

# **VISION 2005 A Strategic Plan**

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# Table of Contents

<b>Vision Statement</b> .....	<b>1</b>
<b>Background</b> .....	<b>1</b>
<b>Undergraduate Education</b> .....	<b>1</b>
Technical Communication .....	2
Capstone Design .....	2
Engineering Economics, Ethics, Construction, Safety and Numerical Methods.....	2
Introduction to Transportation Engineering.....	3
Teaching Capacity in Geotechnical and Structural Engineering, and Fluid Mechanics.....	3
Early Exposure to Design .....	3
Exposure to Research.....	4
<b>Graduate Education</b> .....	<b>4</b>
Recruitment.....	4
Breadth, Balance and Resources.....	5
Preparing Doctoral Candidates for Teaching.....	5
<b>Education in General</b> .....	<b>5</b>
Quality, Responsibility and Accountability .....	5
New Pedagogical Techniques .....	6
Technology .....	6
Student Competitions.....	6
Study Abroad .....	6
<b>Research</b> .....	<b>7</b>
Environmental Engineering .....	7
Infrastructure Engineering .....	7
Transportation Engineering .....	8
Administration and Promotion of MDOT Centers .....	8
Scholarship.....	9
Coordination of Research and Teaching Laboratories.....	9
<b>Outreach</b> .....	<b>9</b>
Highway Traffic Safety Program (HTSP) .....	9
Technical Outreach Services for Communities (TOSC) .....	9
<b>Space and Facilities</b> .....	<b>10</b>
Infrastructure Research and Teaching .....	10
Environmental Engineering Research.....	10
<b>External Relations and Fund-Raising</b> .....	<b>10</b>
Alumni Cultivation .....	10
Professional Advisory Board .....	11
Fund-Raising.....	11
<b>Personnel Recruitment</b> .....	<b>11</b>

## **Vision Statement**

The Department of Civil and Environmental Engineering at Michigan State University will:

- establish an outstanding undergraduate program capable of producing the future leaders of the profession;
- establish nationally and internationally renowned research and graduate programs in the focus areas of environmental, infrastructure and transportation engineering, and provide leadership and support to federal, state and private agencies in these areas;
- excel in outreach and service to the profession and the community at large in selected areas, in keeping with the land-grant philosophy of the university; and
- employ principles of continuous quality improvement to enhance its programs and its mission.

## **Background**

The decade from 1995 to 2005 has started out, and is projected, to be one of significant change for higher educational institutions in the U.S., especially public ones. State legislatures and the public at large have become weary of the cost of education rising much faster than the cost of living and are demanding increased accountability from higher educational institutions. University administrators in turn are demanding accountability from faculty, and university budgets are generally being constricted. This is especially true at Michigan State University (MSU) because of the tuition guarantee provided to incoming freshmen over the last three years that their tuition will not rise above the consumer price index for four years after admission. Since approximately 50% of the operating budget of the university is derived from tuition, the tuition guarantee severely constricts the university's budget.

Another external factor motivating change in the undergraduate curriculum is the new ABET Criterion 2000 procedure for accreditation. This procedure requires programs to define educational objectives, develop appropriate assessment methods, and then continually improve the program. Continuous quality improvement (CQI) principles that form the basis of Criterion 2000 are consistent with the endorsement of these principles by the university in its partnership with Ford Motor Company.

The civil and environmental engineering (CEE) department at MSU is undergoing and will continue to undergo dramatic change in the decade from 1995 to 2005. This is not only due to the pressures imposed by the new climate, but also due to the age of the faculty, resignations that have occurred recently, and the retirements that will occur in this period. In this period of change, it is important that the CEE faculty have a clear vision of what they wish the department to be—hence this strategic plan. In the process of developing and fulfilling this plan, the CEE department will employ CQI principles.

## **Undergraduate Education**

The quality of our undergraduate program is one of the department's strengths. Our undergraduate students are engaged in the classroom by enthusiastic faculty, are exposed to teamwork, are involved in technical communication, partake in research projects, have good opportunities for cooperative education experiences with employers, and have opportunities for study abroad. Un-

dergraduate education is a strength that we must nurture. Further, in order to be accountable to the public and the university administration, undergraduate education cannot be neglected in favor of graduate education and research. Issues that must be addressed in this period are described below.

- **Technical Communication**

Problem/Need: While strong technical competency is highly valued by employers of our students, an area in which they see a need for significant improvement is in the ability to communicate clearly in written and oral form.

Objective: Involve students in technical communication throughout their junior and senior years so that by the time they graduate they will have mastered this skill.

Plan: While faculty have an ongoing responsibility to include and evaluate technical communications in the context of individual courses (e.g., design projects, laboratory reports) for which they are responsible, there is a clear need for assistance to be made available to students and instructors in this area. The department will therefore hire a specialist in technical communication to work with faculty so that technical communication is intertwined into several courses. Faculty must cooperate and work with the technical communication specialist, and take appropriate initiatives on their own, in order for this plan to be successful.

- **Integrated Design**

Problem/Need: In the existing curriculum, experience in engineering design has traditionally been gained through several different design classes. Students appear to have difficulty in coordinating and managing several design projects in the same semester, especially when many involve teams. There appears to be a need for an option or perhaps the requirement that students partake in one comprehensive design project, with a reduction (although not necessarily an exclusion) of other large team-based design efforts.

Objectives: Explore options for an integrated design class which would require students to work on a comprehensive design project spanning several subdisciplines of civil engineering, and involve team work, drawing, report writing and presentation experiences.

Plan: Formally assess difficulties encountered by students because of team-based projects in existing courses. Explore the option of implementing a required integrated design class each semester while de-emphasizing large team-based projects in other classes. The integrated design class should involve a large design project incorporating two or more subdisciplines of civil engineering, require students to work in teams, require a substantial design report including drawings to be submitted, and require a significant oral presentation to be made.

- **Engineering Economics, Ethics, Construction, Safety and Numerical Methods**

Problem/Need: Shortly after the conversion of the university calendar from quarters to semesters, partly due to the fact that the conversion of courses did not achieve the target reduction in credits required to maintain the same teaching load, the CEE faculty removed a number of courses from the curriculum. The material deleted from the curriculum consisted of engineering economics, engineering ethics, and numerical methods. Based on employer surveys, results from the Fundamentals of Engineering Examination, and other information, much of this material would be desirable in the CEE curriculum.

More recently, employer surveys and student opinions also indicated that students should be exposed to construction engineering, a topic that was absent even in the old quarter-

based CEE curriculum. This opinion is bolstered by the fact that a significant component of the current civil engineering market is construction-oriented. Many students who participate in cooperative education experiences encounter construction methods, but other students are often ignorant of these.

Objectives: Implement a curriculum in which all undergraduate students will have an opportunity to become familiar with engineering economics, ethics, construction, safety, and numerical methods. If possible, facilitate students wishing to focus more deeply in construction engineering to do so.

Plan: Explore options, including: introducing a junior-level class into the curriculum to include engineering economics and ethics, possibly taught by a part-time instructor; introducing an elective class in construction engineering, possibly taught by a part-time instructor; implementing a cooperative agreement with the CEE department at the University of Michigan, to use advanced video-conferencing technology that would enable our students to take a construction engineering course taught by their faculty, and their students to take a transportation engineering course taught by our faculty; complementing the strengths of the Building Construction Management Program at MSU and strengthening links with it; and introducing numerical methods in engineering in a “just-in-time” delivery mode into existing CEE classes.

- **Introduction to Transportation Engineering**

Problem/Need: Another victim of the transition from quarters to semesters was the “Introduction to Transportation Engineering” class. This was replaced with the requirement that all CEE undergraduate students take a senior-level transportation class. Employer surveys and student opinions indicated that an introductory transportation class was desirable.

Objective: Ensure that all undergraduate students are exposed to a broad variety of topics related to transportation engineering.

Plan: Continue offering a required introductory transportation engineering class each semester. This class was reintroduced beginning fall ‘98.

- **Teaching Capacity in Geotechnical and Structural Engineering, and Fluid Mechanics**

Problem/Need: With the appointment of Tom Wolff as associate dean, and with projected retirements, the department will be understaffed for teaching geotechnical and structural engineering and fluid mechanics classes. These are core areas of civil engineering that must be sustained to maintain the viability of the undergraduate program and to ensure continued accreditation.

Objective: Maintain adequate capacity for teaching geotechnical and structural engineering and fluid mechanics classes.

Plan: When hiring, look for faculty capable of teaching geotechnical and structural engineering and fluid mechanics classes at the undergraduate and graduate levels. Address both teaching and research needs when hiring new faculty.

- **Early Exposure to Design**

Problem/Need: In the current curriculum, students typically do not experience engineering design until their senior year. Exposing students to the excitement of design in the freshman or sophomore years could help retention, allow students to come into contact with the de-

partment early, and allow them to have an early feel for the different engineering disciplines.

Objective: Expose students to engineering design early in their curriculum.

Plan: Participate in the early design class coordinated by the college and evaluate the impact of this on students. If the impact on students is favorable, then continue to invest CEE faculty time in this course as needed.

- **Exposure to Research**

Problem/Need: Some undergraduate students desire to be involved in research, and this opportunity often helps graduate recruitment.

Objective: Expose students to research.

Plan: Encourage and employ undergraduate students to participate in research projects when appropriate. Continue to participate in the college's summer research internship program.

## Graduate Education

Graduate education is an important component of the department's mission, and is a basic requirement for research to flourish. The CEE profession appears to be moving toward a professional degree (e.g., a BS + MS) being the entry requirement for students to join the work force. While this issue is still controversial, it is likely to reinforce the MS program. Recent major studies on graduate education stress the need for breadth. The majority of graduate students will be placed in industry and not at universities, and the need of most industries is for a broadly educated generalist as opposed to a narrowly educated specialist.

Although the CE and ENE graduate programs have remained viable over the last few decades, at present enrollment in classes offered in some areas is low, and the recruitment of graduate students is problematic. Serious attention must be paid to graduate student recruitment and graduate education in general.

- **Recruitment**

Problem/Need: The recruitment of high quality graduate students is difficult, both for domestic as well as international students. A primary shortcoming is the lack of financial support when admitted. The availability of just a few teaching assistantships does not help this situation. A secondary shortcoming is the lack of visibility of department strengths, especially to attract domestic students from outside MSU.

Objective: Improve recruitment of high quality domestic and international graduate students.

Plan: Pursue a broad array of strategies including: (a) federal funding in focussed areas for support of graduate students (e.g., NSF GAAN program); (b) offer of 1/4-time research assistantships to highly rated incoming students, to be supplemented by the department using release funds; (c) strongly recommending graduate school to our undergraduates and recruiting them; (d) enhancing the Web pages devoted to graduate education; (e) circulation of brochure to other universities highlighting strengths of the department; (f) establishment of strong relationships with feeder schools that do not have graduate programs (e.g., Calvin College); (g) increasing visibility of department by increasing journal and conference publications.

- **Breadth, Balance and Resources**

Need/Problem: The need for breadth and balance in graduate programs tends to stretch faculty resources beyond capacity.

Objective: Maximize breadth in programs under constraints imposed by faculty size.

Plan: (a) Maximize use of support courses offered by other departments (e.g., MSM and statistics departments); (b) develop coordinated modular course units drawing upon the strengths of faculty within the department as well as from outside the department (e.g., joint courses between: ENE and chemical engineering faculty for a coordinated environmental engineering program; between geotechnical, pavements and structures faculty for a coordinated infrastructure program; between CEE and mechanical engineering faculty for a coordinated fluid mechanics program); (c) provide balance in courses, especially at MS level, between analysis, design, experimentation and planning.

- **Preparing Doctoral Candidates for Teaching**

Problem/Need: While some doctoral candidates desire to become college professors, they often are not trained to teach during their graduate studies.

Objective: Provide teaching experience to those doctoral candidates who desire to become college professors.

Plan: Participate in the teaching certification program being explored by the college, and encourage doctoral students who desire to become college professors to obtain certification. Allow capable graduate students to help teach courses with strong oversight and mentoring by faculty.

## **Education in General**

In order to remain at the forefront of higher education, the faculty will embrace the following:

- **Quality, Responsibility and Accountability**

Problem/Need: High involvement in research and outreach can sometimes undermine the quality of instruction and accountability in instruction. Maintenance of high quality requires that faculty invest thought and effort in making their courses as educationally effective as possible. Faculty also need to work with departments that provide service courses to CEE students to document and communicate needs and shortcomings so that the curriculum in the freshman and sophomore years can be improved.

Objective: Provide students with a high quality educational experience and be responsible in teaching.

Plan: Emphasize high quality and responsible teaching in performance evaluations, merit raises, and promotions. Explore implementation of methods to assess teaching in addition to student feedback. Ensure that: (a) regular faculty teach all required classes and most elective classes in the curriculum; (b) faculty limit extensive travel when they have teaching obligations; (c) faculty establish an acceptable number of office hours and be accessible to students outside of the classroom, including through electronic mail; (d) teaching capability of visiting instructors is carefully screened; and (e) faculty document and communicate needs and shortcomings of service courses to departments offering the courses.

- **New Pedagogical Techniques**

Problem/Need: With the gradual shifting of emphasis from teaching to learning, there is a nationwide movement for undergraduate curriculum reform in which learning is taking the center-stage. This has been accompanied by the elucidation that traditional pedagogical techniques by themselves often do not maximize student learning.

Objective: Maximize the learning potential of students.

Plan: Introduce new pedagogical techniques such as cooperative learning, development of student portfolios, etc., into the curriculum as appropriate. This will require faculty to take an interest and learn new pedagogical techniques when opportunities arise. Promote scholarship of successful new pedagogical techniques in regional and national journals and conference proceedings.

- **Technology**

Problem/Need: Education needs to keep pace with the rapid change in technology. Faculty members must be conversant with new technology so that they may: (a) expose students to it as appropriate and prepare them for a modern workplace; and (b) utilize it to enhance instruction and learning (e.g., by creative use of the Web, employing distance learning techniques, etc.).

Objectives: Expose students to new technology in relation to their classes and for enhancing learning.

Plan: Encourage faculty participation in technology-related seminars, promote the use of technology in instruction, and provide students to help faculty implement new technology in their classes.

- **Student Competitions**

Strengths/Needs/Opportunities: Students' learning experience is enhanced by participation in regional and national student competitions. The department participates strongly in the ASCE/AGC concrete canoe competition, the AISC steel bridge competition, and the WERC environmental design contest, as well as other competitions including student poster contests at some key annual conferences.

Objective: Enhance learning experiences by providing students opportunities to participate in regional and national competitions.

Plan: Provide financial, material and facilities support to enable students to compete and encourage faculty to coach projects.

- **Study Abroad**

Problem/Need: With increasing globalization of the engineering profession, students need to be aware of cultures and business practices around the world.

Objective: Expose students to cultures and business practices in other countries.

Plan: Strengthen study abroad program in Russia to include a variety of CEE subdisciplines. Restructure and stabilize the graduate program with the National University of Science and Technology in Pakistan. Develop additional study abroad programs, especially at the undergraduate level.

## Research

The national and international reputation of the department, and its appeal to both graduate and undergraduate students, will be based on its success in research. Therefore it is imperative that the department's research be strengthened. In order to make an impact, research activities will need to be focussed on areas where the potential for impact is greatest based on accomplishments to date.

- **Environmental Engineering**

Strengths/Needs/Opportunities: The department's strengths are in chemical and biological environmental remediation and on the use of ozone in environmental applications. There is strong potential for continued funding in these areas from the Great Lakes Hazardous Research Substance Center (HSRC), the Environmental Protection Agency (EPA), the National Institute for Environmental Health and Safety (NIEHS), the National Science Foundation (NSF), and other sources. However, with the resignation of Craig Criddle, there is a strong need for someone with expertise in environmental microbiology, biological processes and/or environmental biotechnology. There also is a strong need within the MSU environmental science and engineering community for expertise related to air pollution. The potential for sustained research funding in the air pollution area is strong. A framework must be established to continue activities currently sponsored by HSRC when this center comes to an end. The department leads the effort to coordinate the university's environmental science and engineering activities and must continue this until 2005 and beyond.

Objectives: Remain strong and viable in environmental remediation research. Create a focal point for environmental science and engineering research at MSU to take the place of HSRC and the MSU Center for Microbial Ecology when these centers cease to exist. Increase work related to the use of remediation and ozone in agrarian applications. Facilitate the creation of a viable base for research related to air pollution.

Plan: Hire an assistant or associate professor with expertise in environmental microbiology, biological processes and/or environmental biotechnology. Establish an environmental remediation experiment station. Continue pressure on the central administration to fund two new positions related to air pollution. Continue leadership in coordination of environmental sciences and engineering activities at MSU. Continue to interact strongly with chemical engineering and agricultural engineering faculty at MSU.

- **Infrastructure Engineering**

Strengths/Needs/Opportunities: The department's strengths are in pavement and construction materials engineering. The department has the strongest pavement engineering research program of all universities in Michigan. The Michigan Department of Transportation (MDOT) sponsored Pavement Research Center of Excellence (PRCE) headquartered in the department is a source of steady funding. There is strong potential for continued funding in pavement and construction materials engineering from MDOT, the Great Lakes Center for Truck and Transportation Research (GLCTTR), the Federal Highway Administration (FHWA), the National Cooperative Highway Research Program (NCHRP), and other federal sources.

Strong research opportunities also exist at the state and federal levels for the application of composite materials to infrastructure problems. An expert in this area would add to the de-

partment's and college's materials focus, and would strengthen the capabilities of the MSU Composite Materials and Structures Center (CMSC).

For the growth and viability of research in infrastructure engineering, a pressing need exists for a Civil Infrastructure Laboratory.

Opportunities are emerging within Michigan for applied research in construction engineering related to the strengthening of the design-build process in construction, and assisting construction companies with the establishment and measurement of metrics for continuous quality improvement. Traditional research in construction engineering is limited by funding opportunities, and the emerging applied research opportunities are likely to be unsuitable for scholarship.

Objectives: Remain strong and viable in pavement engineering, and strengthen research capability in construction materials by adding expertise in the application of composites to infrastructure problems.

Plan: Renew the pavement research center beyond 2000. Hire a faculty member with expertise in the application of composites to infrastructure problems. Construct a Civil Infrastructure Laboratory. Hire a specialist in construction engineering to address both teaching needs and applied research potential.

- **Transportation Engineering**

Strengths/Needs/Opportunities: The department has the strongest transportation engineering program of all universities in Michigan, with expertise in traffic safety and operations, and emerging expertise in intelligent transportation systems. The MDOT-sponsored Traffic Safety and Operations Research Center of Excellence, and the Michigan Transit Center, are sources of steady funding. There is strong potential for continued funding in this area from MDOT, the Office of Highway Safety Planning (OHSP), GLCTTR, FHWA and other sources. The anticipated retirement of three of the five transportation engineering faculty members in the period leading up to 2005 will have a serious impact on the department's strength in this area. A carefully planned recruitment process is required to ensure that retirements does not decimate this thrust area of the department and college.

Objectives: Continue to be the strongest university department in the state for research in transportation engineering, and balance expertise across design, planning and operations.

Plan: Renew the two MDOT-sponsored transportation centers beyond 2000. Strategically replace retiring faculty members by hiring at the associate/full professor level an established researcher and teacher to collaborate with the remaining core group to maintain breadth and balance, and expand the strong links with MDOT, GLCTTR, and other agencies.

- **Administration and Promotion of MDOT Centers**

Problem/Need: The separate administration of three MDOT-sponsored centers duplicates effort and creates unnecessary overhead costs.

Objective: Administer and promote all MDOT-sponsored centers in a unified manner.

Plan: Work with MDOT management to create a unified administrative structure for all MDOT-sponsored centers. Develop materials to promote the centers nationally and internationally.

- **Scholarship**

Problem/Need: Becoming nationally and internationally renowned requires consistent scholarship in leading journals and presentations at prominent conferences.

Objective: Become nationally and internationally renowned in the focus areas of environmental, infrastructure and transportation engineering.

Plan: Promote scholarship amongst all faculty, and emphasize this strongly in performance evaluations, awarding of merit raises, and promotions.

- **Coordination of Research and Teaching Laboratories**

Problem/Need: With ownership of a significant amount of highly sophisticated laboratory equipment there is a strong need for ensuring the proper operation and maintenance of the equipment. This is presently the case with environmental engineering laboratories, and will also become the case for the Civil Infrastructure Laboratory being planned. Maintenance of computer equipment in the transportation and graduate student computer laboratories is also a need.

Objective: Provide adequate coordination of research and teaching laboratories and relieve faculty members of this burden.

Plan: Establish and hire laboratory coordinators for environmental and infrastructure laboratories. These coordinators are to be supported mostly by research funds generated by all faculty members using these laboratories. However, in order to ensure continuity, these positions should be established as continuing system appointments. Provide continued student support for maintaining the transportation and graduate student computer laboratories.

## Outreach

- **Highway Traffic Safety Program (HTSP)**

Strengths/Needs/Opportunities: The HTSP is strong and self-sustaining, and consists primarily of the offering of short courses in Michigan. Courses are offered in accident investigation and reconstruction, alcohol enforcement, radar instructor training, traffic engineering and safety, and more recently pavement engineering. While some short courses are funded by state agencies, most charge tuition fees. Funding by state agencies is becoming constricted, and the long-term potential for continued support is uncertain.

Objective: Continue offering high quality short courses, and expand offerings.

Plan: Gradually convert state-funded short courses for which potential for continued funding is uncertain to tuition-based courses. Expand offerings to other civil engineering areas by using funds generated by tuition fees to employ part-time instructors and coordinators.

- **Technical Outreach Services for Communities (TOSC)**

Strengths/Needs/Opportunities: The TOSC program is strong and growing, and provides assistance to various communities in dealing with their environmental pollution problems. Meetings are held with community representatives, and complex technical problems are presented in non-technical terms, so that communities can develop effective strategies to combat environmental pollution. The program is funded by federal agencies, and the potential for continued funding is strong.

Objective: Continue TOSC.

Plan: Sustain a high quality service that will continue to be funded by federal and state agencies.

## Space and Facilities

At present, research and teaching activities are significantly hampered by the lack of space and adequate facilities.

- **Infrastructure Research and Teaching**

Problem/Need: In the civil infrastructure area, teaching and research in geotechnical engineering, pavements and construction materials share common and inadequate lab space. If the plan to construct a Civil Infrastructure Laboratory is successful, then this will largely remedy the problem. However, the new laboratory will need to be equipped, and additional laboratory space is required for expansion of research on asphalt pavements.

Objective: Secure sufficient space and equipment for infrastructure research and teaching.

Plan: Give high priority to construction and equipping of the Civil Infrastructure Laboratory in fund-raising activities. Request additional laboratory space from the college for expansion of research in asphalt pavements.

- **Environmental Engineering Research**

Problem/Need: The Research Complex–Engineering, where environmental engineering research is performed, is not properly designed for work involving hazardous substances. In addition, the laboratory space allocated there is inadequate for the work being done. Space that is available for allocation is not properly equipped with benches and hoods and is therefore of little use. As environmental sciences and engineering work across MSU is coordinated, a focal point for this work is needed in the form of an environmental remediation experiment station.

Objective: Secure a suitably designed facility, or suitably renovate the Research Complex–Engineering, to house an environmental remediation experiment station.

Plan: Give high priority to the establishment of an environmental remediation experiment station in fund-raising activities. Work with the college and the central administration to secure a suitably designed facility.

## External Relations and Fund-Raising

- **Alumni Cultivation**

Problem/Need: While public universities have generally not paid much attention to alumni cultivation, budget constraints necessitate increased effort on this front. The establishment of discretionary funds, and endowed faculty positions and student fellowships, is a must for the growth of the department.

Objective: Improve alumni relations in order to increase the long-term potential for fund-raising.

Plan: Continue publication of the department newsletter at least once per year. Hold regular alumni events such as an annual dinner, an annual tailgate party preceding a football game, and so on. The department chairperson, as well as prominent faculty members, will visit potential donors who have been cultivated by the college development staff.

- **Professional Advisory Board**

Problem/Need: The department needs a professional group to assist with alumni cultivation, provide feedback regarding trends in the work place and how the CEE programs address them, and assist in championing the department within the university administration as well as the external public.

Objective: Transform the Professional Advisory Board into a high-performing team.

Plan: Recruit alumni and professionals with high energy into the board. Focus board activities to a few essential tasks. Gradually give more and more responsibility to the board. Recognize highly active board members through awards and honors.

- **Fund-Raising**

Problem/Need: A sustained fund-raising effort is critically needed for improving and expanding faculty activities. Fund-raising is especially significant in this period since MSU is expected to embark on a capital campaign.

Objective: Raise a significant amount of external funds for facilities improvements and endowments.

Plan: Cultivate alumni and private industry for major gifts. Cooperate with the college development office to visit major donor prospects. Senior faculty participation is important in the cultivation effort. Target capital campaign funds for the following: construction of and equipment for the Civil Infrastructure Laboratory; establishment of Environmental Remediation Experiment Station; endowed student scholarships and fellowships; endowed laboratory development fund, including support for student design experiences, competitions, and activities; endowed faculty chairs and fellowships; study abroad endowed and expendable scholarships, fellowships and stipends; endowed faculty and staff development fund, especially for new faculty; and an endowed lecture series.

## **Personnel Recruitment**

In order to address the problems, needs and opportunities outlined above, the plan for hiring new personnel in the period up to 2005 will be as follows:

- Immediately search for a 50% to 100% time fixed-term specialist to impart technical communication skills to students.
- Immediately search for an assistant or associate professor with expertise in environmental microbiology, biological processes and/or environmental biotechnology.
- Hire an assistant or associate professor by fall 1999, with expertise in the application of innovative materials to infrastructure problems, and with the ability to teach undergraduate and graduate classes in structural engineering. The new faculty member should be capable of interacting strongly with CMSC and/or PRCE.
- Explore the possibility of: (a) using part-time instructors to teach construction engineering, engineering economics, and ethics; and/or (b) hiring a faculty member with expertise in construction management and engineering to be jointly appointed in agricultural engineering (lead) and CEE, who will teach construction engineering courses for CEE and perform applied research and outreach for construction companies.

- If Tom Wolff's position as associate dean for undergraduate studies becomes permanent, then hire an assistant professor with expertise in geotechnical engineering and cross-disciplinary research interests.
- Strategically replace retiring transportation engineering faculty members by hiring at the associate/full professor level an established researcher and teacher to collaborate with the remaining core group to maintain breadth and balance, and expand the strong links with MDOT, GLCTTR, and other agencies.
- Replace retirements and resignations in a strategic manner such that instructional capability in the core areas of civil and environmental engineering is maintained, and research in the department's focus areas of environmental, infrastructure and transportation engineering is strengthened.