterization, and modeling of enzymes from traditional and recombinant organisms.

Fluids Laboratory – Pumping systems, pipe flow networks, and channel flow equipment for water flow in pipes, open channels and pumps, air flow, flow measurement and high pressure hydraulics are available for the study and analysis of fluid dynamics.

Geographic Information Systems (GIS) Laboratory – This laboratory contains workstations and PC’s, color plotters/printers/ high-quality scanners and a Calcomp digitizer to analyze spatial data. SPANS, Arc/Info, ArcView and ERDAS software packages are used in many applications to environmental engineering.

Processing Systems Laboratory – The laboratory houses a supercritical extraction unit for examining solvent extraction and high pressure reaction processes, differential scanning calorimeter and thermo-gravimetric analysis systems for measuring physical and thermal properties and computer vision for process evaluation and control. The laboratory also contains a Szego mill, process centrifuge, a reverse osmosis/ultrafiltration pilot unit, a vibrating separator, a batch solid/liquid extractor and a continuous paddle-wheel extractor.

Pulp-Bleaching Pilot Plant – A $1.9 million pilot plant extends bench-scale studies of non-chlorine wood pulp bleaching to 5 ton/day pre-commercial batch sizes. A 32 kg/kay ozone generator provides input of pressurized oxidant for bleaching in computer-controlled sequences with xylanase enzyme stages.

Office of the State Climatologist – Extensive weather and climate impact data and computer models are available for design to meet Georgia's environmental conditions.

Rainout Shelters – Both low and high rise rainout shelters provide isolated monitoring of plant growth under controlled water availability.

Research Park – Extensive facilities for research in irrigation and chemigation are available including solid set, linear travel, center pivot simulates for applications on land at the experimental station and adjacent farm sites. Subirrigation plot land has developed with computer monitored and controlled water levels and water quality sampling capabilities.

Systems Modeling Facilities – Numerous microcomputers are available for modeling many agricultural processes including plant root growth and postharvest systems.

Topographic Data Collection – Equipment for line-of-sight surveying is available for spatial data collection. Total stations and data collectors are state-of-the-art and provide the capabilities for rapid collection and field analysis of topographic data. These facilities are also used for physical habitat characterization in support of the watershed assessment research programs.

Water Quality Analysis and Modeling Laboratories – Facilities for analyzing water samples for physical, chemical and biological characteristics. Computer facilities are available for modeling water quality in watersheds, streams, and lakes. Facilities include a 4-channel Technicon Traacs 800 chemical autoanalyzer, an Ohmicron Enzyme Linked Immunosorbent Assay (ELISA) system for pesticide screening, liquid chromatography, and evaluation fields sites for groundwater quality testing.

Watershed Assessment – Extensive research programs combining bioassessments, physical habitat assessments, water quality analysis and hydrologic modeling. This laboratory offers workstations and PC's for use in GIS analysis and computer modeling.

The following additional facilities are needed to accommodate new courses and labs for undergraduate design and graduate research projects. The anticipated increase in student enrollment will require enhancing the capacity of some existing facilities.

<u>Unit Process Operation Laboratory</u>

The facility will be equipped with a large unit process operations and processes laboratory including constant temperature rooms. The lab will have the capability of analyzing growth and decay of bacteria, organic and inorganic contaminants, conductivity, porosity, dispersion and mixing phenomena. The laboratory will also include batch flow reactors.

<u>Solid/Hazardous Waste Laboratory</u>
Facilities for analyzing the stability/instability of solid waste, leachate contaminants, compaction and solid/hazardous waste materials properties. Additional capabilities for hazardous substance treatment and control and materials recycling will also be housed in this facility.

<u>Air Quality Laboratory</u>
Facility for analyzing the behavior of gaseous and particulate air pollutants, fate of pollutants and particle, and gas deposition using various devices. The laboratory will include the capability to model atmospheric dynamics and transport phenomena.

<u>Environmental Analysis Laboratory</u>
Comprehensive facility for analysis of energy and mass transport, hydraulics, subsurface transport processes, soil and groundwater remediation, natural process treatment, environmental analysis of trace organic and inorganic pollutants, soil physics and groundwater modeling.

An additional 12,000 sq. ft. of lab space is needed to accommodate the new facilities listed above.

10. ADMINISTRATION

Describe how the proposed program will be administered within the structure of the institution.

The program will be based in the “Institute” of The Faculty of Engineering. The overall responsibility will reside with the Director of the Faculty of Engineering who will be the administrative officer of the program and who will be responsible for budgetary and related business matters. The Director will actively engage contributing UGA academic units in developing arrangements for appropriately sharing new resources provided for this degree program. The Undergraduate Coordinator of the Faculty of Engineering will coordinate this undergraduate degree program with regard to such matters as recruitment, admission, scheduling, advising students, curriculum revision and other matters insuring continued program enhancement.

11. ASSESSMENT

Indicate the measures that will be taken to assess the effectiveness of the program and the learning outcomes of students enrolled.

The effectiveness of the proposed degree program will be assessed by the following five methods.

A. Graduates of the program

The performance of graduates of this degree program will be monitored by collecting information on:

i. Employment opportunities

Number of job offers received
Positions obtained
Unemployed
Underemployed
Type of industries and institutions offering jobs
Advancements in position and salary

ii. Additional Graduate Studies
Successful enrollment in subsequent graduate programs
Nature of graduate programs to which enrolled
Professional schools or other degrees

iii. Other
Graduates starting new companies
Consulting areas
Alumni surveys

B. Recruitment and Enrollment

The success of the B.S. in Civil Engineering will be assessed by the impact on recruitment and enrollment.

i. Number and quality of applicants

SAT scores
GPA
Number of applicants having already received undergraduate degrees
Incoming honors students

ii. Number and quality of applicants from underrepresented groups

Number of students from outside state

Number of transfer students and nature of program transferring from

C. Performance of Enrolled Students

Students enrolled in the B.S. in Civil Engineering program must perform at a high level in both science and engineering courses. Their performance will be assessed by comparing their grades with science and other engineering majors at UGA as well as their performance on the Fundamentals of Engineering Examination.

D. Impact of Enrolled Students

Students enrolled in the program should positively impact in developing Civil Engineering at the University of Georgia. Their impact will be assessed by:

i. New courses developed by faculty in engineering and developed jointly with Ecology, Environmental Design, Agricultural, Biological and Environmental Engineering
ii. Courses modified
iii. Participation in co-op work experience
iv. Unique undergraduate research experiences where creative exercises add to the learning process
v. Participation in study-abroad
vi. Number of honors students
vii. Recognition at University and College levels of scholarship and service
viii. Activities in professional societies and contributions in student clubs and/or professional societies

E. Regional and National Standing of the Program

The recognition of the B.S. in Civil Engineering program at the regional and national levels will be assessed by

i. Faculty in this program invited to consult with other universities
ii. Faculty in this program invited to lead or participate in workshops and debates
iii. Faculty in this program retained as consultants by civil engineering industries
iv. Demand for graduates both at regional and national levels
v. Publication in scholarly journals

12. ACCREDITATION

Identify accrediting agencies and, where applicable, show how the program meets the criteria of these agencies.

The accrediting agency for undergraduate professional engineering degree programs in the U.S. is ABET (formerly the Accrediting Board of Engineering and Technology). UGA has two accredited undergraduate engineering programs: B.S. in Biological Engineering and B.S. in Agricultural Engineering. Accreditation for the B.S. in Civil Engineering will be pursued under the ABET Program Criteria for Civil Engineering. These program criteria apply to engineering programs including "civil" and similar modifiers in their title. The program must demonstrate proficiency in mathematics through differential equations, calculus-based physics, chemistry, probability and statistics, and proficiency in a minimum of four recognized major civil engineering areas. The curriculum must provide the ability to conduct laboratory experiments and to critically analyze and interpret civil engineering design by means of design experience integrated throughout the curriculum: an understanding of professional practice issues such as: procurement of work, bidding versus quality-based selection processes, how the design professional and the construction professionals interact to construct a project and other professional practice issues.

13. AFFIRMATIVE ACTION IMPACT

Indicate what impact the implementation of the proposed program will have on the institution's desegregation and affirmative action programs.

The degree program will be open to all qualified persons and shall not discriminate on the basis of race, color, religion, national origin, sex, age, or physical disability. The engineering program at the University of Georgia has focused effort in recruiting students and faculty from under-represented groups and is a charter member of the Southeastern Consortium for Minorities in Engineering (SECME). In addition to continued active participation in SECME, engineering recruiting activities include participation in identifying students in the under-represented populations through letters, personal contacts and visitations. The University has agreements with several HBCU's and the proposed engineering program in Civil Engineering is expected to enhance the effectiveness of these agreements especially with institutions having established colleges of engineering.

It is anticipated that the strong civil engineering emphasis in the engineering program will be appealing to students from a broad spectrum of engineering and environmental interests. It is expected that this program will enhance minority recruitment and will contribute to the University's goal of increasing enrollment from the under-represented groups. Perhaps the under-represented groups have been most affected by poor infrastructure consideration and are more inclined to consider the proposed course of study.

14. DEGREE INSCRIPTION

Indicate the degree inscription that will be placed on the student's diploma upon completion of this program of study.

Bachelor of Science in Civil Engineering

15. FISCAL AND ENROLLMENT IMPACT AND ESTIMATED BUDGET

On this form please indicate the expected EFT and headcount student enrollment, estimated expenditures, and projected revenues for the first three years of the program. Include both the reallocation of existing resources and anticipated or requested new resources. Second and third year estimates should be in constant-dollars – do not allow for inflationary adjustments or anticipated pay increases. Include a budget narrative that explains significant line items and discusses specific reallocations envisioned.

Budget Narrative

	FY 10 First Year	FY 11 Second Year	FY12 Third Year
I. ENROLLMENT PROJECTIONS (indicate basis for projections in narrative)			
A. Student majors			
1. Shifted from other programs	5	10	10
2. New to institution	15	45	90
Total Majors	15	55	100
B. Course sections satisfying program requirements.			
1. Previously existing	64	64	64
2. New	7	17	27
Total Program Course Sections	71	81	91
C. Credit Hours generated by those courses			
1. Existing enrollments	9,898	9,898	9,898
2. New enrollments	470	1,215	2,700

Total Credit Hours	10,368	11,113	12,598
D. Degrees awarded	3 (yr 2)	10 (yr 3)	17 (yr 4)

II. COSTS	EFT	Dollars	EFT	Dollars	EFT	Dollars
A. Personnel–reassigned or existing positions						
1. Faculty	0.5	45,000	0.6	54,000	0.6	54,000
2. Part-time Fac.	0	0	0	0	0	0
3. Grad. Assist.	0	0	0	0	0	0
4. Administrators	0.05	2,500	0.05	2,500	0.05	2,500
5. Support staff	0.05	1,500	0.05	1,500	0.05	1,500
6. Fringe benefits		13,350		15,780		15,780
7. Other personnel costs		0		0		0
TOTAL EXISTING PERSONNEL COSTS		62,350		73,780		73,780
B. Personnel–new positions						
1. Faculty	2.0	196,000	3.0	294,000	4.0	392,000
2. Part-time Fac.	0	0	0	0	0	0
3. Grad. Assist.	0.5	8,500	1.0	19,000	1.0	36,000
4. Administrators	0	0	0	0	0	0
5. Support staff	0.5	15,000	0.8	25,000	2.0	60,000
6. Fringe benefits		58,595		89,080		128,640
7. Other personnel costs						
TOTAL NEW PERSONNEL COSTS		278,095		427,080		616,640

	FIRST YEAR	SECOND YEAR	THIRD YEAR
C. Start-up Costs (one-time expenses)			
1. Library/learning resources	4,000	6,000	8,000
2. Equipment	240,000	500,000	550,000
3. Other (New Faculty)	500,000	300,000	500,000
D. Physical Facilities: construction or major renovation	250,000	300,000	450,000
TOTAL ONE-TIME COSTS	994,000	1,106,000	1,508,000
E. Operating Cost (recurring costs–base budget)			
1. Supplies/Expenses	5,000	10,000	20,000

2. Travel	2,000	4,000	6,000
3. Equipment	13,500	24,000	34,000
4. Library/learning resources	5,000	10,000	10,000
5. Other (_________)	0	0	0
TOTAL RECURRING COSTS	365,945	548,860	760,420
GRAND TOTAL COSTS	1,359,945	1,654,860	2,268,420
III. REVENUE SOURCES			
A. Source of Funds			
1. Reallocation of existing funds	62,350	73,780	73,780
2. New student workload	xxxxxxxxxxx	xxxxxxxxxxxx	
3. New tuition	33,720	101,160	202,320
4. Federal funds	0	40,000	50,000
5. Other grants	0	0	0
6. Student fees	0	0	0
7. Other (_________)	0	0	0
Subtotal	96,070	214,940	326,100
New state allocation requested	1,263,875	1,439,920	1,942,320
GRAND TOTAL REVENUES	1,359,945	1,654,860	2,268,420
B. Nature of funds			
1. Base budget	365,945	548,860	760,420
2. One-time funds	994,000	1,106,000	1,508,000
GRAND TOTAL REVENUES	1,359,945	1,654,860	2,268,420

Budget Narrative

New faculty are required to teach the new courses for this degree program as well as some current courses to meet increased demand by the anticipated increase in enrollment. The new faculty will initiate research and outreach programs in high priority areas to meet the state’s need and support graduate programs. Additional graduate assistants are needed to assist with the increased enrollments in core courses and with research and outreach projects. Incremental increases in current administrative and support staff are needed to manage the degree program. Start-up library costs are for reference works and recurring library costs are for periodicals appropriate to the major. Substantial start-up equipment is needed to develop the required instructional laboratories and the research laboratories for new faculty. The source of reallocated existing funds will be primarily from tuition of students shifting to this program from other current programs. Recurring funds for supplies, travel and equipment are needed to provide basic resources for program maintenance and equipment for upgrading teaching laboratories. Funds to upgrade teaching laboratories are essential to providing a quality learning environment. The educational objectives of the proposed degree program fit well with funding priorities of several federal and private (including industry) sources of grant funds.

APPENDIX A

Undergraduate Course Descriptions for the B.S. in Civil Engineering Degree

I. Course Descriptions for Existing Engineering Courses

ENGR 1120. Engineering Graphics. (3-hr.)
Standards and techniques for engineering drawings. Orthographic and isometric drawings through descriptive geometry. Computer graphics using AutoCAD software.

ENGR 1140 Computational Engineering methods (2-hr.)
Computer programming and matrix techniques used in the analysis of engineering problems.

ENGR 2110 Engineering Decision Making (3-hr.)
Economics, finance and computer modeling are applied to engineering decisions.

ENGR2120 Engineering Statics (3-hr.)
Two and three dimensional force systems, equilibrium, rigid structures, centroids, friction and area moments of inertia.

ENGR2130 Dynamics (3-hr.)
Particles and rigid bodies that are moving with respect to a reference system. Kinematics deals with motion in terms of displacement, velocity, and acceleration. Kenematics includes the effect of forces on particles and bodies.

ENGR 2140. Strength of Materials. (3-hr.)
Elements of stress analysis, resistance, and design as applied to engineering materials and structures.

ENGR 2170. Electrical Circuits. (3-hr.)
Circuit element, circuit models, and techniques for circuit analysis. The course emphasizes the application of Kirchhoff's laws in determining the transient and steady state response of circuits.

ENGR 2920. Engineering Design Methods. (2-hr.)
Design methodology will be taught and practiced through use of term projects. Students will learn QFD for problem definition, conceptual design techniques and analysis procedures for detailed design.

ENGR 3120. Engineering Spatial Analysis. (3-hr.)
Methods, instrumentation, and computations related to line-of-sight spatial data collection and analysis. Topics include leveling, distance measurements, direction determination, and topographical surveying. Additional emphasis on large scale, web-based data collection and analysis using Geographic Information Systems.

ENGR 3140. Thermodynamics & Kinetics. (2-hr.)
The science of energy analysis from an engineering perspective. Focus on forms of energy, transformations of energy, and energy flows. Study applications in biological and traditional engineering systems.

ENGR 3150. Heat Transfer. (3-hr.)
Theory of heat transmission by conduction, convection, and radiation. The solution of steady and unsteady state engineering problems involving heat transfer.

ENGR 3160. Fluid Mechanics. (3-hr.)
Elements and engineering applications of the laws of fluid behavior to evaluate the forces and energies generated by fluids at rest and in motion.

ENGR3410 Introduction to Natural Resource Engineering (3-hr.)
Engineering, hydrology, soil erosion, channel design, techniques, engineered containment structures, water distribution and non-point water quality.

ENGR 3420. Soil Mechanics. (3-hr.)
Topics including soil shear strength, shallow foundations, slope stability, lateral earth pressure and soil compaction, design of shallow foundations for agricultural structure, retaining walls, and engineered slopes will be discussed.

ENGR 3440. Water Management. (3-hr.)
Science and design methods associated with managing water on a field scale. Topics will include the management of excess and deficient surface and ground water conditions that may impact activities such as agricultural production, construction, bioremediation, and environmental restoration.

ENGR3610 Structural Design (3-hr.)
Deals with relationships between loads and deflections which occur in structures as well as designing with wood and concrete.

ENGR 4440. Water and Wastewater Unit Operations. Engineering science and design related to treatment of drinking water and wastewater as well as the treatment and ultimate disposal of the sludges created during water treatment.

ENGR 4450. Solid and Hazardous Waste Systems. Engineering science and design related to environmental modeling, solid waste management, and hazardous waste management. Concepts of risk assessment will also be introduced.

ENGR 4460. Natural Wastewater Treatment Systems. The engineering design of natural wastewater treatment systems. Pond, aquaculture, constructed wetlands, land application, and small on-site treatment systems will be covered. Natural methods for sludge handling and processing will also be discussed.

ENGR 4610 Design of Light Steel Structures (3-hr.)
Design of light frame steel structures. Theory and behavior of these type members under load and their connections.

ENGR 4630 Engineering Design of Residential Structures (3-hr.)
Design of foundations, structural members, heating and cooling systems, water supply and distribution, waste removal, electrical systems and lighting. Selection of thermal insulation, vapor barriers, windows and doors and HVAC equipment determined by engineering principles.

ENGR 4650 Management of Structural Environments (3-hr.)
A study of the physiological basis for determining ventilation, cooling and heating requirements of structures and of the scientific principles behind the equipment, operating systems, and transport mechanisms in and around buildings.

ENGR 4660 Sustainable Building Design (3-hr.)
Design of buildings and their systems using sustainable design. Discussion of LEED techniques and LEED building certification is discussed.

ENGR 4920. Engineering Design. (4-hr.)
Engineering design experience including completion of a design project under the supervision of a project director.

II. Course Descriptions for Courses in the Environmental Engineering Degree Program (Some of these courses are currently undergoing curriculum review)

ENVE 3460 Groundwater Hydrology for Engineers. (3-hr.) Unsaturated and saturated water flow will be modeled along with fate and transport of inorganic and organic pollutants. Classical analytical approaches beginning with the Dupuit-Forchheimer assumptions and classic analytical approaches will be covered. Modern numerical approaches will be covered. Emphasis will be placed on natural and engineered approaches that remove pollutants and minimize risk.

ENVE 3490 Introduction to Air and Noise Pollution Management (3-hr.)
Perspectives of man's effect on ozone depletion, global climate change and regulatory backdrop are discussed and primary chemical and particulate pollutants are identified. Noise and its mitigation will be discussed. Atmospheric dispersion modeling is introduced. There will be an emphasis on techniques for minimizing inputs that in turn lead to undesirable effects.

ENVE 4240 Sustainable Energy Systems in a Global Economy (3-hr.)
Analysis of various approaches for conducting energy based engineering projects around the world. For example, differences between the Western European, Pacific Rim and North American approach to the design and utilization of energy generation and consumption systems, and how environmental impacts associated with each system are addressed. Concepts and principles of engineered systems that support human populations. Fossil fuel-based, hydroelectric, biomass, wind, solar, nuclear systems and other potential emerging technologies will be integrated throughout the course with regard to their respective efficiencies and long-term prospects for sustaining and promoting the current quality of life at local, regional and global scales.

ENVE 4490 Integrated Solid Waste Management (3-hr.)
Sources, composition and properties of solid waste are considered. Principles of generation, collection, handling, separation, storage, transport, separation, processing, recycling, biological and thermal conversion, and recycling/disposal are considered from a life cycle analyses perspective and from the larger political/regulatory context.

ENVE 4620 Sustainable Design in Urban Systems (3-hr.)
The urban environment as a complex interaction of people, transportation, buildings, industry as well as the natural ecosystem. Concepts relevant to consumption of non-renewable resources or renewable resources at rates that greatly exceed their ability to be replenished. This course uses case study examples of both good and bad urban system designs that illustrate the magnitude of the challenges (technical and non-technical), the integration needed between those disciplines, as well as develop a vision of how sustainable design concepts can be implemented into these complex urban systems.

ENVE 4710 GIS for Urban Engineering, Planning and Development (3-hr.)
Applications of Geographic Information Systems (GIS) for quantifying spatial distribution and quantity of entities on the landscape will be demonstrated. Mapping for utility management, identifying potential pollution sources and natural resources, population will be emphasized.

ENVE 4720 Urban Infrastructure Planning and Development (3-hr.)
The process for planning and developing urban systems, with emphasis on the environmental impact and interactions between natural and engineered systems. A review of past development to give insight into how current urban areas were developed, and case study applications for new developments that are intended to

lead to a more sustainable urbanized area. Comparison of the infrastructure planning and development in the U.S. with Europe and other parts of the world.

III. Course Descriptions for Existing Courses in Other Departments

FORS 4120 Quantitative Hydrology (3-hr.)
Advanced analysis of hydrologic processes to provide a theoretical understanding of precipitation, evapotranspiration, streamflow, groundwater occurrence, and movement, and soil zone, flow and transport. Emphasis is upon quantitative methods used in conjunction with field and laboratory data to identify flow and transport dynamics in hydraulic systems.

IV. Course Descriptions for New Courses

XXXX 2XXX – Engineering Project Management (2-hr.)
Principles of economics, decision-making and law applied to the management of engineering projects. Financial management, life-cycle, contracts, scheduling, risk analysis, law and ethics.

XXXX 4XXX – Open Channel Hydraulics (3-hr.)
Energy and momentum concepts, frictional resistance in open channels. Varied flow in open channels; unsteady flow in open channels; channel and culvert design.

XXXX 4XXX – Structural Design of High-Rise Buildings (3-hr.)
Building structural systems in steel reinforced concrete and composite steel and concrete. Design loads and methodologies. Structure system behavior and design. Design of floor systems, beam-columns, connections, walls and frames.

XXXX 4XXX – Life Cycle Analysis (3-hr.)
Introduction to concepts of building life cycle analysis to evaluate relative cost effectiveness of alternative buildings and building-related systems and/or components. Concepts of comparative economic measure for alternative designs; including net savings, savings-to-investment ratio, adjusted internal rate of return and years to payback are taught. Evaluation of energy and water conservation and renewable energy projects are discussed.

XXXX 4XXX – Design of Bridges (3-hr.)
Introduction to bridge structural systems in steel and concrete. Discussion of AASHTO standards. Loads and specifications.

XXXX 4XXX – Building Information Modeling (BIM) – (3-hr.)
Introduction to BIM related to geometry, spatial relationships, geographic information, quantities and properties of building components (for example manufacturers' details). Building life cycle including the processes of construction and facility operation. Systems, assemblies, and sequences are shown in a relative scale with the entire facility or group of facilities. The requirements of construction

documents include the drawings, procurement details, environmental conditions, submittal processes and other specifications for building quality.

XXXX 4XXX – Commercial Building Systems (3-hr.)
Design of mechanical, lighting, fire protection, electrical and plumbing systems for commercial buildings. Energy modeling for high performance buildings. Green building design of commercial buildings.

XXXX 4XXX – Reinforced Concrete Design (3-hr.)
Analysis, design and detailing of reinforced concrete members, and simple systems for strength, including beams, columns, beam-columns, and slabs.

XXXX 4XXX – Cold-Formed Steel Design (3-hr.)
Introduction to cold-formed steel design, behavior, strength and design of structural members, including beams, columns, beam-columns, and tension members. Basic methods of joining members to form a structural system. Introduction to cold-formed steel design using AISI standards.

XXXX 4XXX – Timber Design (3-hr.)
Introduction to timber design, behavior, strength and design of structural members, including beams, columns, beam-columns, and tension members. Basic methods of joining members to form a structural system.

XXXX 4XXXX – Masonry Design (3-hr.)
Introduction to design using masonry materials. Materials properties of masonry materials and the behavior of masonry assemblages. Design of columns, shear walls, reinforced beams and lintels. Requirements and specifications for masonry structures using design standards.

XXXX 4XXX – Pre-Stressed Concrete Design (3-hr.)
Principles of pre-stressing. analysis and design of basic flexural members. Pre-stress losses, flexure, shear, torsion and deflection. Design of pre-stressed concrete floor systems, concrete bridges decks and connections.

XXXX – 4XXX – Design of Foundations (3-hr.)
Application and theories of soil mechanics to foundation design. Bearing capacity, settlement, lateral earth pressure principles. Design of shallow foundations, spread footings, beams on elastic foundations, mat foundations, retaining walls, sheet pile walls and walls for excavations. Single piles, pile foundations, drilled piers and caissons.

XXXX 4XXX Ground Improvement Engineering (3-hr.)
Mechanics of soil stabilization; principles and technique, grouting and injection methods, reinforced earth methods, deep compaction, sand drains, geo-textiles and geo-membranes.

XXXX 4XXX Fundamentals of Designing with Geo-Synthetic Materials (3-hr.)
Fundamentals and theories of designing soil structures with geo-synthetics. Road and highway applications; reinforced embankments; slope stabilization; waste containment systems; erosion control; filtration and drainage.

XXXX 4XXX Matrix Structural Anaysis (3-hr.)
Introduction to matrix structural analysis, applied to trusses, beams, frames and two dimensional elasticity problems. Use of computer programs for structural analysis.

XXXX -4XXX Construction Estimating (2-hr.)
Introduction to estimating problem-solving in general conditions, civil work, concrete, and masonry (excavation, backfill, grading, paving, landscaping, etc.). Hands-on estimating with quantity take-off, pricing, and bidding is stressed. Uniform cost index categories will be covered.

XXXX – 3XXX Construction Planning and Scheduling (3-hrs.)
Introduction to construction project management, project documentation techniques, bonds, insurance, construction equipment selection and operation, safety and elements of a project.

APPENDIX B

Scholarship, Publications and Professional Activities of the Faculty Directly Involved

a. Name, rank, academic discipline, institutions attended, degrees earned

Sidney Alan Thompson
U. H. Davenport Professor, Biological and Agricultural Engineering

Ph. D.	Agricultural Engineering	University of Kentucky
MS	Civil Engineering	Purdue University
BS	Civil Engineering	Kansas State University

b. Current workload for typical semester, including specific courses actually Taught

Fall Semester:
ENGR2140 Strength of Materials (3 credit hours)
ENGR3610 Structural Design (3 credit hours)
ENGR4630 Residential Design (3 credit hours)
ENGR4630 is Team Taught – I teach approximately ¼ of the lectures

Spring Semester:
ENGR2140 Strength of Materials (3 credit hours)
ENGR2920 Design Fundamentals (2 credit hours)
ENGR2920 is Team Taught
ENGR4610 Steel Design (3 credit hours)
ENGR4920 Senior Design (4 credit hours)
Faculty teaching ENGR4920 do so on demand based on project and class needs.

Currently: Undergraduate Coordinator for the Biological and Agricultural Engineering Department

c. Scholarship and publication record for past five years

Das, K. C., J. D. Governo and S. A. Thompson. 2002. Computer tool for composting process design and cost estimation. Applied Engineering in Agriculture.Vol. 17(5):711-718.

Molenda, M. J. Horabik, S. A. Thompson and I. J. Ross. 2002 Bin loads induced by eccentric filling and discharge of grain. Transactions of the ASAE. 45(3):781-785.

McNeill, S.G., S. A. Thompson and M. D., Montross. 2004. Effect of moisture content and broken kernels on the bulk density and packing of corn. Applied Engineering in Agriculture. 20(4):475-480.

Molenda, M., M. D. Montross, J. Horabik and S. A. Thompson. 2004. Vertical wall loads in a model grain bin with non-axial internal inserts. Transactions of the ASAE, 47(5):1681-88.

Molenda, M., Horabik, J., Thompson, S. A. and Ross. I. J. 2004. Effects of grain properties on loads in model silo. Journal of International Agro-physics. Vol. 18, No. 4. pp 329-332.

Webster, A. B., S. A. Thompson, N. C. Hinkle and W. C. Merka. 2006. In-house composting of layer manure in a high-rise tunnel ventilated commercial layer house during an egg production cycle. Journal of Applied Poultry Science. 15(3):447-456.

Molenda, M., Montross, M. D., Thompson, S. A. and J. Horabik. 2006. Vertical loads from wheat on obstructions located on the floor of a model bin. Transactions of the ASAE 49(6):1855-1865.

Visser, M. C., B. Fairchild, M. Czarick, M. Lacy, J. Worley, S. A. Thompson, J. Kastner, C. Ritz and L. P Naeher. 2006. Fine particle measurements inside and outside of tunnel ventilated broiler houses. Journal of Applied Poultry Research 15(3):394-405.

Burmeister, J, Foutz, T. L. and S. A. Thompson. 2007. Sophomore Engineering Design: Back to the Future. International Journal of Engineering Education. 23(5):894-901.

Books, Book Chapters and Proceedings Chapters:

Bucklin, R.A., S. A. Thompson, M. Montross and A. Abded-Hadi. 2007. Grain Storage Systems Design. In: Handbook of Farm, Dairy and Food Machinery Handbook. M. Kutz, ed. William Andrew Publishing, Norwich, NY.

d. Professional Activity

Professional Societies:

ASAE - American Society of Agricultural Engineers
ASCE - American Society of Civil Engineers
ASEE - American Society of Engineering Education

e. Expected contributions to this degree program

Teach mechanics of materials sections
Teach current undergraduate courses related to the structural engineering.
Serve on graduate committees with research topics associated with structural engineering.

a. Name, rank, academic discipline, institutions attended, degrees earned

John Schramski
Assistant Professor
Environmental Engineering
Faculty of Engineering

Ph.D.	2006	University of Georgia	Ecology
M.S.	1993	University of Cincinnati	Mechanical Engineering
B.S.	1989	University of Florida	Mechanical Engineering

b. Current workload for typical semester, including specific courses actually taught

ENGR 4300	Mechanism Design II	(3 credit hours)
ENGR 3160	Fluid Mechanics and Laboratory	(1 credit hour)

c. Scholarship and publication record for past five years

Schramski JR, Gattie DK, Patten BC, Bata SA, Whipple SJ, Borrett SR, Fath BD. 2007. Indirect effects and distributed control in ecosystems: Distributed control in the environ networks of a seven-compartment model of nitrogen flow in the Neuse River Estuary, USA — Time series analysis. *Ecological Modelling, 206(1-2):18-30*.

Gattie DK, Schramski JR, Bata SA. 2006. Analysis of microdynamic environ flows in an ecological network. *Ecological Engineering, 28(3):187-204.*

Schramski JR, Gattie DK, Patten BC, Borrett SR, Fath BD, Thomas CR, Whipple SJ. 2006. Indirect effects and distributed control in ecosystems: Distributed control in the environ networks of a seven-compartment model of nitrogen flow in the Neuse River Estuary, USA — Steady-state analysis. *Ecological Modelling, 194(1-3):189-201*.

Gattie, DK, Schramski JR, Borrett SR, Patten BC, Bata SA, Whipple SJ. 2006. Indirect effects and distributed control in ecosystems: Network environ analysis of a seven-compartment model of nitrogen flow in the Neuse River Estuary, USA — Steady-state analysis. *Ecological Modelling, 194(1-3):162-177*.

d. Professional activity

Conference Organizing Committee, Session Moderator, and Participant, Ecological Network Analysis workshop–Systems and Engineering Ecology. University of Georgia, Athens, GA. March 1-3, 2005.

Invited Discussant, International Workshop – Ecosystem Complexity. Bled, Slovenia. Sept. 25-26, 2004.

Organizer and Chair, Ecological Network Analysis (ENA) Conference Organizing Committee, University of Georgia's Faculty of Engineering, April 23, 24, and 25, 2008 — Fall 2007 planning is complete with 28 world scholars invited to participate as discussants. Registration is now underway.

Reviewer for Ecological Modelling.

e. Expected responsibilities in this program

Teach the large number of undergraduate and graduate level courses common to both Civil and Environmental Engineering.

Sit on graduate committees and serve as major professor for M.S. and Ph.D. students working with civil and environmental related research.

Advise undergraduate and graduate students.

Lead research programs in the environmental sciences that directly involve or impact the Civil Engineering related areas of research including but not limited to geotechnical, hydrological, infrastructure, and structural concerns.

a. Name, rank, academic discipline, institutions attended, degrees earned.

Tom Lawrence
Public Service Associate
Mechanical Engineer
Purdue University (B.S., Ph.D.), Oregon State University (M.S.),
Washington University (M.S.)

b. Current workload for typical semester, including specific courses actually taught.

Position is ½ teaching and ½ engineering outreach
Fall Semester teaching

ENGR 4630	Design of Residential Structures	(3 credit hours)
ENGR 4660	Sustainable Building Design	(3 credit hours)
ENGR 3150	Heat Transfer	(3 credit hours)

Spring Semester teaching

ENGR 4650	Management of Structural Environments	(3 credit hours)
ENGR 4920	Senior Design (faculty mentor)	(4 credit hours)

c. Scholarship and publication record for past five years.

RECENT JOURNAL PUBLICATIONS:

Lawrence, T.M. and J.E. Braun. 2007, "Calibrated Simulation for Retrofit Evaluation of Demand-Controlled Ventilation in Small Commercial Buildings", *ASHRAE Transactions* 113(2):227-240.

García-Núñez, J.A., K.C. Das, T.M. Lawrence. 200X, Physical and Thermal Models of Pyrolysis of Oil Palm Shell in a Tubular Bench Scale Reactor, submitted to *Biomass and Energy.*

Hilten, R.N., T.M. Lawrence and E.W. Tollner. 200X, "Developing a predictive stormwater model for a greenroof with engineered soil", submitted to *Journal of Hydrology*.

Lawrence, T.M. and J.E. Braun. 2007. "Determination of Occupant CO_2 Source Generation Rates from Measured Field Data at Smaller Commercial Buildings", *Buildings and Environment* 42(2):623-639.

Lawrence, T.M. and J.E. Braun. 2006. "Modeling of CO_2 Concentrations in Small Commercial Buildings", *Buildings and Environment* 41(2):184-194.

Lawrence, T.M., J.D. Mullen, D.S. Noonan, and H.J. Enck. 2005. "Moving Beyond the First Cost Mentality", *Solar Today* 19(6):34-37.

Lawrence, T.M., J.D. Mullen, D.S. Noonan, and H.J. Enck. 2005. "Overcoming Barriers to Efficiency", *ASHRAE Journal* 47(9):S40-S44.

Lawrence, T.M. 2004. "Demand-Controlled Ventilation and Sustainability", *ASHRAE Journal* 46(12):117-121.

CONFERENCE PRESENTATIONS:

Lawrence, T.M. 2007. "What's New with the ASRHAE Green Guide, 2nd Edition?", ASHRAE Summer Meeting, Long Beach California, June 2007.

Hilten, R.N, and T.M. Lawrence. 2007. "Using Green Roofs and Other Technologies for Reducing the Need for Stormwater Retention Capacity Requirements", Low Impact Development Conference, Wilmington, NC, March 2007.

Swift, J., and T.M. Lawrence. 2007. "The ASHRAE GreenGuide: One Means of Establishing a Link between Sustainable Design Practitioners", CLIMA 2007 Congress, Helsinki, Finland.

Swift, J., B. Millard, E. Avis, and T.M. Lawrence. 2007. "Air Distribution Strategy Impact on Operating Room Infection Control", CLIMA 2007 Congress, Helsinki, Finland.

Lawrence, T.M. 2006. "Using Case Studies to Bring Real World Situations into the Engineering Course Learning Environment", Amer. Soc. of Engineering Education Southeastern Conference, Tuscaloosa, AL, April 2006.
Hilten, R. N., T. M. Lawrence, E. W. Tollner, and D. Gattie. 2006. Predicting building energy use and stormwater runoff associated with greenroofs. American Ecological Engineering Society.
Lawrence, T.M. and J.E. Braun. 2003. "Ventilation Effectiveness and Indoor Air Quality at Modular Schoolrooms", CIBSE/ASHRAE Green Buildings Conference, Edinburgh, Scotland Sept. 2003

d. Professional Activity

Chair of ASHAE Technical Committee 2.8, *Building Impact on the Environment and Sustainability*
ASHRAE Distinguished Lecturer staring in 2007. Various invited presentations given on *Sustainable Design and Green Buildings*, including Dubai (United Arab Emirates), Indianapolis, New Orleans, Mobile Alabama, Boston, San Diego, New York City, Montreal, with a number of other venues scheduled in the U.S., India, China, Singapore and Taiwan.

CONFERENCE SESSIONS CHAIRED:
"HVAC Related Building Systems Interaction with the Local Environment". ASHRAE 2006 Winter Meeting, Chicago, IL
"California Energy Update: Energy Efficiency Using Innovative Approaches". ASHRAE 2004 Winter Meeting, Anaheim, CA

BOOKS AND BOOK CHAPTERS:

Senior editor for the second edition of the *ASHRAE GreenGuide*, published by the American Society of Heating, Refrigeration and Air Conditioning Engineers, released in 2006. Author of a new chapter titled "Building HVAC Interaction with the Local Environment"

"Automobile Assembly Plant Paint Shop Oven Heat Transfer", 2006. Chapter 14 of *Heat Transfer Calculations* edited by Myer Kurtz, McGraw-Hill, New York, New York.

Subject Matter Expert for an on-line learning course for ASHRAE and Elsevier titled *Fundamentals of Sustainable Buildings and High Performance Systems Design* based on the ASHRAE GreenGuide.

e. Expected responsibilities in this program.

Teaching of courses (existing and perhaps new) that are part of the proposed new curriculum.
Curriculum development and program planning

a. Name, rank, academic discipline, institutions attended, degrees earned.

Ernest W. Tollner
Professor , Biological & Agricultural Engineering

Education
B.S.A.E. 1972 University of Kentucky Agricultural Engineering
M.S.A.E. 1974 University of Kentucky Agricultural Engineering
Ph.D. 1981 Auburn University Agricultural Engineering

b. Current workload for typical semester, including specific courses actually taught.

Courses Taught:
Fall Semester:
ENGR 4210 Linear Systems (3 credit hours)
ENGR6410 Open Channel Hydraulics and Sediment Transport (3 credit hours)

Spring Semester:

ENGR3420 Soil Mechanics (3 credit hours)
ENGR3440 Water Management (3 credit hours)

c. Scholarship and publication record for past five years.

A. PUBLICATIONS

1. Books authored or co-authored:

Tollner, E.W., 2001. Natural Resources Engineering. Iowa State Press Ames, Iowa.

2. Chapters in books:

Tollner, E.W., 2003. Osmotic Pressure. IN Encyclopedia of Agricultural, Food and Biological Engineering, Ed by D. Heldman. 712 - 716. (invited).

Tollner, E.W. 2003. Soil dynamics. IN Encyclopedia of Agricultural, Food and Biological Engineering, Ed by D. Heldman,906 - 910. (invited).

Tollner, E.W., R.L. Schafer and T.K. Hamrita. 2002. Sensors and controllers for primary drivers and soil engaging implements. Advances in Soil Dynamics II: 179 – 224, 244 – 253. Am. Soc. Agr. Engrs., St. Joseph, MI.

Tollner, E.W. and M.H. Shahin. 2000. X-ray imaging for classifying food products based on internal defects. IN Nondestructive food evaluation. Ed by S. Gunasekaran. Marcel Decker, New York.

3. Journal articles (in print or accepted):

Bhandarkar, S.M., X. Luo, R.F. Daniels and E.W. Tollner. 2008. Automated planning and optimization of lumber production using machine vision and computer tomography. Transactions on Automation Science and Engineering 5:1-18.

K.C. Das, P.A. Annis, E.W. Tollner and S. Dudka .2006. Technical and economic aspects of utilizing fibrous wool composts in horticulture. Journal of Applied Horticulture, 8(2): 165-169. (not notified until 2007).

Bhandarkar SA, Chowdhury AS, Tang Y, and E W Tollner. 2007. Computer vision guided virtual craniofacial reconstruction . Computerized Medical Imaging and Graphics 31 (6): 418-427.

Meyer, S., J. Molnar, D. Meyer. and E. Tollner. 2007. Tilapia fingerling production in Honduras. Journal of Applied Aquaculture 19 (2): 1-27.

Tollner, E.W. and C. Kazanci. 2007. Discrete simulation approaches for analyzing ecological thermodynamics.208(1): 68-79**.**

Tekeste, M.Z., R.L.Raper and E.W. Tollner, T.R. Way. 2007. Finite element analysis of cone penetration in soil for prediction of hardpan location. Trans. ASABE 50(1): 23-31.

Birkett, C., E.W. Tollner and D. Gattie. 2007. Total Suspended Solids and Hydraulic Regime effects on periphyton growth in a laboratory flume. Transactions of the ASABE 50 (3): 1095-1104.

Tollner, E.W., S.E. Prussia and W. Florkowski. 2006. Modeling Product Flow Through a Generic Postharvest Distribution System. Journal of Food Distribution Research. 37(2):23-34.

Bhandarkar SM, Luo XZ, Daniels R, and E.W. Tollner. 2006. A novel feature-based tracking approach to the detection, localization, and 3-D reconstruction of internal defects in hardwood logs using computer tomography. Pattern Analysis and Applications 9 (2-3): 155-175.

Tollner, E.W. and T.C. Rasmussen. 2005. Simulated moving bed forms effects on real-time in-stream sediment concentration measurement with densitometry. Jour. of Hydraulic Engineering. 131(12):1141-1144.

Pablo R. Martinez, Joseph Molnar, Elizabeth Trejos, Daniel Meyer, Suyapa Triminio Meyer & William Tollner . 2005. Cluster Membership as a Competitive Advantage in Aquacultural Development: Case Study of Tilapia Producers in Olancho, Honduras. Journal of Aquacultural Economics 8(5-6): 281-294.

Bhandarkar SM, X.Z. Luo, R. Daniels and E.W. Tollner. 2005. Detection of cracks in computer tomography images of logs. Pattern Recognition Letters 26 (14): 2282-2294.

Gattie D.K., E.W. Tollner, T.L. Foutz. 2005. Network environ analysis: A mathematical basis for describing indirect effects in ecosystems. *Trans ASAE, Vol. 48(4):1645-1652.*

Tollner, E.W., R. Gitiatus, K. Seebold and B. Maw. 2005. Experiences with an onion inspection machine. Applied Engineering in Agriculture 21 (5): 907-912.

Tollner, E.W. and K.C. Das. 2004. Predicting Runoff from a Yard Waste Windrow Composting Pad. Transactions of the ASAE Vol. 47(6): 1953-1961.

van Donk, SJ; Tollner, EW; Steiner, JL, Soil temperature under a dormant bermudagrass mulch: Simulation and measurement. Transactions of the ASAE, 47 (1): 91-98 JAN-FEB 2004.

Ezeike, GOI; Hung, YC; Tollner, EW 2004. Laser-based positioning and drilling system for placing a temperature sensor into a food sample Appl Eng Agric, 20 (3): 329-334 May 2004.

Tollner, EW. 2004. Efficacy and economics of placing X-ray machines in an onion packinghouse. Rec Res Dev Crop Sci, 1: 55-69 Part 1

Tollner, E.W., D. Meyer, S. Triminio-Meyer, B. Verma, G. Pilz and J.J. Molnar. 2004. Spreadsheet tools for developing surface water supplies for freshwater fish in developing countries. Jour. Of Aquacultural Engineering 31(1-2):31-49.

Dong, X. and E. W. Tollner. 2003. Evaluation of Anammox and denitrification during anaerobic digestion of poultry manure. Bioresource Technology 86(2): 139-145.

Das, KC and E.W. Tollner. 2003. Comparison between composting of untreated and anaerobically treated paper mill sludges. Trans ASAE, 46 (2): 475-481.

Gaskin, Julia W., Robert B. Brobst, William P. Miller, and E. W. Tollner. 2003. Long-term biosolids application effects on metal concentrations in soil and Bermudagrass forage. J. Environ. Qual. 32(1):146-152.

Gattie, D., M. Smith and E.W. Tollner. 2003. The Emergence of Ecological Engineering as a Discipline. Journal Of Ecological Engineering 20 (5): 409-420.

Das, K.C., E.W. Tollner and M.A. Eiteman. 2002. Comparison of natural and synthetic bulking agents in food waste composting. Compost Science 11 (1): 27-35.

Shahin, M.A., E. W. Tollner, R. D. Gitaitis, D. R. Sumner, B. W. Maw. 2002. Classification of Sweet Onions Based on Internal Defects Using Image Processing and Neural Network Techniques. Transactions of the ASAE 45(5):1613 – 1618.

Shahin, M.A., E. W. Tollner, R. W. McClendon, H. R. Arabnia. 2002. Apple Classification Based on Surface Bruises Using Image Processing and Neural Networks. Transactions of the ASAE 45(5): 1619 – 1627.

Das, KC, M. Y. Minkara, MY, ND Melear, and E. W. Tollner. 2002. Effect of poultry litter amendment on hatchery waste composting. J Appl Poultry Res, 11 (3): 282-290.

Das, KC; Tollner, EW; Tornabene, TG. 2002. Windrow composting of paper mill by-products: Scale-up and seasonal effects. Compost Sci Utilization, 10 (4): 347-355.

B. PROFESSIONAL SERVICE

GRANTS, AWARDS AND GIFTS RECEIVED

PI OR CO-PI ON GRANTS TOTALING OVER $2,000,000 IN THE PAST 5 YEARS.

Membership in professional societies:

Current

- American Society of Agricultural Engineers (ASAE/ASABE) 28 yr
- Georgia Section, ASAE Awards Chair (1995-96), Section Chair 2005
- National Society of Professional Engineers (2006-Pr)
- Ecological Engineering Society (2000-Pr, Charter member)
- American Society of Engineering Education (1996 – Pr)

Past

- Sigma Xi (1994 – Pr; President 1997-98)
- SPIE (1997-99)
- American Society of Agronomy (1990-1994)
- Institution of Biological Engineers (2004-05)
- World Aquacultural Society (2005-07)

C. National committee leadership and special assignments:

2007 Incoming Director, ASABE Publications
2007 ASABE representative, EPE committee
2007 Organizing Committee for ASABE International Water Conference
2005-07 Member of the Aquacultural CRSP Technical coordinating committee
2006 Ga Section ASABE past Chair
2005 Ga Section ASABE Chair
2005-06 P-412 (Ethics Committee) chair and session organizer

2005 IBE Thermodynamics Session Organizer
2005 Program Chair, ASEE-BAE division
2005 Incoming Chair, ASEE-BAE division
2004-Pr NCEES FE exam committee – Biological coordinator
2000-Pr Member, ASAE Publication Council
1997-Pr Member, PE Exam writers workshop
1997-Pr P-414 (Registration committee)
2004-Pr Member, FE Exam writers workshop
2004 Ga Section ASAE incoming chair
2004 ASEE-BAE division program chair
2003-04 ASAE representative, EPE committee
2001-02 Chair of P-414 Engineering Registration Committee
2000-Pr Member, ASAE Membership Council

Expected contributions to this degree program

- Teach current undergraduate courses related to the environment to larger classes or additional sections.
- Mentor young faculty as they join the engineering department.
- Mentor graduate students

a. Name, rank, academic discipline, institutions attended, degrees earned

David K. Gattie
Associate Professor, Department of Biological & Agricultural Engineering
Member, Faculty of Engineering

Ph.D. 1993 University of Georgia, Ecology
B.S. 1983 University of Georgia, Agricultural Engineering

b. Current workload for typical semester, including specific courses actually taught

Fall Semester:
ENGR 1920 Introduction to Engineering (2 credit hours)
ENGR 3410 Introduction to Natural Resources Engineering (3 credit hours)

Spring Semester:

ENGR 3120 Spatial Data Analysis (3 credit hours)

ENGR 3160	Fluid Mechanics	(3 credit hours)
ENGR 8560	Systems & Engineering Ecology	(3 credit hours)
ENGR 4920	Engineering Design Project	(4 credit hours)

c. Scholarship and publication record for past five years

Gattie DK, Wicklein RC. 2008. Curricular value and instructional needs for infusing engineering design into grades 9-12 technology education. [*Journal of Technology Education: Accepted for Publication, June 2007*].

Gattie DK, Kellam NN, Turk HJ. 2007. Informing ecological engineering through ecological network analysis, ecological modelling, and concepts of systems and engineering ecology, *Ecological Modelling,208(1):25-40*.

Gattie DK, Foutz TL. 2007. Systems and engineering ecology: Developing formal foundations for ecological engineering. *International Journal of Engineering Education, 23(4):683-690*.

Bata SA, Borrett SR, Patten BC, Whipple SJ, Schramski JR, Gattie DK. 2007. Equivalence of throughflow- and storage-based environs. *Ecological Modelling, 206(3-4):400-406*].

Birkett C, Tollner EW, Gattie DK. 2007. Turbidity and flow regime effects on periphyton development in a laboratory channel, *Trans. ASABE, 50(3):1095-1104*.

Schramski JR, Gattie DK, Patten BC, Bata SA, Whipple SJ, Borrett SR, Fath BD. 2007. Indirect effects and distributed control in ecosystems. Distributed control in the environ networks of a seven-compartment model of nitrogen flow in the Neuse River Estuary, USA: Time series analysis, *Ecological Modelling, 206(1-2):18-30*.

Whipple SJ, Borrett SR, Patten BC, Gattie DK, Schramski JR, Bata SA. 2007. Indirect effects and distributed control in ecosystems: Comparative Network Environ Analysis of a Seven-Compartment Model of Nitrogen Flow in the Neuse River Estuary: Time Series Analysis, *Ecological Modelling, 206(1-2):1-17*.

Gattie DK, Schramski JR, Bata SA. 2006. Analysis of microdynamic environ flows in an ecological network, *Ecological Engineering, 28(3):187-204*.

Gattie DK, Schramski JR, Borrett SR, Patten BC, Bata SA, Whipple SJ. 2006. Indirect effects and distributed control in ecosystems: Network environ analysis of a seven-compartment model of nitrogen flow in the Neuse River Estuary, North Carolina, USA - Steady state analysis. *Ecological Modelling, 194(1-3):162-177.*

Schramski JR, Gattie DK, Patten BC, Borrett SR, Fath BD, Thomas CR, Whipple SJ. 2006. Indirect effects and distributed control in ecosystems: Distributed control in the environ networks of a seven-compartment model of nitrogen flow in the Neuse River Estuary, North Carolina, USA - Steady state analysis. *Ecological Modelling, 194(1-3):189-201.*

Gattie DK, Tollner EW, Foutz TL. 2005. Network environ analysis: A mathematical basis for describing indirect effects in ecosystems. *Transactions of ASAE, Vol. 48(4):1645-1652*.

Gattie DK, Lewis DL. 2004. A high-level disinfection standard for land-applying sewage sludges (biosolids). *Environmental Health Perspectives, 112(2): 126-131.*

Gattie DK, Smith MC, Tollner EW, McCutcheon SM. 2003. The emergence of ecological engineering as a discipline. *Ecological Engineering, 20(5):409-420*.

Lewis DL, Gattie DK, Novak ME, Sanchez S, Pumphrey C. 2003. Interactions of pathogens and irritant chemicals in land-applied sewage sludges (biosolids). *New Solutions, 12(4) 409-423*.

Kellam NN, Gattie DK. Peters, W. 2007. Niche construction as an analog for improving educational systems. *Complexity Science and Educational Research Conference*, Vancouver, BC, Canada, February 18-20, 2007.

Kellam NN, Gattie DK, Kazanci C. 2007. A network model of distributed and centralized systems of students. *Frontiers in Education*. Wisconsin, 2007.

Gattie DK, Wicklein RC. 2005. Curricular value and instructional needs for infusing engineering design into K-12 Technology Education. *Proc. ASEE Intl. Mtg* (ASEE Paper 2005-3110-204).

Tollner EW, Gattie DK. 2005. Extending thermodynamic concepts from the microscopic nonliving system to the macroscopic living system. *Proc. ASEE Intl. Mtg* (Paper# 2005-1408-234).

Gattie DK, Tollner EW, Collins JV. 2003. Integrating Design Criteria for Management of Urban Ecosystems. *Proc. GA Water Res. Conf., pp. 425-428*.

Tanner Smith HM, Gattie DK, Smith MC, Byne FW, Collins JV. 2003. Gaps in Watershed Assessments in Georgia: Observations and Suggested Changes. *Proc. GA Water Res. Conf., pp 284-287*.

*Gattie DK, Kellam NN. 2008. Engineering Education as a Complex System. *Complexity Science and Educational Research Conference*, Athens, GA, Feb 3-5, 2008.

*Kellam NN, Gattie DK. 2008. Developing a Systems Understanding of Education through Ecological Concepts. *Complexity Science and Educational Research Conference*, Athens, GA, Feb 3-5, 2008.

Kellam NN, Gattie DK, Kazanci C. 2007. A network model of distributed and centralized systems of students. *Frontiers in Education*. Wisconsin, 2007.

Gattie DK, Schramski JR. 2007. Environs, ascendency, exergy and emergy: System-level properties for ecosystem analysis and the need for synthesis in ecological engineering. *AEES Annual Conference*. Manhattan, KS, May 23-25 2007.

Kellam NN, Gattie DK. Peter, W. 2007. Niche construction as an analog for improving educational systems. 2007. *Complexity Science and Educational Research Conference*, Vancouver, BC, Canada, February 18-20, 2007.

Gattie DK. 2006. Ecological Systems Analysis: The Modeling Problem. *ASABE International Meeting*. Portland, OR, July 2006.

*Gattie DK, Foutz TL. 2006. Development and Assessment of Critical Thinking Skills for Engineering Students. *ASEE International Meeting*, Chicago, IL, June 18-21, 2006.

Gattie DK. 2006. Analysis of Ecosystem Properties and Function: Issues of Modeling. *AEES Annual Meeting*, Berkeley, CA, April 13-14, 2006.

*Gattie DK, Turk HJ. 2006. Informing Ecological Engineering through Ecological Network Analysis. *Invited Presentation at the Ecosystem Networks Workshop*, University of Copenhagen, Copenhagen, Denmark, June 7-10, 2006.

Gattie DK. 2005. Systems and Engineering Ecology. UGA Faculty of Engineering Annual Meeting. Athens, GA, October 24, 2005.

*Gattie DK, Schramski JR, Bata SA. 2005. Ecological Network Analysis: An analytical methodology for mathematically deriving holistic ecosystem properties. *ASAE International Meeting*. Orlando, FL, July 2005

*Gattie DK, Wicklein RC. 2005. Curricular value and instructional needs for infusing engineering design into K-12 Technology Education. *ASEE International Meeting*, Portland, OR, June 11-15, 2005.

*Gattie DK, Tollner EW. 2005. Developing student insight into living systems through network analysis. *ASEE International Meeting*, Portland, OR, June 11-15, 2005.

*Tollner EW, Gattie DK. 2005. Extending thermodynamic concepts from the microscopic nonliving system to the macroscopic living system. *ASEE International Meeting*, Portland, OR, June 11-15, 2005.

*Gattie DK, Schramski JR, Bata SA. 2005. Analysis of microdynamic environ flows in an ecological network. *AEES Annual Meeting*, Columbus, OH, May 18-20, 2005.

*Gattie DK. Ecological Network Analysis. 2005. *AEES Annual Meeting*, Columbus, OH, May 18-20, 2005.

*Wicklein RC and *Gattie DK. 2005. Engineering design focus for Technology Education. *ITEA Annual Conference*, Kansas City, MO, April 2-5, 2005.

*Hill RB, *Wicklein RC, *Gattie DK, and Thompson SA. 2005. Optimization: It's not Engineering design without it. *ITEA Annual Conference*, Kansas City, MO, April, 2005.

*Gattie DK, Foutz TL. 2005. Systems and engineering ecology: A basis for developing fundamental ecological engineering sciences. *IBE Annual Meeting*, Athens, GA, March 4-6, 2005.

*Gattie DK, Schramski JR, Bata SA. 2005. Holistic analysis of ecosystem properties and complexity. *IBE Annual Meeting*, Athens, GA, March 4-6, 2005.

*Turk HJ, Gattie DK. 2005. Propagation of indirect causality by enfolded network transmittances. *IBE Annual Meeting*, Athens, GA, March 4-6, 2005. [Dr. Gattie is directing Mr. Turk's doctoral research]

*Tollner EW, Gattie DK. 2005. Lagrangian and Eulerian perspectives on network analyses. *IBE Annual Meeting*, Athens, GA, March 4-6, 2005.

*Borrett SR, Gattie DK, Patten BC, Whipple SJ, Schramski JR, Bata S. 2004. Throughflow decomposition and indicators of ecosystem complexity in Network Environ Analysis. *Ecosystem Complexity Workshop*, Bled Slovenia, September 25-26, 2004.

*Thompson SA, Wicklein RC, Gattie DK, Hill R. 2004. *First Annual UGA Engineering Conference*, Athens, GA, October 28, 2004.

*Gattie DK, Schramski JR, Borrett SR, Patten BC, Whipple SJ. 2004. Network (Output) Environ Analysis of a nitrogen flow model. *First Annual UGA Engineering Conference*, Athens, GA, October 28, 2004.

*Gattie DK, Patten BC. 2004. Systems and engineering ecology. *First Annual UGA Engineering Conference*, Athens, GA, October 28, 2004.

*Gattie DK, Foutz TL. 2004. The network construct as a foundation for developing ecological engineering science, *First Annual UGA Engineering Conference*, Athens, GA, October 28, 2004.

*Patten BC, Gattie DK, Whipple SJ, Schramski JR, Borrett SR, Turk HJ, Fath BD. 2004. Environs and Network Environ Analysis: Introduction and Overview. *European Conference on Ecological Modelling*, Bled, Slovenia, Sept. 29-Oct. 1, 2004.

*Gattie DK, Schramski JR, Borrett SR, Patten BC, Turk HJ. 2004. Network

Environ Analysis of a Seven-Compartment Model of Nitrogen Flow in the Neuse River Estuary, USA: Steady-state Analysis. *European Conference on Ecological Modelling*, Bled, Slovenia, Sept. 29-Oct. 1, 2004.

*Schramski JR, Gattie DK, Patten BC, Whipple SJ, Borrett SR, Fath BD. 2004. Distributed Control in the Environ Networks of a Seven-Compartment Model of Nitrogen Flow in the Neuse River Estuary, USA: Static Analysis. *European Conference on Ecological Modelling*, Bled, Slovenia, September 29-October 1, 2004.

Schramski JR, *Gattie DK, Patten BC, Bata SA, Whipple SJ, Borrett SR, Fath BD. 2004. Distributed Control in the Environ Networks of a Seven-Compartment Model of Nitrogen Flow in the Neuse River Estuary, USA: Time Series Analysis. *European Conference on Ecological Modelling*, Bled, Slovenia, September 29-October 1, 2004.

*Gattie DK, Tollner EW. 2004. Network Environ Analysis: A Rigorous and Formal Basis for an Ecological Engineering Science. *ASAE*, Ottawa, Canada, July 2004.

*Gattie DK. 2004. Extending fundamental systems ecology into an engineering program of study: A focus on first principles at the graduate level. *ASEE*, Salt Lake City, UT, June 2004.

*Gattie DK, Tollner EW. 2004. Development of the University of Georgia Campus as an Urban Ecosystem Learning Laboratory. *ASEE*, Salt Lake City, UT, June 2004.

*Gattie DK, Schramski JR, Borrett SR, Patten BC, Turk HJ, Whipple SJ. 2004. Analysis of Ecosystem as a Network of Environments. *AEES*, Fayetteville, AR, 2004.

*Gattie DK, Foutz TL, Tollner EW. 2004. The Network Construct as a Foundation for Building an Ecological Engineering Science. *AEES*, Fayetteville, AR, June, 2004.

*Tanner HS, Gattie DK, 2004. Ecological Engineering: Science to Policy. *AEES*, Fayetteville, AR, June, 2004.

*Millington HK, Gattie DK. 2004. Developing Ecologically Sound Engineering Design Criteria for Small Stream Crossings to Provide Adequate Fish Passage. *AEES*, Fayetteville, AR, June 9-12, 2004. [Dr. Gattie directed Ms. Millington's M.S. Thesis]

*Turk HJ, Gattie DK. 2004. Toward Understanding Ecological Self-Design through Network Environ Analysis and Design Theory. *AEES*, Fayetteville, AR, June, 2004.

*Wicklein RC, *Gattie DK. 2004. Bridges to Engineering. *ITEA*, Albuquerque, NM, March, 2004.

Gattie DK, 2004. The Need for the Engineering Method in Technology Education. *Keynote Address for the Technology Education Collegiate Association Annual Meeting*, Virginia Beach, VA, February, 2004.

*Tollner EW, Gattie DK. 2004. Graduate Opportunities in Ecological Engineering at UGA: Micro-, Meso-, Basin Scales. *AEES*, Fayetteville, AR, June 9-12, 2004.

*Gattie DK. 2003. Watersheds or ecosystems? The need for an integrated approach to assessment analysis and management. *Georgia Urban Forestry Council*, Madison, GA, August 2003.

Gattie DK, *Smith MC, Winger PV, Smith HM, Byne FW, Collins JV. 2003. Integrated watershed assessments by linking biological metrics to physical habitat attributes and landuse characterization, *ASAE*, Las Vegas, Nevada, July 27-30, 2003.

Gattie DK. 2003. Environmental and ecological aspects of engineering. *NSF Summer Institute. UGA College Ag. and Environ. Sciences*, Athens, GA, July, 2003.

*Gattie DK, Smith MC, Rosemond A. 2003. Development of ecological engineering education at the University of Georgia. *ASEE* Nashville, TN, June 2003.

*Gattie DK, Tollner EW. 2003. Integrating engineering, ecological and environmental design concepts into a capstone senior design project. *ASEE*, Nashville, TN, June 2003.

*Gattie DK. 2003. Ecology and Engineering. *NSF Bridges to Engineering Summer Institute*, College of Ed. & Faculty of Engineering, UGA, Athens, GA, June, 2003.

*Gattie DK, Borrett SR, 2003. Indirect Effects in Transport Networks. *AEES*, College Park, MD, May 2003.

*Gattie DK, Tollner EW, Collins JV. 2003. Integrating design criteria for management of urban ecosystems. *GA Water Res. Conf.*, Athens, GA, March 2003.

*Tanner Smith HM, Gattie DK, Smith MC, Byne FW, Collins JV. 2003. Gaps in Watershed Assessments in Georgia: Observations and Suggested Changes. *GA Water Res. Conf.*, Athens, GA, April 2003.

*Gattie DK, Borrett SR. 2003. Network Indirect Effects in Transport Networks: Integral Elements of System Complexity. *IBE, Athens*, GA, January, 2003.

d. Professional activity

American Society for Engineering Education

American Ecological Engineering Society
Institute of Biological Engineering
American Society for Agricultural & Biological Engineering

e. Expected responsibilities in this program

Teach undergraduate and graduate level courses
Advise undergraduate students
Sit on graduate committees and serve as major professor for M.S. and Ph.D. students