Department of Construction Management

University of Washington

Program Self Study

May 2000

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NARRATIVE

I. Context

A. Name of unit authorized to offer degree: Department of Construction Management

B. School or College: College of Architecture and Urban Planning

C. Exact title of degrees offered:

Master of Science in Construction Management

Bachelor of Science in Construction Management

D. Brief history of the field and its history at the University of Washington:

Construction management is a multi-dimensional professional field that involves the planning and construction of man's built environment. Some construction managers identify project criteria and scope, select design teams to develop detailed plans and specifications, and select skilled construction teams to create the facilities described in the plans and specifications. Other construction managers analyze project plans and specifications, determine the means and methods of construction, develop project budgets, and plan work sequences to construct projects efficiently. Still other construction managers are responsible for managing construction firms.

The construction management program at the University of Washington had its beginning during the 1950's when students created their own individual programs from existing university courses. Students pursuing these studies were awarded BA degrees from the College of Arts and Sciences. In October 1962, a decision was made to discontinue the BA degree option within the College of Arts and Sciences and to replace it with a similar program in the College of Architecture and Urban

Planning. In May 1963, the Board of Regents approved the curriculum and created a program entitled Building Technology and Administration. The first course was offered to 31 students during the winter quarter in 1964. The first six graduates were granted BS degrees in June 1965. The present department was created by the Board of Regents in August 1968 and given the title of the Department of Building Construction. In April 1994, the Board of Regents approved the curriculum and authorized the creation of a Master of Science in Building Construction program. The first graduate courses were offered during the autumn quarter of 1994 with an initial enrollment of ten graduate students. Also in 1994, the department developed the Certificate program in Construction Management with UW Extension. In 1996, the Board of Regents changed the name of the department to the Department of Construction Management and the degrees offered to Bachelor of Science and Master of Science in Construction Management. The first Master of Science in Construction Management degree was awarded in June 1997. Undergraduate enrollment has grown to 60 students per class, and there are about 50 students in the master's program.

II. Unit Roles and Responsibilities

A. What are the principal roles and the responsibilities of your unit within your school/college and the university?

Roles and Responsibilities of the Department of Construction Management

The strategic plan for the Department of Construction Management (Appendix F) was adopted in September 1999. The department's mission is "to prepare individuals for careers in the construction and related industries by providing a high quality education, to conduct research that will benefit the construction industry, and to provide service to the community." Our vision is "to become a recognized program of choice for students seeking a construction management education and an internationally recognized research center." The varied roles of the department in education,

research, scholarly activity, and professional and public service all stem from this mission and vision.

Roles in Professional Undergraduate Education

The primary educational program within the Department of Construction Management is the accredited Bachelor of Science in Construction Management program. This program prepares graduates for professional careers in the construction industry. The interdisciplinary curriculum shown in Appendix H contains a mix of technical, managerial, and business courses. Students complete their first two years of study as a pre-major at the University of Washington or at a community college. The professional portion of the curriculum is concentrated in the student's final two years of study. The curriculum is continuously reviewed by the faculty to ensure that graduates are provided with the skills and knowledge necessary to perform effectively in entry-level positions within the industry. The program is accredited by the American Council for Construction Education, with its latest review and accreditation being in July 1995. A copy of the accreditation report is in Appendix J. The next review is scheduled for 2001.

Roles in Professional Graduate Education

The department's evening graduate program was established in 1994 to provide graduate education opportunities to working professionals by allowing them to broaden and improve their technical and managerial abilities. The curriculum was developed jointly by the faculty and leaders of the local construction industry. The focus of the program is to prepare graduates for upper management positions in a construction activity, whether it be in an owner's organization, a design firm, or a construction firm. The program consists of a required core curriculum, student-selected construction

emphasis courses, electives, and a significant research product, either a thesis or a graduate research report. All graduate classes are offered during the evening to accommodate students who work during the day. The details of the program are described in Appendix G.

Roles in Professional Continuing Education

The department established a 9-month Certificate Program in Construction Management with UW Extension in the autumn of 1994 to provide educational opportunities for professionals in construction, architecture, and engineering who wish to develop and expand their technical and managerial skills without pursuing degrees in construction management. Enrollment was limited to 50 students each year until 1996, when it was raised to 60 students. A descriptive brochure is in Appendix M. In 1999, a distance-learning version of the program was offered in addition to the traditional classroom version to accommodate individuals who are unable to attend on-campus courses.

Faculty members conduct continuing education seminars as a part of the college's continuing education program and participate in educational programs offered by the Associated General Contractors of Washington, Mechanical Contractors of America, the Federal Emergency Management Agency, the Central Area Motivation Program's Contractors' Resource Center, and local government agencies. The department is also working with the Seattle School District's School-to-Work Program to provide high school vocational education in the construction trades.

Roles in Applied Research

Faculty members conduct research to expand the knowledge base within the profession. Major research focuses are on construction productivity, construction labor forecasting, construction materials and building systems, sustainable materials, use of recycled materials, project delivery methods, and project management techniques. The department has requested funding to establish the Pacific Northwest Center for Construction Research and Education to provide a focal point for coordinating its research activities. A copy of the proposal is in Appendix O. Recent and current research activities are described in Section II B *Opportunities in Research.*

Roles in the Creation of Scholarly Work

Faculty members produce scholarly works to expand the knowledge base within the profession and to disseminate their research findings. They have published their research results in professional journals and in technical conference proceedings. Technical reports also have been published by the department to inform local industry leaders of research activities. Two books have been published by faculty members that can be used as textbooks in professional education programs and as professional references.

Other Roles in Relation to the College and the University

The department is fortunate to be located in the College of Architecture and Urban Planning with three other departments; the Department of Architecture, the Department of Landscape Architecture, and the Department of Urban Design and Planning. The department also enjoys a variety of links to other units in the university, with the principal relationship being with the Department of Civil and Environmental Engineering. One faculty member has a joint appointment in the Department of

Urban Design and Planning, and three others hold adjunct appointments in the Departments of Architecture and Civil and Environmental Engineering. One faculty member teaches a construction materials and methods course that is required by all architecture students, and another teaches a design and construction law course for architecture students and a labor relations course for civil and environmental engineering students.

The most completely structured shared program is the undergraduate double-degree program in architectural studies and construction management. It is a coordinated program with a clearly defined curriculum that enables students to earn both a BA in Architectural Studies and a BS in Construction Management in five years. A copy of the double-degree curriculum is in Appendix I.

B. What opportunities do these roles provide you and how have you taken advantage of them? What plans do you have for exploring additional opportunities? What opportunities have you missed and why?

Opportunities Provided by Professional Constituency

Seattle and the Puget Sound Region not only serve as a laboratory, but also as a significant resource. The department enjoys the advantages of strong links to local construction firms, professional organizations, and public agencies. It routinely draws upon local professionals to serve as guest speakers in classes, part-time faculty, and jury members for fourth-year undergraduate student CAPSTONE presentations. This provides needed expertise to supplement that available among the full-time faculty. The many construction projects within the metropolitan area serve as laboratories for student field trips and research.

The department is significantly aided by an active Construction Industry Advisory Council that provides advice regarding curriculum and research activities. The Executive Committee of the Council meets with the faculty quarterly to discuss department programs and initiatives. An annual membership meeting provides an opportunity for members to interact with students and faculty. The Council was responsible for raising funds to purchase the equipment needed to establish the construction management computer laboratory in Gould Hall. The vision and mission of the council and a list of current executive committee members are in Appendix N. The council provides resources to recognize outstanding students and to assist the department in its fund-raising efforts.

The department also benefits from a strong alumni association, because many of its graduates are employed in the local area. The alumni association assists with student recruiting and hosts social events for students.

Opportunities Provided by the University

Our graduate students take courses offered by the Department of Civil and Environmental Engineering, and their graduate students take graduate courses offered by our department. Many of our graduate students take their elective courses from the School of Business Administration, which supplement the business management courses in our curriculum. The department is developing a self-supporting distance-learning Master of Science in Construction Engineering program that is to be offered jointly with the Department of Civil and Environmental Engineering. This program will provide accessible graduate education to professionals in heavy construction who are unable to attend on-campus classes.

Resource Opportunities

Because of the establishment of the graduate program and faculty resignations and retirements, the department has had the opportunity to hire five new faculty members in the last six years. The diversity of experience among the new faculty members has strengthened the department, and provided an opportunity to increase course offerings and pursue a variety of research initiatives. The strong financial support from the local construction industry allowed the department to equip a 25-workstation computer laboratory and purchase automation equipment to support instruction and research activities. In addition, significant contributions are provided each year to support student participation in competitions hosted by the National Association of Home Builders, the Associated Schools of Construction, and the Associated General Contractors of America. These student competitions provide excellent educational experiences for our students.

Students receive scholarship support from the Associated General Contractors of Washington, the National Association of Women in Construction, the Master Builders Association of King and Snohomish Counties, the Mechanical Contractors of America, and the Construction Specification Institute.

All undergraduate students are required to complete an internship in the industry between their third and fourth year of study. The large number of construction firms in the Puget Sound Region provides a wide variety of work experiences for our students. Construction firm managers work closely with the department to maximize the students' learning experiences during these internships.

Professor Riley in conjunction with four other faculty members in the college submitted a proposal to the "Tools for Transformation" fund in the Provost's office seeking funding to create a "web center" for courses offered in the college. This proposal received significant funding and the college web center was established in mid-1999. Other faculty members are using the "web center" to place their instructional materials on the web. Professor Nemati , in collaboration with Professor Jansen in the Department of Civil and Environmental Engineering, has prepared a "Tools for Transformation" proposal to establish a construction materials laboratory.

Opportunities in Research

The department's research activities have grown significantly in the past five years with the hiring of additional faculty and the establishment of the graduate program. The department submitted a request for funding to establish the Pacific Northwest Center for Construction Research and Education as an Advanced Technology Initiative. The request was not funded by the State Legislature during the 1999-2001 biennium, but the Provost's office provided funding to develop an enhanced proposal to request funding for the 2001-2002 biennium. The funding will be used to support research into sustainable building materials and the development of a web site database devoted to construction materials. Professor Riley received grants from the National Electrical and Mechanical Contracting Foundations to study work sequencing to improve job site productivity. Fourteen construction projects were studied to identify methods of coordination management on production and effective techniques for developing productive work sequences. He also partnered with Professor Palleroni from the Department of Architecture to research how alternative building methods can be used to solve housing problems for migrant farm workers and Native Americans. Professor Schaufelberger has received an annual grant from the Associated General Contractors of

Washington Education Foundation for each of the past five years to analyze the impact of the construction industry on the economy of the Washington State. He also has guided numerous graduate student research projects. Professor Pace is working with the Seattle Construction Roundtable to forecast the demand for construction labor in King County over the next five years and the availability of skilled labor.

Opportunities Missed

Our greatest missed opportunity is our inability to provide students with hands-on laboratory experience with construction materials and building systems, because we lack suitable facilities. To overcome this deficiency, the development of a construction materials laboratory at Sand Point is a key component of our Advanced Technology Initiative request for the establishment of the Pacific Northwest Center for Construction Research and Education (Appendix O).

In response to a demand for greater access to our undergraduate program, we increased enrollment from 40 students per class to 60 students per class. Since no additional resources were provided, this enrollment increase resulted in increased teaching loads for our faculty members. As a consequence, we missed the opportunity to increase our research activities and to pursue collaborative projects with other departments and universities.

Another area of missed opportunity is our lack of course offerings for students who want to pursue careers in heavy construction. A new distance-learning Master of Science in Construction Engineering program being developed with the Department of Civil and Environmental Engineering will provide graduate education opportunities for these students. A heavy construction elective is

being developed for our undergraduate curriculum to provide students an opportunity to study heavy construction issues.

C. What differences do you observe between your view of your role and the college/university expectations of your unit? How might these differences be resolved?

We believe that the department's view of its roles, as described earlier, are very much in synchronism with the priorities of both the college and the university. These priorities are embedded in our strategic plan (Appendix F). Our research productivity has been less than desired, but that should improve as recent faculty hires develop their research agendas, and we obtain funding for hiring additional faculty members and graduate assistants. We believe significant productivity improvement will be achieved if the department receives funding to establish the Pacific Northwest Center for Construction Research and Education (Appendix O).

D. What changes have occurred in your field over the past decade that have influenced your conception of the unit's role? What pressures, internal and external, have caused significant changes, and what further pressures and changes do you anticipate in the next ten years? What changes have taken place in the relationships between your field and other related fields?

Changes over Past Decade

The major change that has occurred over the past decade is the maturing of construction management as a recognized profession. The number of universities offering degrees in construction management has grown significantly, and the demand for graduates has increased. Much of this demand is a result of the competitive nature of the industry and the technical and business skills needed for success. Purchasers of construction services are more sophisticated, and they demand high quality projects that must be completed in short periods of time. This requires skilled construction managers, placing pressure on the educational institutions to educate them. As a result,

our undergraduate enrollments have increased without increases in faculty resources. The changes in the industry over the past decade also have resulted in several curriculum adjustments.

Another major change has been the increased use of automation for construction management. Even small firms now use specialized software to manage their construction projects. The curriculum was modified to add courses in the use of automation, and private funding was raised to establish a construction management computer laboratory.

Increasing specialization within the industry and the changes in construction management techniques over the past decade led to increased demand for continuing education. To respond, the department established both the evening Master of Science in Construction Management program (Appendix G) and the Certificate Program in Construction Management (Appendix M).

Anticipated Changes over Next Decade

The major changes anticipated over the next decade are increased use of web-based technology for construction management and the use of new construction materials and techniques. The proposed Pacific Northwest Center for Construction Research and Education (Appendix O) would be a focal point for research into these areas. Curriculum will need to be reviewed to incorporate research findings and changes in industry practices. These anticipated changes also will generate increased demand for continuing education programs.

Relationship Changes with Related Fields

The discussion in Section II B *Other Roles in Relation to the College and the University* described a number of relationships with other academic fields on campus. These will continue to grow as the faculty expand their research efforts. There is considerable interest within the industry in integrating the design and construction professions, as many owners select a design-build method of project delivery. In the international construction market, owners are using a build-operate-transfer delivery method, in which the construction manager must arrange for project financing, design the project, construct it, and operate it for a designated period of time. Relationships with architecture, engineering, business management, government relations, and legal fields will increase as we structure the curriculum to provide the educational foundation needed for success in an evolving construction industry. Research activities also will become more multidisciplinary, as increasingly complex issues are studied.

E. What criteria are typical in your field against which you measure the success of your unit as a whole?

The primary criteria are the quality of our course offerings, the graduate and undergraduate curriculums, and the quality of our graduates. Our undergraduate program is reviewed by the American Council for Construction Education every six years to ensure it meets accreditation requirements. The last review was in 1995, and the next is scheduled for 2001. A copy of the most-recent accreditation report is in Appendix J. Other criteria are our ability to attract and retain experienced faculty members and the significance of our research activities and scholarly publications. Also, the success of our students in regional and national competitions is an indication of the strength of our program.

F. In what ways is your unit a leader in your field? Describe areas and strategies for developing your potential for leadership in your field.

Leadership in Construction Education

The quality of the educational experience provided by the department has improved significantly over the past six years as five new faculty members have been hired and the curriculum has been strengthened to emphasize technical, managerial, and communication skills. Also, a construction management computer laboratory has been established to provide students an opportunity to learn automated cost estimating and project scheduling skills. As a result of these improvements, there has been greater demand for access to the construction management major. Undergraduate enrollment has grown from 40 students per class to 60 students per class. The number of applicants has grown over the past four years, and our standards for admission have increased. Industry demand for graduates also has grown with the number of firms recruiting on campus increasing four-fold over the past three years.

Undergraduate students participating in student competitions hosted by the Associated Schools of Construction and the Associated General Contractors of America have placed high for the past four years. Our commercial construction team took first place in the national competition in 1999 and second place in 2000. The success of our students in these competitions demonstrates the quality of our educational program. It has resulted in many national construction firms coming to the UW to recruit our students.

While our evening graduate program was established to provide educational opportunities for working professionals, we have attracted several full-time traditional students. Many international applications have been received, and 13 international students have been admitted during the past

four years. The military departments also have recognized the quality of our program and have sent six officers during the same period.

To strengthen our educational programs, we are planning to develop a materials laboratory and mechanical and electrical construction laboratory at Sand Point and to add course offerings to provide undergraduate students an opportunity to study issues in heavy construction and specialty contracting.

Leadership in Research

The department is aggressively pursuing research opportunities, and is capitalizing on the expertise of recent faculty hires. The focal point of these initiatives is the proposal to establish the Pacific Northwest Center for Construction Research and Education (Appendix O). If funded, the center will provide the resources needed to create a strong interdisciplinary research program. Professor Riley has received funding from the National Electrical and Mechanical Contracting Foundations to study work sequencing and improve job site productivity. He also received a research grant to investigate the suitability of using straw bales as a construction material. Professor Schaufelberger has received annual grants from the Associated General Contractors of Washington Education Foundation to study the impact of the construction industry on the economy of the State of Washington. To increase our research activities, the department needs additional faculty resources to reduce the teaching load of our current faculty members and needs funding for graduate assistants.

Leadership in Scholarship

Department faculty members have demonstrated leadership in scholarship by presenting papers at conferences and by publishing journal articles and books. Professors Daniali, Nemati, Pace, Riley, and Schaufelberger have presented papers at national conferences conducted by the American Society of Civil Engineers, the Associated Schools of Construction, and the Association for the Advancement of Cost Engineering. They also have published peer-reviewed papers in national journals. Professor Goldblatt edited a book entitled *1991 Wiley Construction Law Update.* Professor Schaufelberger published two books: *Contracts With the Trades: Scope of Work Model for Home Builders*, with John Fredley in 1997, and *Construction Equipment Management* in 1999. Professor Nemati has presented several papers on fracture mechanics of concrete to international conferences. Our productivity in the production of scholarly work will improve as we strengthen our research activities. In spite of limited travel budgets, the department uses its discretionary funding to finance faculty participation in technical conferences.

G. In what ways do you collaborate with units at other institutions to maximize the effectiveness of each institution's contributions to the field? How do your ties to similar departments in other institutions across the country help you respond to new developments in your field? How could/should these ties be strengthened?

Collaboration occurs at major national conferences sponsored by academic and professional organizations, such as the Associated Schools of Construction, the American Council for Construction Education, the American Concrete Institute, and the American Society of Civil Engineers' Construction Congresses. Department faculty members collaborate with faculty from other institutions in workshops, panel discussions, paper presentations and discussions, and interest group meetings. The 1997 annual meeting of the Associated Schools of Construction was hosted on the UW campus by the department. The department is a member of the Specialty Construction

Institute, a collaborative effort with five other universities (University of California at Berkeley, University of Kansas, Georgia Tech, Virginia Tech, and Penn State) to develop a shared curriculum in specialty construction. In November 1999, Professor Nemati led a civil engineering delegation to the People's Republic of China under the auspices of the People to People program. He also is collaborating with faculty at Michigan State University in studying rapid rehabilitation of concrete pavements and with faculty at the University of Tokyo studying the modulus of elasticity for modern concrete.

H. In what ways have you collaborated with related areas across this campus? What would be needed for ties with related units to be strengthened?

The department collaborates with other units on campus in a variety of ways. It shares with the Department of Architecture a 5-year undergraduate double-degree program in which students earn both a BS in Architectural Studies and a BS in Construction Management (Appendix I). Students from the Business School and the Department of Civil and Environmental Engineering regularly enroll in both undergraduate and graduate construction management courses. Department faculty members serve on graduate supervisory committees in Civil and Environmental Engineering. Ties with Civil and Environmental Engineering will be strengthened as the distance-learning MS in Construction Engineering program is developed. The department also collaborates with UW Educational Outreach in the development and offering of continuing education programs such as the Certificate Program in Construction Management and professional short courses.

III. Degree Programs

A. Bachelor's degree

1. Describe the objectives of your bachelor's degree program in terms of student learning and other relevant outcomes, as well as its benefits to the department, university, and region.

The undergraduate curriculum (Appendix H) consists of two years of general studies at the UW or a community college followed by two years of professional studies as a construction management major. During the first two years, students fulfill department general education requirements and build a strong liberal arts and sciences foundation. The final two years are focused on acquiring technical and managerial skills. The educational objectives of the program are to enable graduates to develop:

- Technical skills necessary to define and solve practical construction problems,
- Managerial skills necessary to make and implement sound and timely decisions in a prudent and professional manner,
- Broad perspectives of the humanities and social and natural sciences, and
- The ability to communicate clearly and concisely both orally and in writing.

Graduates of the program have multiple options. Some seek employment with construction firms. Others seek employment with public agencies or private firms that have their own construction management staffs. Others seek employment with design firms, particularly those who receive degrees in both architectural studies and construction management. A few pursue graduate studies, but most want to acquire industry experience before considering graduate school.

The construction management program is one of four in the state that serve the construction industry. There is a two-year degree program at Edmonds Community College, a four-year degree program at

Central Washington State University in Ellensburg, and a five-year degree program at Washington State University in Pullman and Spokane. Our program is the oldest and largest in the state.

2. List the standards by which you measure your success in achieving your objectives for the undergraduate program. Using these standards, assess the degree to which you have met your objectives, and discuss the probable causes for your success. Indicate the factors that have impeded your ability to meet your objectives and your plans for overcoming these impediments.

The department uses several techniques for evaluating the success of the undergraduate program. The accreditation evaluations conducted by the American Council for Construction Education every six years provide an external assessment of our program. Only one evaluation was conducted during the past decade, and that was in 1995. A copy of the accreditation report is in Appendix J. Another technique is the use of the individual course evaluations. Copies of the course evaluations for the past three years are shown in Appendix L. During the spring quarter, each fourth year student is required to select a project; develop a detailed cost estimate, project schedule, and project management documentation; and make an oral presentation to a jury of industry leaders. This CAPSTONE exercise causes each student to apply the skills learned in previous classes. Jury feedback is used to assess the effectiveness of the program in meeting the objectives discussed in the previous section. The final technique is a survey that is sent out every three years to recent graduates and to their employers. Analysis of these assessment techniques indicates that we have been successful in achieving our educational objectives.

3. In what ways have you been able to involve undergraduates in research programs in your unit?

Undergraduate students are required to research various aspects of construction management as a part of their course requirements. Some students also take independent study credits to conduct research with faculty into selected topics.

4. Indicate the steps the unit has taken to comply with state-mandated accountability measures (i.e., reduced time to degree; increased graduate efficiency index; increased retention rate). What additional steps do you envision to improve the overall quality of undergraduate degree programs?

We accept up to 60 new undergraduate students per year. Most graduate at the end of two years of study. Many, however, require five years to complete their degree requirements, because they did not decide to pursue a major in construction management until the end of the freshman year. Having taken few of the prerequisite courses, they need an additional year to complete their basic education requirements. To help eliminate this problem, we are working with community college counselors to ensure prospective students learn of our prerequisite requirements. We have minimal attrition, because we are an upper division program and require demonstrated academic performance before granting admission.

B. Master's degree

1. Show the relationship of the master's degree program to the undergraduate degree program in your unit. Describe the objectives of your master's degree program in terms of student learning and other relevant outcomes, as well as its benefits for the academic unit, the university, and the region. Compare your objectives with those for programs at institutions you think of as peers.

Like most undergraduate professional programs, the construction management program prepares graduates for entry-level professional, supervisory, or managerial positions in the construction

industry. It does not prepare them for upper management positions. The master's degree program was established in 1994 to fill this void by providing an advanced educational program that focused on upper management issues. To minimize impediments to enrollment, an evening program was selected to accommodate working professionals. Senior industry leaders were consulted in creating the curriculum and course offerings shown in Appendix G. The curriculum was structured to build upon the educational foundation gained in an undergraduate construction management curriculum. Students with different educational backgrounds are admitted, but they are required to take prerequisite courses. Applicants possessing undergraduate degrees in architecture or engineering are required to take the following courses as a part of their graduate studies unless they validate the requirement by examination or provide a transcript indicating completion of similar courses:

- CM 333 – Construction Safety
- CM 410 – Construction Estimating
- CM 411 – Project Planning and Control
- CM 421 – Project Management
- CM 422 – Computer Applications in Construction

Applicants who have undergraduate degrees in disciplines other than construction, architecture, or engineering take the series of prerequisite courses shown in Appendix G before being admitted. These prerequisites may be validated if similar courses are reflected on the applicant's transcript or if the applicant desires to take validation examinations. The purpose of these prerequisites is to ensure that all master's degree graduates possess the requisite technical skills to be successful members of the profession.

The graduate program is structured to allow students the flexibility to shape their programs of study to meet their individual educational objectives. They can shape their programs of study by their selection of construction emphasis courses, electives, and thesis or project topics. Most students are working professionals, and they tend to select research topics related to the segment of the industry in which they are employed. A listing of theses and graduate reports completed in the last three years is in Appendix G.

Our master's program is the only graduate program in construction management in the State of Washington. It serves the state by providing students an opportunity to study upper management issues and to conduct independent research into construction management topics.

We consider our peer programs to be those offered by Arizona State University, Colorado State University, Texas A&M University, and the University of Florida. Our program objectives are comparable to those of these universities. We may offer more non-traditional courses, because of industry involvement in identifying learning objectives for the individual courses.

2. List the standards by which you measure your success in achieving your objectives for the master's program. Using these standards, assess the degree to which you have met your objectives, and discuss the probable causes for your success. Indicate the factors that have impeded your ability to meet your objectives and your plans for overcoming these impediments. What additional steps do you envision to improve the overall quality of the master's degree program?

The department uses several techniques for evaluating the success of the master's program. UW Graduate School Exit Questionnaire survey data is used as one indicator. The latest data covering the period summer 1998 through spring 1999 is in Appendix P. Another technique is the use of individual course evaluations. Copies of these evaluations for the past three years are in Appendix

K. Another technique is evaluation of the quality of the theses and graduate research reports written by students. The final technique is a survey that will be sent to graduates every three years. Since the first degree was awarded in 1997, the first survey will be sent out during the summer of 2000. Analysis of these assessment techniques indicates that we have been successful in achieving our educational goals. The only problem area is the time to degree for many of our part-time students. Because of work and family conflicts, several students have not been able to complete their theses or research reports in three quarters, which is a goal that we have established. To keep the students motivated and making progress, the graduate adviser spends considerable time with each master's degree student during the preparation of his or her thesis or research report.

IV. Responses to Change

A. How have teaching and learning for both undergraduate and graduate programs changed in your unit in the last 10 years? What further change do you anticipate or would like to instigate?

The major change that has occurred in our undergraduate program in the past 10 years is the increased use of full-time faculty. In 1990, most courses were taught by part-time faculty. Today, we use part-time faculty only for three undergraduate courses. This was accomplished because the number of full-time faculty members grew from 2 to 7.5 over the decade. The hiring of additional faculty members and curriculum revisions have strengthened our academic program significantly. Another major change is the increased use of automation. Word processing and spread sheet analyses are now used routinely in many courses. With local industry funding, we developed a construction management computer laboratory to teach students automated cost estimating and project scheduling. The fourth year CAPSTONE course has been significantly revised to focus on communication skills and industry involvement. Web-based instructional materials are being used

in some courses, and their use will expand over the next few years. Creation of lab-based materials instruction is a major goal of the department. This is addressed in the funding request for the Pacific Northwest Center for Construction Research and Education (Appendix O). Since the graduate program was started in 1994, its major change has been an increase in course offerings and an increase in the number of students.

B. In what ways have new developments in the following areas influenced teaching in your unit?

- **Interdisciplinary studies**
- **Distance learning**
- **Experiential learning**
- **International study**
- **Educational technology**

What plans have you made to maximize your effectiveness in these areas? What impediments do you see to these plans and how do you anticipate overcoming them?

Interdisciplinary Studies

Construction management is a multi-disciplinary field requiring technical, managerial, and communication skills. Undergraduate students complete their first two years of study as an interdisciplinary pre-major in the College of Arts and Sciences or at a community college. This provides a broad liberal arts and science foundation to their educational experience. The final two years are focused on technical courses within the department and business electives from the Business School. The major development in undergraduate interdisciplinary learning has been the creation of the double-degree program with the Department of Architecture (Appendix I). The graduate program has been interdisciplinary since its inception in 1994. Students with diverse backgrounds have been admitted after completing needed prerequisites. Graduate students routinely take their electives from the Departments of Architecture and Civil and Environmental Engineering and the Business School. In spring 2000, the department jointly offered with the Department of

Architecture a course on straw bale building methods in migrant and tribal communities. Students from all four departments in the college participated in this research seminar.

Distance Learning

Both the undergraduate and graduate programs continue to be classroom based to provide personal interaction between the faculty and the students. A distance-learning version of the Certificate Program in Construction Management was started in July 1999, and a second class will start this summer. A proposed distance-learning Master of Science in Construction Engineering program is being developed with the Department of Civil and Environmental Engineering will be our second distance-learning initiative.

Experiential Learning

The many construction projects in the region serve as laboratories where students can actually experience construction issues. In addition, all undergraduate students are required to work with a construction firm as an intern during the summer after they complete their junior year of study. This allows them to experience the challenges of being a construction manager and provides a context for their final year of study. Most of our graduate students are working professionals who can apply acquired knowledge and skills in their daily work experiences. Community service projects and course projects that required hands-on building experiences also are completed each year. Our greatest shortcoming in experiential learning is our inability to provide students with hands-on laboratory experience with construction materials and building systems. To overcome this deficiency, the development of a construction materials laboratory is a key component of our request

for funding to establish the Pacific Northwest Center for Construction Research and Education (Appendix O).

International Study

The department established a graduate course in international project management in 1995 to provide students an opportunity to study the international construction industry. The focus of the course is for each student to develop a detailed assessment of the construction business potential of a specific foreign country. This encourages students to establish contacts with foreign embassies in Washington, D.C. and professionals within the countries that they are studying. Later in the course, they develop project management plans for executing specific projects in the countries that they studied.

Educational Technology

The growing use of automation in the industry has led to increased use of computers in classroom instruction and by students in preparing class requirements. As previously discussed, the department established a 25-work station construction management computer laboratory and invested in software acquisition. The undergraduate curriculum was modified to include courses in both automated cost estimating and automated project scheduling. We anticipate creating a new course on web-based project management. In 1998, the department faculty took part in the establishment of the college web center to promote the use of the Internet in the classroom. Several department courses utilize the Internet for course enhancement.

C. In what ways have new developments in the following areas influenced research, scholarly or creative activity in your unit?

- **Revolutionary advances in the discipline**
- **Changing paradigms in the discipline**
- **Changing funding patterns in your field**
- **New technologies**

One of the major paradigm changes in construction management has been the adoption of alternate project delivery methods. Project owners are selecting qualification-based procurement methods for selecting construction firms and often use negotiated rather than bid procedures. Construction management-at-risk, design-build, and build-operate-transfer are examples of these delivery methods. Several graduate students have written theses on these delivery methods, and additional research is being conducted to assess the advantages and disadvantages of these techniques.

The increased cost of construction has resulted in research into alternate building materials and construction productivity. Faculty members are researching the use of straw bales and composites as building materials. Research also is being conducted into construction site organization and craft sequencing to identify strategies for improving job site productivity.

By what means does your unit measure its performance in research, scholarly or creative activities? In terms of those measures, how successful is your unit?

Criteria used by the department to measure its performance include the following:

- Quality and quantity of scholarly work as evidenced by peer-reviewed journal and conference papers, books and technical reports.
- Range and variety of scholarly work and research.
- Initiatives to develop new directions in scholarship and research that are responsive to the needs of the profession.

- Pursuit and achievement of external research support.
- Student involvement in research and scholarly work.

The department's productivity in research and scholarly work has improved significantly since the establishment of a graduate program and the hiring of additional full-time faculty members. Productivity will increase as recent faculty hires develop their research agendas and pursue external funding. If funded, the Pacific Northwest Center for Construction Research and Education (Appendix O) will provide a focal point for expanded research initiatives.

D. What changes have you observed and do you anticipate in the next 5 years as your unit responds to the need to provide service to:

- **The University of Washington**
- **Your discipline or profession**
- **The broader community**

The major changes we anticipate are increased enrollment in our undergraduate program and expanded course offerings for professional continuing education. As more students are admitted to the university, we anticipate greater demand for admission to the construction management program. Adoption of new construction materials and techniques by the industry will result in increased demand for professional continuing education.

By what means does your unit measure its performance in service activities? In terms of those measures, how successful is your unit?

Criteria used by the department to measure its performance include the following:

- Quality and quantity of graduates from undergraduate, graduate, and certificate programs.
- Accessibility of programs to both working professionals and full-time students.

- Quality and relevance of research reports.
- Faculty participation in college and university councils and committees and professional organizations.

The department provides significant service to the university, the profession, and the community. As discussed in earlier sections of this report, the department increased the number of undergraduates from 40 students per class to 60 students per class without any increase in resources. The department established the evening graduate and certificate programs in 1994 to accommodate working professionals. The distance-learning certificate program was created in 1999 to accommodate people who are unable to attend classes on campus. Departmental faculty members serve in the Faculty Senate and on numerous university committees. Others work with industry groups such as the Associated General Contractors of Washington Education Foundation and the Mechanical Contractors of America by participating in their professional continuing education programs. Faculty members also contribute their time in supporting the Central Area Motivation Program's Contractors' Resource Center and Sun Innovation's Small Disadvantaged Business Assistance in Learning (SAIL) program. Both the Center and the SAIL program provide educational opportunities for minority contractors.

E. What strategies has your unit developed to address the following anticipated changes in the next 10 years?

- **Faculty retirements**
- **Increasing numbers of undergraduate students (majors and non-majors)**
- **Increasing demand for master's or doctoral programs that will accommodate the needs of working professionals**
- **Increased need for doctoral training that will prepare faculty for the full spectrum of higher education institutions**
- **Increased need for doctoral training that will meet the requirements of industry**
- **Emerging technologies for research and training**
- **Pressures on space**
- **Pressures on budgets**
- **The demand for accountability**

Identify the ways (other than budget increases) the college and/or university could facilitate your progress in these areas.

Faculty Retirements

During the last decade, the department lost four faculty members by resignation and one by retirement. Three retirements are anticipated in the next ten years, which is almost half of the full-time faculty members. Finding quality replacements will be a challenge, because there is great demand throughout the United States for quality construction management faculty members.

Increasing Numbers of Undergraduate Students

As was mentioned previously, we have increased the number of undergraduate students by 50% during the last four years without an increase in teaching resources. We anticipate future demand for even larger enrollments, but will need additional teaching resources, both faculty and teaching assistants, to accommodate any enrollment increases above 60 students per class.

Increased Demand for Master's or Doctoral Programs That Accommodate the Needs of Working Professionals

Our evening master's program was created to accommodate the needs of working professionals. It is a flexible program that can be tailored to meet the needs of individuals who work full-time or part-time. We do not anticipate any demand for a part-time doctoral program.

Increased Need for Doctoral Training to Prepare Faculty for Higher Education Institutions

Our department is not large enough to support a doctoral program. The college is exploring the possibility of establishing a college-wide doctoral program. If this initiative is successful, we plan to participate, if additional teaching resources are provided.

Increased Need for Doctoral Training to Meet Industry Requirements

There is little demand for doctoral training to meet industry requirements, and we do not anticipate much future demand outside academic and research institutions.

Emerging Technologies for Research and Training

Establishment of the Pacific Northwest Center for Construction Research and Education (Appendix O) would provide the department a capability for incorporating emerging technologies into research and teaching activities. In addition, we plan on greater use of web-based course materials.

Pressures on Space

Faculty offices are inadequate in terms of space, and we have no space for teaching assistants or research assistants to work. Opportunities for additional space in Gould and Architecture Halls is

non-existent as other departments in the college have severe space limitations. The 23,000 square feet of space being made available at Sand Point will provide space for faculty and graduate student research activities and faculty offices.

Pressures on Budgets

Our most severe budgetary problem is in the area of discretionary funding that can be used to support teaching assistants, part-time lecturers, and faculty travel. Budget for these purposes is largely limited to extension funds derived from serving non-matriculated and extension students in our courses and the department endowment. To generate discretionary funds, faculty members carry heavy teaching loads and do without teaching assistants. The department absorbed its proportional share of the 1% University Initiatives Fund budget cut in July 1997. The dean's office of the college took the entire 1% cut for the college in July 1999, but has indicated that it cannot take another cut of this size. The department will likely lose a faculty position in the remaining budget cuts in 2001, 2003, and 2005.

Demand for Accountability

We welcome greater emphasis on accountability through the use of indicators that monitor performance, productivity, and quality of our teaching, research, and service. We have improved the curriculum during the past five years, increased our undergraduate enrollment by 50%, and hired new faculty with diverse backgrounds and expertise. We anticipate our research and scholarly work productivity to improve as recent faculty hires develop their research agendas and pursue external funding.

F. Demographic changes

How is your unit responding to changing U.S. demographic trends? What specific steps have you taken to make your student body, staff, and faculty more inclusive by incorporating members of underrepresented groups? What additional steps have been planned? What specific steps have you taken to ensure that members of underrepresented groups are included in the life of the department in ways that benefit their professional development and success?

The department has responded to the changing demographics of the region and the nation. About 15% of our undergraduate students are female, up from about 10% in previous years. Minority students tend to be Asian Americans, as few African-American students have applied to our program. About 20% of our graduate students are female, and about one third are Asian or Asian American. Six of the 30 graduates in the past three years were female, 9 were Asian or Asian-American, and one was an African-American. To recruit underrepresented students, we have participated in diversity career fairs and made presentations during career days at local high schools.

G. Personal productivity

1. What steps has your unit taken to encourage and preserve productivity (in research, teaching, and service) on the part of all segments of your faculty? How are junior faculty members mentored to enhance their professional development? What impediments to faculty productivity exist, and what plans do you have for overcoming them?

The department has sought to help faculty members preserve productivity in all areas by limiting each full-time faculty member to five courses per academic year. New faculty hires are given one quarter without any teaching assignments to develop their research initiatives. Junior faculty members are mentored by the department chair to ensure that they are making progress in teaching, research, and service. The greatest impediment to increased faculty productivity is the lack of funding to support teaching and research assistants. Without graduate student assistants, faculty members must devote the majority of their time to their teaching responsibilities. To address this resource issue, the department is actively soliciting external funding.

2. What steps has your unit taken to encourage and preserve productivity on the part of all segments of your staff? How are staff recognized and rewarded for their performance? What programs are in place to support professional development of staff?

The department has two full-time staff members. They work as a team, addressing many requests from faculty, students, applicants, professionals, and others who seek information and assistance from the department. Both have been provided opportunities to take skill-enhancement training and were provided new work station furniture and computers during the 1998-1999 academic year.

V. Goals

A. What is the process by which the unit sets its overall goals? How are departmental goals reviewed and reassessed? In what ways do you anticipate the goals for your program will change in the next 10 years?

In 1996, the department implemented a strategic planning process as a means of goal setting, review, and revision. The latest strategic plan (shown in Appendix F) was developed at a faculty retreat in September 1999. Specific action plans were developed for accomplishing each of the strategic objectives. Progress toward accomplishing each of the objectives are assessed at faculty retreats conducted at the beginning of each academic year. We do not anticipate the specific goals changing over the next ten years, but do anticipate developing specific initiatives each year.

B. List your goals for the next 5-7 years. How should you be rewarded by the college and/or the university (specify alternatives in addition to increased budgets) for achieving these goals? In what specific ways could the college and/or university assist you in achieving your goals?

The strategic plan in Appendix F contains a listing of both our goals (objectives) and specific action plans. The goals are listed below:

- Provide accessible programs that prepare individuals to be capable of assuming technical and management level positions in the construction industry.
- Provide a learning environment where students acquire high-quality skills and knowledge necessary for identifying practical construction problems and managing construction processes.
- Conduct research that benefits the construction industry and the community.
- Ensure undergraduate program remains fully accredited by the American Council for Construction Education.
- Maintain relationships with the construction and related industries.
- Encourage service projects that benefit the community.

The department is not looking for rewards for achieving these goals, as we are committed to our mission and sincerely believe that success in achieving these goals is its own reward. We do need assistance in achieving them. Most important is assistance in maintaining the strength of our faculty and in providing them with the resources they need to be productive. All faculty members carry heavy teaching loads, and some relief is needed if we are to expand our research initiatives. Relief needed are additional faculty positions and funding for graduate assistants. Additional space is needed to provide undergraduate students with a place to spread our their plans and specifications and develop their project cost estimates and construction schedules, just as architectural students need space for their visually intensive curriculum. To provide needed laboratory and research facilities, we request continued support for the Northwest Center for Construction Research and Education contained in Appendix O. To reduce the time to degree and respond to the high demand for our graduates, we need Undergraduate Advising to do a better job of notifying entering freshmen of the construction management program's merits and its prerequisite requirements.

Items for Higher Education Coordinating Board

1. **Degree program title:** Construction Management

2. **Year of last review:** This is the first program review for the construction management program.

3. **Documentation of continuing need:** Undergraduate enrollment has grown from 40 students per class to 60 students per class over the last four years. The number of applicants has grown during the same period, and the quality of admitted students has increased as the department has been more selective in its admission decisions. Industry demand for construction management graduates also has grown with the number of firms recruiting on campus increasing four-fold over the past three years. The graduate program has grown from 10 students in 1994 to 55 today, and 30 have graduated during the past three years.

4. **Assessment information relating to student learning outcomes and program effectiveness:** The undergraduate program is accredited by the American Council for Construction Education and reviewed every six years. The last review was conducted in 1995, and the next is scheduled for 2001. Course evaluations prepared by students indicate satisfaction with both the quality of instruction and the content of the department's courses. Each graduating student must complete a detailed analysis of an actual construction project and present the results to a jury of industry leaders. Jury

feedback has been extremely positive and complementary of student understanding of the profession. Undergraduate students participating in student competitions hosted by the Associated Schools of Construction and the Associated General Contractors of America have placed high for the past four years. The success of students in these competitions is another indicator of the quality of the department's educational program. Graduate School exit questionnaires completed by graduating students and individual course evaluations indicate student satisfaction with the quality of the graduate program.

5. Plans to improve the quality and productivity of the program: The department has increased the number of undergraduate students by 50% during the last four years without an increase in teaching resources. Future enrollment increases can be accommodated only if additional resources are provided. The department has requested funding for the Pacific Northwest Center for Construction Research and Education as an Advanced Technology Initiative. If funded, the center will provide the department with needed construction materials laboratories to provide experiential learning opportunities for students.

6. Data on number of majors and degrees granted in last three academic years: There have been 300 undergraduate students majoring in construction management during the past 3 years, and 145 have received their Bachelor of Science in Construction Management degrees. There have been 85 graduate students majoring in construction management during the past 3 years, and 30 have received their Master of Science in Construction Management degrees.

7. Number of FTE faculty and graduate assistants that teach in the department:

7.5 FTE faculty and no graduate assistants teach in the Department of Construction Management.