TO: Randy Smith, Vice Provost for Academic Programs
FROM: Anika Anthony, Associate Dean of Academic Affairs, Graduate School
DATE: November 24, 2021
RE: Proposal for a new Master of Structural Engineering, College of Engineering

The College of Engineering is proposing a new Master of Structural Engineering in the Department of Civil, Environmental, and Geodetic Engineering.

The proposal was received by the Graduate School on June 3, 2021. On June 7, 2021, the Graduate School requested revisions in preparation for the combined GS/CAA subcommittee's initial review. The Graduate School received the revised proposal on September 24, 2021. GS/CAA first reviewed the proposal on September 29, 2021 and requested revisions. Revisions were received on November 2, 2021. GS/CAA conducted a second review of the proposal and recommended it for approval by the Graduate Council on November 9, 2021. The proposal was approved by the Graduate Council on November 15, 2021.

THE OHIO STATE UNIVERSITY

College of Engineering

Department of Civil, Environmental and Geodetic Engineering

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3/31/2021

Dr. Randy Smith
Vice Provost for Academic Programs
Office of Academic Affairs
The Ohio State University
203 Bricker Hall
190 North Oval Mall
Columbus, OH 43210

Re: Proposal for a New Tagged *Master of Structural Engineering* Degree Program

Dear Vice Provost Smith:

The Civil, Environmental, and Geodetic Engineering Department presents a proposal for a tagged Master of Structural Engineering degree. The goal of this degree is to equip working professionals with the technical skills to design complex vertical and horizontal structures. Example structures include 30-storey buildings and long span bridges, respectively. Additionally, this degree provides graduates with the skills to transition rapidly to roles with larger project management responsibilities. Such a job pathway is commensurate with the career stage when engineers lead design work for large structures. The Master of Structural Engineering degree addresses an identified need among the community of engineering consulting firms and regulatory agencies that are located in the Central Ohio region. We anticipate enrolling the first student cohort in AU22, following University and Ohio Department of Higher Education approvals.

Background. Structural engineering is recognized as a speciality subdiscipline within the field of civil engineering. The American Society of Civil Engineers sets accreditation criteria for the design of Bachelor of Science degrees intentionally to yield broad training of undergraduate civil engineering students. This BS training exposes students to basic concepts for undertaking design and analysis calculations for relatively simple structures. Additional training is necessary for a civil engineer to take on a leadership, or major contributing role, in the design and analysis of large structures (e.g. office towers, stadiums, bridges) such that their safety, durability and reliability are ensured. One pathway for such additional training is through the completion of 30-credits of post-baccalaureate coursework.

Degree Structure. The tagged Master of Structural Engineering degree was developed to address the workforce needs for civil engineers to engage in advanced design work. This 30-credit degree consists of four primary elements: (i) core advanced and structural dynamics topics (9 cr); (ii) technical electives to build breadth or depth in specialized aspects of structural design and analysis (9 cr); (iii) professional development topics in business management and finance (6 cr), and (iv) a two-semester Structural Engineering Studio Project grounded in a complex design challenge from concept to engineering drawings. This unique combination of graduate degree training is not available at other local or national programs.

Faculty Endorsement. The faculty of the Department of Civil, Environmental and Geodetic Engineering endorsed the Master of Structural Engineering proposal on Mar. 10, 2021.

We are requesting approval of the proposed changes by the Council on Academic Affairs.

Sincerely,

Allison MacKay, Ph.D., BCEEM
Professor and Department Chair

THE OHIO STATE UNIVERSITY
FISHER COLLEGE OF BUSINESS

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April 30, 2021

Dean Ayanna Howard
College of Engineering
2070 Neil Avenue
Columbus, Ohio 43210

Ref: Professional Masters in Structural Engineering (PMSE)

Dear Dean Howard:

I am writing to indicate the Fisher College of Business' strong support for the College of Engineering's proposed Professional Masters in Structural Engineering (PMSE). Students attracted to this program will benefit from the unique combination of technical and professional content available between both of our colleges, and will no doubt better prepare our graduates for careers in engineering leadership.

We are happy to cooperate with Engineering in developing this new degree, specifically by offering accessibility to the array of courses in our graduate MBA program indicated in the PMSE proposal. We look forward to working with the College of Engineering on this new masters degree and hope to develop additional cooperative ventures as we move forward.

Sincerely,

Anil K Makhija

Anil K. Makhija
Dean and John W. Berry, Sr. Chair in Business

THE OHIO STATE UNIVERSITY

Curriculum Proposal Checklist

Title of Program: Master of Structural Engineering

Effective term: Autumn 2022 **College:** Engineering

New/Establish: ✔ **Secondary Major Eligible:** ☐ **Academic Unit:** Civil, Environmental and Geodetic Eng

Revise: ☐ **50% Revision:** ☐ **Mark Up:** ☐ **Program Contact:** Anthony Massari

Terminate: ☐ **Suspend:** ☐ **Certificate Category*:**

Degree/Credential: New

Program of Study : Graduate Program **Title:** Master of Structural Engineering

Code:

Program Focus*: Focus Structural Engineering

Credit hours to degree/credential: 30 **Is this a change to the current total?** ☐ Yes ☐ No

Program offered only online? ☐ Yes ✔ No **If yes, is there a signed MOU with ODEE?** ☐ Yes ☐ No

Campus(es) where offered: ✔ Columbus ☐ ATI ☐ Lima ☐ Mansfield ☐ Marion ☐ Newark

Rationale: The proposed degree is a professional degree at the post-baccalaureate level aimed at practicing structural engineers. This is a non-thesis degree with no required research component (and thus the Master of Science degree is not appropriate) and it does not fit any existing master's degree program at The Ohio State University. Prospective students may be employed in either the public or private sector (for profit or non-profit). Students are expected to aspire to benefit their organizations through both technical and managerial skills so as to be leaders and innovators in their organizations. Their personal goals include gaining technical leadership skills, enhancing their flexibility, practicing life-long learning and improving their competitiveness in the marketplace. The proposed program serves the College's land grant mission by providing engineers who are prepared to work and respond to rapidly changing technical conditions influencing the trade and market space.

Student Curriculum Sheet Required: ✔

Four Year (or appropriate) Plan: ✔

Academic Unit Curriculum Committee approval date: 3/10/21

College Curriculum Committee approval date: 6/1/21

Graduate School Council approval date*: 12/14/21

Regional Campus approval date*:

Council on Academic Affairs approval date:

University Senate approval date*:

Board of Trustees approval date*:

ODHE approval date*:

* If applicable

THE OHIO STATE UNIVERSITY

Proposal to the Chancellor's Council on Graduate Studies
for a new degree program:

Master of Structural Engineering

Submitted by the
College of Engineering

In partnership with the
Fisher College of Business

The Ohio State University

Prepared by:
Dr. Anthony Massari P.E. LEED AP
Associate Professor of Practice

Master of Structural Engineering

Executive Summary

The proposed Master of Structural Engineering degree is a professional program aimed at the practicing structural engineer seeking to increase their technical skills alongside their management and leadership abilities. The Master of Structural Engineering program is a specialized degree program that fills a need for the structural engineer with a broadened role as fundamental technical experts as well as project managers. The program requires both technical and managerial mastery which is capable of being completed over a 1 year program; however it is flexible for the concurrent attainment of the degree while actively working in practice.

Master of Structural Engineering

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I. Introduction and Overview

The College of Engineering (CoE) at The Ohio State University (OSU) faculty and instructors propose a new professional master's degree in Structural Engineering. The curriculum proposed will provide essential skills and experience at the graduate level for students intending to or already working as practicing structural engineers in the field to allow them to develop solutions to the problems of the 21st Century.

a) Designation

The degree will be called the Master of Structural Engineering.

b) Rationale

The proposed degree is a professional degree at the post-baccalaureate level aimed at practicing structural engineers. This is a non-thesis degree with no required research component (and thus the Master of Science degree is not appropriate) and it does not fit any existing master's degree program at The Ohio State University. The title Master of Structural Engineering is intended to convey the technical aspects of an engineering degree specific to the domain of structural engineering, as well as the professional nature of the practice. This implies the degree requires the mastery of both technical and professional proficiencies.

The target audience for the Master of Structural Engineering degree is engineers in the early stages of their professional career who have just begun or whom have been working in the field for fewer than five years. More senior former graduates will also be considered for the program based on their qualifications and experience, but focus is on early career engineering professionals. Prospective students may be employed in either the public or private sector (for profit or non-profit). Students are expected to aspire to benefit their organizations through both technical and managerial skills so as to be leaders and innovators in their organizations. Their personal goals include gaining technical leadership skills, enhancing their flexibility, practicing life-long learning and improving their competitiveness in the marketplace. This cohort of students will consist of both full-time and part-time students, and as such the program is crafted to be accommodating for short duration fulfillment of program requirements for full time students (9-months) and an opportunity to extend the program over multiple years for part-time students who prefer to refrain from a sabbatical from the workforce.

The objective of this advanced engineering degree program is to provide technical and leadership skills to help engineers succeed in the 21st century. From the goals of the 2014-2020 College of Engineering (CoE) Strategic Plan, we aim to "produce graduates with advanced degrees who become national and international leaders in their field." A variety of professional bodies in Engineering have called for the development of leadership skills among engineers, including the National Academy of Engineering and the Accreditation Board for Engineering and Technology (ABET). This degree emphasizing both the technical as well as professional aspects of the trade of structural engineering and tackles this goal directly in building and developing these leaders.

The Master of Structural Engineering degree serves the College's land grant mission by providing engineers who are prepared to work and respond to rapidly changing technical conditions influencing the trade and market space. It is intended for engineers who want to accelerate their careers in industry or the public sector and be better prepared for future leadership roles in their careers. Our research (discussed below) indicates that industry, alumni and students support this degree program.

c) Purpose, Focus and Significance

The purpose of the Master of Structural Engineering program is to prepare professionals in the civil engineering discipline to effectively lead innovative and challenging technical projects within their organizations. The curriculum presents an integrated approach to both technical and professional skills designed to develop leaders of industry.

A multi-term integrative project[1] develops applied skills while at the same time creating an understanding of the relevance of individual projects to the larger context of the community as well as the business of an engineering organization. Graduates will be equipped to advance to technical leadership positons through the effective application of their technical/analytical skills, as well as their business acumen.

In consideration of developing a program for both recent graduates and working professionals, the Master of Structural Engineering curriculum has been developed to deliver critical knowledge in both an effective and flexible manner that accommodates these students. The consistent delivery of quality instruction is critical to the mission of the program, and will be discussed further herein.

The Master of Structural Engineering's professional and technical content has several distinct characteristics. It:

- integrates business and technical knowledge into the core,
- provides a strong technical focus,
- includes a multi-term integrative project to bring technology and professional skills together (optional for those possessing a PE license),
- is delivered with a focus on flexibility for working students while maintaining best practices in pedagogy.

Engineers who complete this curriculum are expected to attain the following outcomes:

- be current in the latest engineering knowledge and related advances in their selected technical fields;
- be able to apply knowledge more effectively in innovative directions;
- know how to communicate with both business and technical specialists;

[1] The multi-term integrative project is optional for those possessing a Professional Engineering license (PE). More detail on this can be found in the Proposed Curriculum in the section labeled "Structural Engineering Studio Project."

- be able to apply the fundamentals of managerial accounting to manage projects to success;
- be trained to successfully lead technical teams

The Ohio State University's Master of Structural Engineering degree will offer students a new technical education linked with professional skills development with an integrated technical project. The technical material will be offered by OSU's preeminent engineering faculty augmented by industry professionals. The professional skills will be provided in part by faculty in the College of Engineering, but largely by the content experts in OSU's Fisher College of Business. This will allow for the highest quality of instruction in these two critical aspects of the degree. The integrated project will tie the professional core and the technical tracks into a cohesive educational experience. This integrated project will be an important tool for bringing together the technical and professional aspects of the course work.

The proposed Master of Structural Engineering program will expand the visibility and reputation of the State of Ohio and The Ohio State University in the field of post-graduate training in the professional practice of engineering. The program will bring not only students, but their professional resources to the college which will enhance the engineering education and overall experience on campus. The program will integrate existing knowledge and resources across the university departments, colleges, centers and schools to create the best learning experience for our students, while also taking advantage of newly formed industry connections.

d) Vision

The OSU Master of Structural Engineering degree program will provide outstanding educational opportunities for the next generation of technical leaders in the structural engineering field. It will prepare students by providing the highest quality of course instruction in both technical and professional domains, and create a cadre of prepared leaders in our ranks.

II. Proposed Curriculum

The proposed curriculum will result in a tagged Master's degree as described in The Ohio State University Graduate Handbook (Section 6.12). The program is intended to be offered fully in person, and is not a distance learning program. To accommodate working professionals, distance education techniques such as posting notes and lecture recordings will be made available when appropriate at the discretion of instructors, but will not be an exclusive means of teaching any course unless that specific course is listed as distance learning. In addition to being the most appropriate pedagogical model, providing the Master of Structural Engineering curriculum in this format will increase the pool of potential students and offer better service and more flexibility for these students as well.

The minimum of 30 semester credit hour program is designed for completion in one year (two semesters) if taken full time. Students have the flexibility of taking the curriculum on a part time basis over a period of two to three years (a maximum of four years) unless the Graduate Studies Committee formed specifically for this program grants an extension. The degree program consists of a set of common core classes (3), a variety of technical electives from which students may choose and an integrative year-long project class. Students may also earn up to 3 hours of credit for previous courses completed elsewhere when course meets the Graduate School Handbook Guidelines (Section 4.1.5).

The following describes these fundamental components (see Appendix A for sample curricula):

a) ***Core Classes (9 hours):*** This integrated core includes courses in advanced design and structural dynamics. These courses draw on OSU's significant strengths in the CEGE department.

The courses and special experiences to be offered in the core include:

Design

- CEGE 5320 Intermediate Steel Design (3 credits)
- CEGE 5350 Intermediate Concrete Design (3 credits)

Analysis

- CEGE 6300 Structural Dynamics (3 credits)

b) ***Technical Electives (min. 9 hours):*** In addition to the required core, each student will have access to a series of relevant professional technical electives which span the technical areas of design and analysis of civil engineering structures. All proposed technical electives would be within the CEGE and Mechanical Engineering department described below:

Design

- CIVILEN 5360 Bridge Engineering (3 credits)
- CIVILEN 5370 Prestressed Concrete Design (3 credits)
- CIVILEN 5510 Durability and Condition Assessment of Reinforced Concrete Structures (3 credits)
- CIVILEN 5571 Principles of Foundation Analysis and Design (3 credits)
- CIVILEN 6510 Advanced Concrete Materials (3 credits)
- CIVILEN 7332 Advanced Behavior and Design of Metal Structures (3 credits)
- CIVILEN 7350 Advanced Reinforced Concrete (3 credits)
- CIVILEN 7330 Earthquake Engineering (3 credits)
- MECHENG 5162 Introduction to Laminated Composite Materials (3 credits)

Analysis

- CIVILEN 5168 Introduction to the Finite Element Method (3 credits)
- CIVILEN 7320 Structural Reliability (3 credits)
- MECHENG 5139 Applied Finite Element Methods (3 credits)
- MECHENG 7100 Introduction to Continuum Mechanics (3 credits)

- MECHENG 7163 Advanced Strength of Materials for Design (3 credits)

c) ***Professional Development (min. 6 hours):*** In addition to the required core and technical electives, each student will have access to a series of relevant professional development electives which span the areas of management and finance. This broad array of electives offers the opportunity to pursue a coursework path that is more suitable to the professional attributes beyond the core and technical curriculum for the professional interested in pursuing the next steps in their career.

- Fisher College of Business
  - MBA 6201 Organizational Behavior (3 credits)
  - MBA 6202 Leadership (3 credits)
  - MBA 6211 Accounting (3 credits)
  - MBA 6253 Marketing (3 credits)
  - MBA 6281 Professional Development and Business Communication (3 credits)
  - MBA 6293 Strategy (3 credits)
- Master of Global Engineering Leadership (Distance Learning Only)
  - ENGR 6210 Leadership and Team Effectiveness (3 credits)
  - ENGR 6220 Accounting/Finance for Engineers (3 credits)
  - ENGR 6230 Technology Strategy & Innovation Management (3 credits)

d) ***Structural Engineering Studio Project:*** The integrative project develops solutions for real- world challenges, applies principles learned through the core and track courses and introduces project development, project management and project assessment. The project serves to knit together the professional core and the technical electives, while also providing an advanced design problem for students to use developed skills throughout the program.

Civil engineering has a state mandated licensing process that is attainable for design professional with 4 or more years of work experience in their field of practice. For students possessing the distinction of Professional Engineer in Civil Engineering, the Term Project will be optional, allowing for more seasoned professionals to instead take more technical and professional courses which broaden their skill set. If the student opts out of the studio course sequence, a mandatory exit exam on the core course work must be completed to evaluate the student's competencies.

Summary of Master of Structural Engineering Degree

- Minimum of 30 graduate credit hours (semester hours)
- Full time or part time
- Courses taught in a combination of distance education format and onsite

The syllabi for all new courses can be found in Appendix D.

e) ***Curricular Options:*** Additional options will be made available to students.

Master of Structural Engineering Certificates of Specialization: Certificates of specialization (hereafter referred to as certificates) can provide milestones to help motivate students through the degree program. In addition, some certificates have specific academic or industry requirements and are widely recognized as valuable in themselves. Faculty may propose programs that award certificates to students upon completion of specific sets of courses. Such certificate programs must be in accordance with university, academic and industry standards, including the Ohio State University Graduate School and Council of Academic Affairs. Each Master of Structural Engineering certificate proposal must be reviewed and approved by the Master of Structural Engineering Graduate Studies Committee. More information can be found in Appendix B.

III. Administrative Arrangements (Details on processes are in Appendix B)

The Master of Structural Engineering degree will be granted through The Ohio State University Graduate School and will be subject to all Graduate School rules and requirements. It will be administered by the College of Engineering through the Civil, Environmental and Geodetic Engineering (CEGE) Department. The Master of Structural Engineering Graduate Studies Committee (The Master of Structural Engineering - GSC) will be established within the College to coordinate the operation of the program.

a) Master of Structural Engineering Graduate Studies Committee (Master of Structural Engineering - GSC)

The Master of Structural Engineering - GSC will be made up of the Master of Structural Engineering Faculty Director, the CEGE graduate coordinator (non-voting), a faculty member teaching in the program from the Fisher College of Business, and two additional Engineering Faculty who teach in the Master of Structural Engineering program (see Appendix B for the selection process for these positions). All voting members of this committee will have graduate faculty status with the Graduate School.

The Master of Structural Engineering Faculty Director will act as the chair of the Master of Structural Engineering - GSC. The Master of Structural Engineering - GSC will handle all tasks normally associated with a graduate studies committee (admissions, new courses, progress of students, etc.). In addition, it will evaluate and must approve any proposed tracks, and changes to existing tracks and any proposed certificate programs. It is also responsible for evaluation of all courses, tracks and certificates in the degree program. It is essential that all aspects of the Master of Structural Engineering degree adhere to the highest standards. It should also be responsive to industry and student needs. Evaluation will be continuous and ongoing.

b) Industry Advisory Board (IAB)

An Industry Advisory Board will be established to ensure the quality of the program and the ability to meet requirements. This board will advise the Master of Structural Engineering Faculty Director, the Engineering College Director of Professional Programs and the Master of Structural Engineering - GSC as well as taking part in the educational programs of the degree. (See more in Appendix B). Upon establishment, board members will agree to a schedule of full program review every 6 years, and annual meetings to discuss the state of the program at a minimum.

c) Master of Structural Engineering operations

The Director of Professional and Distance Learning Programs in the College of Engineering will be responsible for the overall administration of the Master of Structural Engineering degree. Responsibility for the day-to-day operations of the program and will be performed by the Master of Structural Engineering Faculty Director.

The Master of Structural Engineering Faculty Director will perform the following duties:

- chair the Master of Structural Engineering - Graduate Studies Committee;
- establish and chair the industry advisory board;
- establish industry sponsors in collaboration with faculty to ensure the quality of the curriculum through sponsored practice and curriculum research efforts

d) Proposed appointments:

- The Master of Structural Engineering Faculty Director will be appointed by the Chair of the Civil, Environmental and Geodetic Department within the College of Engineering

IV. Evidence of Need

The Civil Environmental and Geodetic Engineering Department within the College of Engineering conducted extensive research for the development of the Master of Structural Engineering degree, providing evidence of substantial need for the degree program. We have undertaken significant primary and secondary research among employers and prospective students to determine the need for this degree program as well as looked at other top universities for both similarities and opportunities. This research is summarized below.

The concept for the Master of Structural Engineering degree program was originally brought to our attention by industry leaders serving on the Civil, Environmental and Geodetic Engineering Industry Board. Among the board

members there was general consensus that a shift in education geared towards stronger leadership and professional skills was critical for work force development, while still maintaining a high level of technical expertise both in the field, as well as in a diverse set of transferable skills.

Per the U.S. Bureau of Labor and Statistics, it is projected that there will be 8% growth in general civil engineering employment from 2020 to 2030, indicating a need for more professionals and leaders to be developed to address the future needs of infrastructure.

To reach beyond the board's intuition and feedback, a survey was conducted of current students, recent graduates, and of local industry leaders (the results of which can be found in **Appendix I**).

a) Survey results

From the employer perspective, it was clear that industry is interested in having students with education beyond the undergraduate level, and further that it was widely preferred to have coursework based graduate education as opposed to research. Additionally, a preference for a degree with industry based coursework, inclusive of professional development can be ascertained.

When asking recent graduates of our undergraduate program who were not registered for graduate studies, we found that a large portion of students were considering graduate school in one form or another. From the same group, there was an overwhelming preference for a course based graduate degree (non-thesis). It was also observed that there was a strong preference for a professionally based program over a purely technical program.

We similarly asked current undergraduate students about their consideration for graduate school and found similar results to our recent graduates in terms of interest. In this group, it was found that there was significantly more interest in traditional thesis based graduate education then in recent graduates, but still a majority of students preferring course based programs, and again showing an interest in a more course based graduate experience with professional development. Another interesting element that came out of the undergraduates was that the introduction of the Master of Structural Engineering increased the total amount of students considering graduate school by 20%, indicating an increased market of students to train.

b) Existing other programs

Beyond the survey, research of universities around the country, and more specifically around the local market of Ohio was conducted. In a general sense, it is clear that course based masters of engineer programs exist around the country in various civil engineering programs, however the unique element of the Master of Structural Engineering program is that some of the bandwidth of the credit hours is dedicated to professional development, whereas most other programs are exclusively technical degrees, or have some professional development in a smaller

portion of their degree requirements. Also while many programs have generic Masters of Engineering programs in Civil Engineering, many do not focus on the trade of structural engineering specifically.

One of the more similar programs in the country is Lehigh's Masters of Engineering in Structural Engineering. This program is a 10-month, 30 credit program that offers a similar Capstone overarching project element, however it lacks the professional development aspects associated with the business of engineering, making our program unique. This element of professional development resonated with recent graduates, and this distinction is what gives the Master of Structural Engineering a competitive advantage over other competitors.

The University of Cincinnati also offers a similar 30 credit 2 year Master of Engineering program, which encompasses professional development (3 credits) and a capstone project course (3 credits) similar to the Master of Structural Engineering. The Master of Structural Engineering is more exhaustive in these efforts, requiring more project training and professional development in its format.

Youngstown State University offers a 36 credit Masters of Science in Engineering with a Management plan that adds business courses (9-12 credits) and a graduate project course (3 credits) similar to the Master of Structural Engineering. There is an advanced math requirement which is not an expectation of the Master of Structural Engineering program, and the graduate project is only 1 semester, whereas the Master of Structural Engineering has a yearlong project.

Other Ohio graduate programs were also researched, which have course based masters degrees, some of which have components of what makes the Master of Structural Engineering unique. They are summarized below:

Ohio University	M.S. - 29 credits of technical coursework plus 3 credit hours of special investigation/project
Dayton University	M.S. - 30 credits of technical coursework
University of Akron	M.S. – 30 credits of technical coursework plus 2 credit hours of special investigation/project
University of Cincinnati	M.Eng. - 30 credits including 3 credit hours of professional development and 3 credits of project work
Youngstown	M.S. – 36 credits including 9 credits of professional development and 3 credits of project work

c) Engineering Licensure and Continuing Education for Professional Engineers

Professional Engineering Licensure requires the attainment of a Bachelor's of Science in an ABET accredited program in Engineering throughout the United States. Students who have completed such programs are eligible for pursuing licensure in their respective jurisdictions, with varying degree of experience required from state to state

before being eligible to apply.

In the state of Ohio, successful completion of graduate study leading to the master's degree in engineering which has followed a baccalaureate degree in engineering from an ABET-accredited program may be used for credit for one year's experience. This will benefit our students who are early in their career in reducing their experience requirements for eligibility to take the licensing exam, should they choose to take advantage of the opportunity.

Professional engineers are required to complete 30 hours of biennial continuing professional development (CPD) relevant to the practices of engineering. By enrolling in the program and taking courses, students holding a professional engineering license will be able to satisfy CPD requirements with respect to maintaining their license, per the Ohio Board of Engineers.

V. Prospective Enrollment and Student Demand

a) Demand

The previously cited survey of current students, OSU alumni and hiring managers gives indications of strong demand for this program. Many of the students surveyed have followed up on their own by contacting the proposal development team to inquire about when the program will be available. Similarly, major corporations have already notified the team that they wish to enroll cohorts of their students in the degree program.

Additionally, research was conducted via the Bureau of Labor and Statistics (BLS), and their projections for growth in the field in the current decade. The BLS anticipates a growth in the demand for Civil Engineers of 8% between now and 2030, and an overall annual job opportunity annually of 25,300 jobs. The American Society for Engineering Education (ASEE) graduation statistics report 13,774 BS and 5,307 MS in civil engineering in 2019 which is a short-fall compared to the estimated job addition (most recent data available, https://ira.asee.org/wp-content/uploads/2021/02/Engineering-by-the-Numbers-FINAL-2021.pdf). Structural engineering is a subset of Civil Engineering and it is anticipated that it would follow in a similar upward trend of job growth.

Based on these inquiries and our research and analysis (See **Appendix I**) convinces us that the program will enroll approximately 5 new students in its first year and that this number would grow to approximately 25 over time. It is anticipated that most students will be part time, pursuing graduate education while working. We expect to sustain the program at that level by keeping the curriculum up-to-date, providing a high quality degree and continuously marketing our program and graduates.

b) Access and Retention of Underrepresented Groups

Excellence cannot be achieved without diversity and the diversification of the engineering student body is a major priority for the College of Engineering as indicated in the College's Strategic Plan. According to this goal, the College will

"Increase the diversity of students, faculty and staff". The college has a well-established and nationally-respected Minority Engineering Program (MEP). It was founded as part of a national effort to increase the representation of African-Americans, Hispanic-Americans, and Native Americans in the professional engineering population. MEP offers a wide range of programs and services to assist in the recruitment, retention, motivation and graduation of minority students. Some of these include: academic and personal counseling, an early-warning monitoring system, a test and reference library, skills-building workshops, and social activities.

Similarly, the College of Engineering established the Women in Engineering (WiE) Program to encourage young women to consider engineering as a career choice, to recruit women into undergraduate and graduate programs, to support women as they matriculate through the engineering programs, and to assist women as they transition to the workforce after graduation. The resources that reside within these two programs are very effective in their charges and their services will continue to evolve as the needs of the Master of Structural Engineering degree emerge. In addition, the Master of Structural Engineering will have access to OSU's many resources for recruiting and retaining under-represented groups. Linkages with national organizations of minority and women engineers (such as the National Society of Black Engineers, the Society of Hispanic Professional Engineers, and the Society of Women Engineers) are already in place and thriving in the College. The College actively recruits from these organizations and also works from GRE lists and the Summer Research Opportunity Program (SROP) lists.

In the marketing of the program we will use all of OSU's resources and make every effort to recruit members of underrepresented groups. The Master of Structural Engineering offers an outstanding opportunity to enhance the careers of female and minority engineers and, in the process, create more role models to improve the diversity of engineering managers in general.

Consistent with the University's Diversity Plan, efforts to recruit and retain engineers who are members of the LGBT community are receiving increasing emphasis in the College of Engineering. Recruitment efforts through an established link with the National Organization of Gay and Lesbian Scientists and Technical Professionals will be engaged to assist in bringing additional diversity to the Master of Structural Engineering program. Retention efforts for LGBT engineers are beginning to be addressed within the context of the College's evolving diversity plan and within the College's updated Performance Plan.

We believe that we are doing well in attempting to enroll minorities and women in the College of Engineering and will continue with this in the Master of Structural Engineering program.

VI. Available Resources and Additional Resource Needs

a) Existing resources

The Master of Structural Engineering degree program will use the current faculty

already teaching in the Civil Environmental and Geodetic Engineering (CEGE) Department and the Fisher College of Business to facilitate many of the courses in the program. The new studio courses in the program will be taught in existing facilities within the CEGE department by Clinical Faculty.

Clinical faculty: The CEGE department currently has 4 clinical faculty with professional knowledge and expertise in infrastructure/structural engineering. These professors of practice come with years of professional field experience, as well as PhD's in various facets of the field. These instructors provide a valuable asset to creating a program which is relevant to the practicing professional.

b) Additional Resources Needed

To pedagogically teach skilled professionals, a higher quality and standard for on-campus experiences necessitate a higher tuition (see **Appendix H**). Two new courses will be created (Structural Engineering Studios 1 and 2) and an existing clinical faculty member from the CEGE department will be the lead instructor. New costs associated with facilitating these courses will include 2 adjuncts for review and mentoring of our students throughout the course.

While we plan to use existing courses in the department to facilitate the degree program, an incentive program for course redesign and modernization of curriculum will aid in the continuous improvement and staying abreast of the latest tools and techniques in industry. As such, a well-supported development program administered by the Master of Structural Engineering Director will keep the program content continuously updated and relevant in the rapidly changing field of practice.

Faculty professional development: The creation and aggressive improvement of existing courses as well as the development of new and up-to-date course content requires instructors to remain abreast of latest codes and standards in industry. To facilitate this, additional budget is allocated for conference travel and registration as well as course development.

Areas where new material and knowledge need to be developed have also been identified. These include:

- advanced technical classes that integrate the different parts of the curriculum
- development of the integrative project to reflect challenges faced by professionals

Physical facilities and equipment: To provide high quality synchronous content for in-person and remote courses as needed, additional budget is allocated for technology improvements in classroom space currently occupied by the CEGE department.

VII. Assessment Plan

This section details the CEGE Master of Structural Engineering continuous improvement plan. The plan consists of the following activities:

- Assessment and evaluation of student achievement of outcomes
- Student Evaluation of Instruction
- Review of student outcomes

The program will engage the appropriate constituents for the various continuous improvement activities. The following are constituents of the program.

- CEGE Faculty
- CEGE Master of Structural Engineering Students
- Master of Structural Engineering Industry Advisory Board
- CEGE Master of Structural Engineering Alumni
- Employers of CEGE Master of Structural Engineering Graduates

a) Assessment and Evaluation of Student Achievement of Outcomes

On a three-year cycle, the faculty of the program will assess the level of achievement of student outcomes.

At least two assessment tools, one direct and one indirect, will be used to evaluate the level of student achievement of the student outcomes.

- If the level of achievement meets or exceeds the threshold level identified as acceptable by the program faculty no additional assessment for that outcome is required until the next regular cycle.
- If the level of achievement falls below the threshold level identified as acceptable by the program faculty, the student outcome will be identified as under review.
- To be removed from the under review designation the outcome must have two consecutive annual assessments that meet or exceed the threshold level identified as acceptable by the program faculty.
- If the level of achievement falls below the threshold level identified as acceptable by the program faculty for three consecutive assessments, the outcome will be identified as deficient and the program faculty must take corrective action.

Outcomes	**Assessment**
be current in the latest engineering knowledge and related advances in their selected technical fields;	Assess design work with latest standards, code provisions, and state of the art technique implementation
be able to apply knowledge more effectively in innovative directions;	Assess ability in complex problems to use skills developed in coursework
know how to communicate with both business and technical specialists;	Assess written and orally presented project design work
be able to apply the fundamentals of managerial accounting to manage projects to success;	Assess coursework in professional development courses
be trained to successfully lead technical teams	Assess team dynamics and function in team based project work

b) *Course Evaluation*
The program faculty will review all courses within the program on an annual basis. Peer evaluations and student evaluations of instruction will be used to measure course satisfaction and reviewed by the Master of Structural Engineering Faculty Director annually.

c) *Review of Program Objectives and Student Outcomes*
On a six-year cycle, the program objectives and student outcomes will be reviewed. This is consistent with the timing of major building code revisions and releases in the structural engineering industry. All constituent groups will provide input on the objectives and outcomes. The program faculty and industry advisory board will evaluate the results of the constituent feedback and develop recommended changes. All changes must be approved by the Master of Structural Engineering - GSC.

THE OHIO STATE UNIVERSITY

Master of Structural Engineering

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Appendix A

Master of Structural Engineering Curriculum				
Core Technical Courses (min. 9 cr-hrs)				
	Dept	Course#	Course Name	Cr Hrs
	CIVILEN	5320	Intermediate Steel Design	3
	CIVILEN	5350	Intermediate Concrete Design	3
	CIVILEN	6300	Structural Dynamics	3
Studio Design Courses (0 to 6 cr-hrs)[1]				
	CIVILEN	6001	Structural Engineering Studio 1[1]	3
	CIVILEN	6002	Structural Engineering Studio 2[1]	3
Engineering Technical Electives (min. 9 cr-hrs)				
	CIVILEN	5168	Introduction to the Finite Element Method	3
	CIVILEN	5360	Bridge Engineering	3
	CIVILEN	5370	Prestressed Concrete Design	3
	CIVILEN	5510	Durability and Condition Assessment of RC Structures	3
	CIVILEN	5571	Principles of Foundation Analysis and Design	3
	CIVILEN	6510	Advanced Concrete Materials	3
	CIVILEN	7320	Structural Reliability	3
	CIVILEN	7332	Advanced Behavior and Design of Metal Structures	3
	CIVILEN	7350	Advanced Reinforced Concrete	3
	CIVILEN	7330	Earthquake Engineering	3
	MECHENG	5139	Applied Finite Element Method	3
	MECHENG	5162	Introduction to Laminated Composite Materials	3
	MECHENG	7100	Introduction to Continuum Mechanics	3
	MECHENG	7163	Advanced Strength of Materials and Elasticity Theory	3
Professional Development (min. 6 cr-hrs)				
	MBA[2]	6201	Organizational Behavior	1.5
	MBA[2]	6202	Leadership	1.5
	MBA[2]	6211	Accounting and Decision Making	3
	MBA[2]	6253	Marketing	3
	MBA[2]	6281	Professional Development and Business Communication	1.5
	MBA[2]	6293	Strategy	3
	ENGR	6210	Leadership and Team Effectiveness (DL)	3
	ENGR	6220	Accounting/Finance for Engineers (DL)	3
	ENGR	6230	Technology Strategy & Innovation Management (DL)	3
	****	****	Or other courses subject to approval	

Notes

[1] *Civil engineering has a state mandated licensing process that is attainable for design professional with 4 or more years of work experience in their field of practice. For students possessing the distinction of Professional Engineer in Civil Engineering, the Studio sequnce will be optional, allowing for more seasoned professionals to instead take more technical courses which broaden their skill set. Students who are eligible and opt out of the studio course will be required to take an exit exam on the core of the program.*

[2] *All MBA courses provided by the Fisher College of Business (FCB) are subject to restricted enrollment by FCB after priority is given to FCB students*

Master of Structural Engineering Advising Form

Student Name _____ Advisor Name _____

Coursework

Core Technical Courses (9 credits)				
Course Number	**Course Title**	**Academic Term**	**Final Grade**	**Credits**
CIVILEN 5320	**Intermediate Steel Design**			
CIVILEN 5350	**Intermediate Concrete Design**			
CIVILEN 6300	**Structural Dynamics**			

Total Credits _____

Studio Design (0 to 6 credits)*				
Course Number	**Course Title**	**Academic Term**	**Final Grade**	**Credits**
CIVILEN 6001	**SE Studio 1***			
CIVILEN 6002	**SE Studio 2***			

Total Credits _____

Engineering Technical Electives (min. 9 credits)				
Course Number	**Course Title**	**Academic Term**	**Final Grade**	**Credits**

Total Credits _____

Professional Development (min. 6 credits)				
Course Number	**Course Title**	**Academic Term**	**Final Grade**	**Credits**

Total Credits _____

*** For students possessing the distinction of Professional Engineer in Civil Engineering, the Studio course sequence is optional. Students who are eligible and opt out of the studio course will be required to take an exit exam on the core of the program.**

Exam Date	**Results (Pass/ Fail)**

Advisor Signature _____

Appendix B

Processes

I. Selection of Personnel

Faculty Director

The Master of Structural Engineering Faculty Director will be selected by the Chair of the Civil, Environmental and Geodetic Engineering (CEGE) department, and appointed for a three-year term. The Master of Structural Engineering Faculty Director will be a faculty member of the CEGE department, have graduate faculty status with the Graduate School, and will be responsible for the overall direction of the Master of Structural Engineering program. The role will preferably be filled by an Assistant/Associate/Full Professor of Practice.

Administrative Staff

The Master of Structural Engineering program will leverage existing resources in the Civil, Environmental and Geodetic Engineering (CEGE) Department to perform administrative duties. In particular, the CEGE graduate coordinator will aid with admissions, faculty advisor assignments, degree auditing, and working with the graduate school directly.

II. Master of Structural Engineering–Graduate Studies Committee (GSC)

The Master of Structural Engineering Faculty Director will act as the chair of the Master of Structural Engineering - GSC. The Master of Structural Engineering - GSC will consist of these voting members: the Master of Structural Engineering Faculty Director, one representative from the Fisher College of Business, and two Engineering faculty who teach Master of Structural Engineering courses. All voting members of the Master of Structural Engineering - GSC will have graduate faculty status with the Graduate School. The Master of Structural Engineering - GSC will handle all tasks normally associated with a graduate studies committee (admissions, new courses, progress of students, and so on). Membership to the Master of Structural Engineering-GSC will be in accordance with the Graduate School Handbook (Section 13).

III. Industry Advisory Board

The Master of Structural Engineering degree will benefit from a strong industry advisory board to ensure that the degree is relevant to the needs of industry. The Master of Structural Engineering - GSC will nominate members and faculty to be involved in the Board. The Board will meet at least once a year to review the degree program, and will consist of local engineering firm leaders with influence in the State of Ohio.

IV. Admissions

a) Master of Structural Engineering Entrance Requirements

The Professional Masters of Structural Engineering program normally requires a candidate to have a B.S. in Civil Engineering from an accredited program (ABET, CAB) at a college or university. The admissibility of a candidate with a BS not in engineering will be evaluated by the Master of Structural Engineering - GSC acting as the admissions committee for the degree program. Applicants for admission to the Master of Structural Engineering degree program must have a cumulative point hour ratio for undergraduate work of at least 3.0 (4.0 scale). Applicants with cumulative point hour ratios for undergraduate work below 3.0/4.0 may be requested to submit GRE scores, require strong commendations and be placed on probation for first 12 credits to maintain minimum GPA of 3.3.

The Master of Structural Engineering - GSC may request applicants with a B.S. engineering degree from a non-ABET accredited program to submit the results of the GRE General Test. Applicants with non-engineering BS degrees will usually be required to take specified makeup work before their applications will be considered for graduate admission. These applicants may also be required to submit the GRE General Test results regardless of grade point average.

b) Professional Work Experience

Students applying to the Master of Structural Engineering program will normally have at least 1 year of post-B.S. work experience in an engineering-related job. The Master of Structural Engineering - GSC may, however, choose to admit exceptional students with less work experience. Any such student must have significant internship, co-op, or work experience that will enable them to bring something to the classroom and will allow them to benefit from the professional skills that make up Master of Structural Engineering core.

c) Student Mentoring and Progress

Students must complete the degree within four years. Student progress will be tracked by the CEGE graduate coordinator and reported to the Master of Structural Engineering Faculty Director, Student Faculty Advisors, and Master of Structural Engineering-GSC to ensure that all students make good progress toward completion of the degree.

The Master of Structural Engineering Faculty Director will act at the academic advisor for all Master of Structural Engineering students. The faculty advisor will mentor the students relating to professional or course related activities throughout the program. The faculty advisor along with the program coordinator and the Master of Structural Engineering - GSC will review the academic performance of each student and ensure that they are making adequate progress towards completion of the degree. The faculty advisor and program coordinator will interact with students at least once per semester. The faculty advisor is available to provide any career development

advice and in addition the College of Engineering has outstanding career services which will be available to all Master of Structural Engineering students.

d) Credit for previous course work

Students may obtain up to three semester hours of credit for class work outside of the Master of Structural Engineering curriculum. The decision to grant credit or not and the amount of credit granted will be made by the Master of Structural Engineering-GSC upon application of the student.

e) Partner Colleges

A key strength of the Master of Structural Engineering program is its ties to the College of Engineering and the Fisher College of Business. It is important that these relationships be carefully fostered by the Master of Structural Engineering Faculty Director and the Master of Structural Engineering - GSC. The Fisher College of Business will be asked to identify voting representative to the Master of Structural Engineering - GSC so that the partner's interests and concerns can be represented on the committee. The Master of Structural Engineering Faculty Director will also meet with each of these representatives (individually or as a group) at least once a year to discuss how the program is going and any concerns or issues that the partners' representatives wish to bring forward.

V. Master of Structural Engineering Certificates of Specialization

a) Master of Structural Engineering Certificate Approval Process

Certificates of Specialization may be proposed for completion of certain sequences of courses. Any certificate to be offered in connection with the Master of Structural Engineering degree must be proposed to the Master of Structural Engineering-GSC for approval. This proposal must include justification for the idea of a certificate for this topic, the courses included in the sequence and the amount of work involved to obtain this certification. If there are any nationally or internationally recognized certifications involved these must be clearly delineated and the way in which this certification program matches the requirements of the national or international bodies explained. Permission from those bodies must also be obtained and included in the proposal. University guidelines should be carefully followed, as well as the Higher Learning Commission and the Ohio Department of Education process and guidelines.

Appendix C

Master of Structural Engineering Plan of Study

1 Year program

Year 1			
Autumn		Spring	
Course Name	Cr Hrs	Course Name	Cr Hrs
CIVILEN 6001 - Structural Engineering Studio 1	3	CIVILEN 6002 - Structural Engineering Studio 2	3
CIVILEN 5320 - Intermediate Steel Design	3	CIVILEN 5360 - Bridge Engineering	3
CIVILEN 5350 - Intermediate Concrete Design	3	CIVILEN 5370 - Prestressed Concrete Design	3
CIVILEN 6300 - Structural Dynamics	3	CIVILEN 5168 - Introduction to Finite Element Methods	3
MBA 6201 - Organizational Behavior	1.5	MBA 6253 - Marketing	3
MBA 6281 - Professional Development and Buisness Communication	1.5		
Total Credit	*15*	*Total Credit*	*15*

2 Year program

Year 1			
Autumn		Spring	
Course Name	Cr Hrs	Course Name	Cr Hrs
CIVILEN 5320 - Intermediate Steel Design	3	CIVILEN 5360 - Bridge Engineering	3
CIVILEN 6300 - Structural Dynamics	3	CIVILEN 5571 - Principles of Foundation Analysis and Design	3
MBA 6202 - Leadership	1.5	MBA 6253 - Marketing	3
Total Credit	*7.5*	*Total Credit*	*9*
Year 2			
Autumn		Spring	
Course Name	Cr Hrs	Course Name	Cr Hrs
CIVILEN 6001 - Structural Engineering Studio 1	3	CIVILEN 6002 - Structural Engineering Studio 2	3
CIVILEN 5350 - Intermediate Concrete Design	3	CIVILEN 5370 - Prestressed Concrete Design	3
MBA 6281 - Professional Development and Buisness Communication	1.5		
Total Credit	*7.5*	*Total Credit*	*6*

3 Year program			
Year 1			
Autumn		Spring	
Course Name	Cr Hrs	Course Name	Cr Hrs
CIVILEN 5350 - Intermediate Concrete Design	3	CIVILEN 5360 - Bridge Engineering	3
CIVILEN 6300 - Structural Dynamics	3	MBA 6253 - Marketing	3
Total Credit	*6*	*Total Credit*	*6*
Year 2			
Autumn		Spring	
Course Name	Cr Hrs	Course Name	Cr Hrs
CIVILEN 5320 - Intermediate Steel Design	3	CIVILEN 5370 - Prestressed Concrete Design	3
MBA 6281 - Professional Development and Buisness Communication	1.5	CIVILEN 5168 - Introduction to Finite Element Methods	3
Total Credit	*4.5*	*Total Credit*	*6*
Year 3			
Autumn		Spring	
Course Name	Cr Hrs	Course Name	Cr Hrs
CIVILEN 6001 - Structural Engineering Studio 1	3	CIVILEN 6002 - Structural Engineering Studio 2	3
MBA 6202 - Leadership	1.5		
Total Credit	*4.5*	*Total Credit*	*3*

1 Year program - No Studio Required for Professional Engineers			
Year 1			
Autumn		Spring	
Course Name	Cr Hrs	Course Name	Cr Hrs
CIVILEN 5320 - Intermediate Steel Design	3	CIVILEN 5360 - Bridge Engineering	3
CIVILEN 5350 - Intermediate Concrete Design	3	CIVILEN 5370 - Prestressed Concrete Design	3
CIVILEN 6300 - Structural Dynamics	3	CIVILEN 5168 - Introduction to Finite Element Methods	3
CIVILEN 5571 - Principles of Foundation Analysis and Design	3	CIVILEN 7330 - Earthquake Engineering	3
MBA 6201 - Organizational Behavior	1.5	MBA 6253 - Marketing	3
MBA 6281 - Professional Development and Buisness Communication	1.5		
Total Credit	*15*	*Total Credit*	*15*

Appendix D

Proposed New Course Syllabi

Course Overview – Structural Design Studio 1

The structural design studio course sequence is designed to give the student "real world" engineering experience at an advanced level and geared specifically to the working professional in structural engineering. The course takes a team approach, which is often the case in "real world" engineering, where individuals with different competencies work together to solve problems and create design solutions. Each team will work together on a project throughout the next two semesters and will ultimately present a final design for their project by means of an oral presentation (client meetings), written report and engineering drawings. As the project progresses, client meetings will be held, where you will present your progress as well as be able to ask questions relevant to your task. Client meetings can lead to potential revisions to the project geometry or scope. This fundamentally requires the engineer to be adaptable and flexible in design development, not holding on strongly to any particular design element so-as to meet the client needs.

The first semester (Structural Design Studio 1) will be focused on identifying design alternatives, evaluating those alternatives, developing schematic designs, as well as preparing a detailed technical report with drawings. A large portion of the expectation here is to be a proactive member in the design process, and engage in the conversation of the overall design. A portion of the course will be dedicated to developing tools oriented to general structural engineering practice, as well as project specific. Parametric modeling will also be an expectation of the course, where the student will develop tools to dynamically interact with client needs and expectations.

The second semester (Structural Design Studio 2) will be focused on completing a final design for the project based on the recommendations made at the end of the first term. The team's work will be documented in a detailed technical report and engineering drawings at the end of this final semester, and will represent an early stage construction document for the project at hand.

Instructor Contact Information

Name	**Dr. Anthony Massari, P.E.**
Office	Hitchcock 491C
E-mail	massari.8@osu.edu
Phone	614.247.8129 (Office) 201.982.0850 (Home/Mobile)

Design Consultants

During your design lab periods, professional practicing structural engineers will be available to assist you with your project. Please refer to the Consultant Bio document posted on Carmen for additional information about the consultants, and identify which ones will be most useful for a particular task/project at hand.

Communication

Communication From Instructor

During the semester, the instructor will use email to communicate critical course information. Therefore, be sure to check your e-mail frequently throughout the semester for course-related communication. Students are responsible for all information provided in email, no exceptions.

Communication To Instructor

All communication is to be done via e-mail. Within every email, please include your team name and project. All communication with the instructors play a role when final grades are being assigned. It is suggested that you consider the following guidelines:

- Please make sure you are not able to answer the question yourself before asking the question. Asking questions that are a google or email search away demonstrates a lack of basic problem solving and initiative.

If you need help or have questions, the instructor will be happy to talk with you by phone or meet with your team. However, we are requesting that you contact them via e-mail to arrange a date and time.

Communication With Consultants

Teams shall not contact studio consultants unless the consultant has requested such communication. No exceptions.

Course Description

Part 1 of the two semester course sequence for the culminating design component in the Master of Structural Engineering program. Must be taken in semester preceding 6002, with sequence completed as close to graduation as possible.

Prerequisite(s)

Acceptance into the Master of Structural Engineering program.

Course Schedule

The course schedule for lecture and lab are given below. While these are the typical meeting times, you are encouraged to refer to the course schedule and monitor email for modifications to this schedule. Please note, your required lab session will be determined based on project and consultant preferences and will be assigned after teams are formed.

Labs/Lectures: Tuesday and Thursday, 5:30PM - 7:35PM

Office Hours: Tues. & Thurs. 3:00PM – 4:00PM, open door policy and email to set meetings as needed

Attendance Policy

- Attendance is required at all lecture and lab periods.
- All unexcused absences will result in a final grade reduction of 5% for each occurrence.
- The faculty realize that due to professional commitments such as work events and job interviews that individuals may need to miss a lecture or a lab. To accommodate these events, all students will be permitted to miss three (3) lecture/lab sessions during the semester. All absences beyond these will be considered unexcused absences. For exceptional cases requiring a student to miss more than three sessions, such as long term illnesses, please contact the instructors as soon as possible to work out arrangements.
- Lectures and labs end at the times indicated in the course schedule. Packing up or leaving before the end of class will be considered an unexcused absence. No exceptions.

Course Learning Objectives

Upon successful completion of this course, students will be able to:

1. Synthesize knowledge from their prior coursework to identify, formulate, and evaluate design alternatives in the context of a structural engineering project that incorporate criteria such as economics, aesthetics, social, and environmental issues and impacts.
2. Identify and collect information at the various stages of the design process necessary for the design of a structural engineering project.
3. Prepare engineering documents such as engineering drawings, general notes, technical reports, and proposals.
4. Prepare and present professional oral presentations for a variety of audiences.
5. Perform effectively as a member of a project team.

Assignments and Grading

Detailed assignment sheets for all items listed in Table 1 will be posted to Carmen. Your final grade will be calculated according to the weights indicated in Table 1 and will be assigned according to the categories in Table 2. In addition, peer evaluations will be used to adjust group grades and assign individual grades.

Table 1. Item weights for determining final course grades

Item	Weight
Part I Statement of Work	10%
Key Elements & Alternatives	10%
Kick Off Meeting	10%
Client Meeting #1 (100% Schematic Design)	10%
Client Meeting #2 (50% Design Development)	10%
50% Design Development Set and Technical Report	30%
Part II Proposal	5%
Midterm Peer Evaluation	2.5%
Final Peer Evaluation	2.5%
Faculty Evaluation (Technical Competence, professional skills, etc.)	10%

Table 2. Final grade categories

Grade Range	Grade
93-100	A
90-92.9	A-
87-89.9	B+
83-86.9	B
80-82.9	B-
77-79.9	C+
73-76.9	C
70-72.9	C-
<70	E

Projects and Project Teams

Project topics will be posted on Carmen. Individuals will have an opportunity to identify their project preferences (Vertical or Horizontal construction). Based on the individual preferences, teams of approximately three (3) to five (5) students will be formed. The instructor will make every effort to accommodate individual project selections; however, please understand that it may not be possible to accommodate each individual's preference.

Peer Evaluations

Peer evaluations are required to be submitted twice during the semester. One at the middle of the term and one at the end of the semester. Please refer to the course schedule posted on Carmen for the dates and times of submission.

Peer evaluations will be used to determine a grade adjustment factor for each individual student. An individual student's grade for a work product will be calculated by multiplying the group grade for the work product by the student's grade adjustment factor. The grade adjustment factor corresponding to the midterm peer evaluations will be applied to all grades assigned prior to the midterm peer evaluations. The grade adjustment factor corresponding to the final peer evaluations will be applied to all grades assigned after midterm peer evaluations.

The instructor reserves the right to reject clearly inappropriate peer evaluations. The instructor reserves the right to give a final grade of E in the class to any individual determined to be abusing the peer evaluation process.

Student Expectations:

A. Students are expected to behave in a professional manner at all times when conducting business related to the class and failure to do so will impact your final grade. This includes but is not limited to behavior related to the following:
    i. Use of electronic devices, such as cell phones, music/video players, and the like, in lecture.
    ii. Excessive e-mailing, texting, use of cell phones, and surfing the internet for personal reasons during design labs.
    iii. Timeliness of arrival to all lectures and design labs.

iv. Formal business attire (appropriate for an interview) is expected during all presentations unless told otherwise.
v. Interactions with all team members, instructors, advisors, and consultants shall be professional and collegial at all times.

B. All team members are responsible for the overall quality of the work products of the group.
C. Students are expected to resolve conflicts within their group in a professional manner. Failure to do so will likely affect your final grade.
D. Students are expected to share the workload on their project in an equitable and professional manner. ***The instructors reserve the right to assign any student that fails to share the workload on their project in an equitable and professional manner an E in the class.***
E. All students will be required to share the design work in an equitable and professional manner. ***The instructors reserve the right to assign any student that fails to demonstrate their ability to complete their design work in a professional manner an E in the class.***
F. ***Students are expected to work a minimum of six (6) hours beyond the regularly scheduled lecture and design labs per week.*** Working more than six (6) hours per week does not guarantee a passing grade; working less than six (6) hours may result in work product of unacceptable quality and grades below your expectations.
G. Project management expectations.
    i. Teams should establish leadership roles to manage their group and project.
    ii. Teams have the option to reorganize their leadership roles throughout the course.
    iii. Teams are expected to meet formally each week, inside or outside of lab time, to discuss progress; minutes from each meeting must be retained and distributed to all team members.
    iv. All team members are expected to attend all team meetings or be noted as excused from the team meeting. The team members are responsible for determining acceptable reasons for excused absences from team meetings. Missing a significant number of team meetings will likely affect your final grade.
H. Students are expected to ***produce professional quality work products in format and content***.
I. Students are expected to ***acquire the necessary new knowledge to produce a professional quality work product.***

Academic Misconduct

"It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct. http://studentconduct.osu.edu/page.asp?id=1; http://studentlife.osu.edu/csc/."

Disability Services

The University strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can privately discuss options. You are also welcome to register with Student Life Disability Services to establish reasonable accommodations. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information:slds@osu.edu; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

Course Overview – Structural Design Studio 2

The structural design studio course sequence is designed to give the student "real world" engineering experience at an advanced level and geared specifically to the working professional in structural engineering. The course takes a team approach, which is often the case in "real world" engineering, where individuals with different competencies work together to solve problems and create design solutions. This course is the second semester of the sequence. As the project continues to progress, client meetings will be held, where you will present your progress as well as be able to ask questions relevant to your task. Client meetings can lead to potential revisions to the project geometry or scope, however in this second phase of the course, more focus will be spent on creating greater clarity and detail in the design.

The first semester (Structural Design Studio 1) was focused on identifying design alternatives, evaluating those alternatives, developing schematic designs, as well as preparing a detailed technical report with drawings.

Structural Design Studio 2 is more focused on developing professional work product associated with the final stages of the project. The team's work will be documented in a detailed technical report and engineering drawings at the end of this final semester, and will represent an early stage construction document set. Appropriate referencing and sufficient general notes will expected, and a formal final presentation of the design will conclude the course (Client meeting #2).

Instructor Contact Information

Name	**Dr. Anthony Massari, P.E.**
Office	Hitchcock 491C
E-mail	massari.8@osu.edu
Phone	614.247.8129 (Office) 201.982.0850 (Home/Mobile)

Design Consultants

During your design lab periods, professional practicing structural engineers will be available to assist you with your project. Please refer to the Consultant Bio document posted on Carmen for additional information about the consultants, and identify which ones will be most useful for a particular task/project at hand.

Communication

Communication From Instructor

During the semester, the instructor will use email to communicate critical course information. Therefore, be sure to check your e-mail frequently throughout the semester for course-related communication. Students are responsible for all information provided in email, no exceptions.

Communication To Instructor

All communication is to be done via e-mail. Within every email, please include your team name and project. All communication with the instructors play a role when final grades are being assigned. It is suggested that you consider the following guidelines:

- Please make sure you are not able to answer the question yourself before asking the question. Asking questions that are a google or email search away demonstrates a lack of basic problem solving and initiative.

If you need help or have questions, the instructor will be happy to talk with you by phone or meet with your team. However, we are requesting that you contact them via e-mail to arrange a date and time.

Communication With Consultants

Teams shall not contact studio consultants unless the consultant has requested such communication. No exceptions.

Course Description

Part 2 of the two semester course sequence for the culminating design component in the Master of Structural Engineering program.

Prerequisite(s)

Acceptance into the Master of Structural Engineering program.

Course Schedule

The course schedule for lecture and lab are given below. While these are the typical meeting times, you are encouraged to refer to the course schedule and monitor email for modifications to this schedule. Please note, your required lab session will be determined based on project and consultant preferences and will be assigned after teams are formed.

Labs/Lectures: Tuesday and Thursday, 5:30PM - 7:35PM

Office Hours: Tues. & Thurs. 3:00PM – 4:00PM, open door policy and email to set meetings as needed

Attendance Policy

- Attendance is required at all lecture and lab periods.
- All unexcused absences will result in a final grade reduction of 5% for each occurrence.
- The faculty realize that due to professional commitments such as work events and job interviews that individuals may need to miss a lecture or a lab. To accommodate these events, all students will be permitted to miss three (3) lecture/lab sessions during the semester. All absences beyond these will be considered unexcused absences. For exceptional cases requiring a student to miss more than three sessions, such as long term illnesses, please contact the instructors as soon as possible to work out arrangements.
- Lectures and labs end at the times indicated in the course schedule. Packing up or leaving before the end of class will be considered an unexcused absence. No exceptions.

Course Learning Objectives

Upon successful completion of this course, students will be able to:

1. Synthesize knowledge from their prior coursework to identify, formulate, and evaluate design alternatives in the context of a structural engineering project that incorporate criteria such as economics, aesthetics, social, and environmental issues and impacts.
2. Identify and collect information at the various stages of the design process necessary for the design of a structural engineering project.
3. Prepare engineering documents such as engineering drawings, general notes, technical reports, and proposals.
4. Prepare and present professional oral presentations for a variety of audiences.
5. Perform effectively as a member of a project team.

Assignments and Grading

Detailed assignment sheets for all items listed in Table 1 will be posted to Carmen. Your final grade will be calculated according to the weights indicated in Table 1 and will be assigned according to the categories in Table 2. In addition, peer evaluations will be used to adjust group grades and assign individual grades.

Table 1. Item weights for determining final course grades

Item	Weight
Client Meeting #1 (100% Design Development)	25%
Client Meeting #2 (50% Construction Documents)	25%
50% Construction Documents Set and Technical Report	30%
Midterm Peer Evaluation	5%
Final Peer Evaluation	5%
Faculty Evaluation (Technical Competence, professional skills, etc.)	10%

Table 2. Final grade categories

Grade Range	Grade
93-100	A
90-92.9	A-
87-89.9	B+
83-86.9	B
80-82.9	B-
77-79.9	C+
73-76.9	C
70-72.9	C-
<70	E

Peer Evaluations

Peer evaluations are required to be submitted twice during the semester. One at the middle of the term and one at the end of the semester. Please refer to the course schedule posted on Carmen for the dates and times of submission.

Peer evaluations will be used to determine a grade adjustment factor for each individual student. An individual student's grade for a work product will be calculated by multiplying the group grade for the work product by the student's grade adjustment factor. The grade adjustment factor corresponding to the midterm peer evaluations will be applied to all grades assigned prior to the midterm peer evaluations. The grade adjustment factor corresponding to the final peer evaluations will be applied to all grades assigned after midterm peer evaluations.

The instructor reserves the right to reject clearly inappropriate peer evaluations. The instructor reserves the right to give a final grade of E in the class to any individual determined to be abusing the peer evaluation process.

Student Expectations:

A. Students are expected to behave in a professional manner at all times when conducting business related to the class and failure to do so will impact your final grade. This includes but is not limited to behavior related to the following:
    i. Use of electronic devices, such as cell phones, music/video players, and the like, in lecture.
    ii. Excessive e-mailing, texting, use of cell phones, and surfing the internet for personal reasons during design labs.
    iii. Timeliness of arrival to all lectures and design labs.
    iv. Formal business attire (appropriate for an interview) is expected during all presentations unless told otherwise.
    v. Interactions with all team members, instructors, advisors, and consultants shall be professional and collegial at all times.
B. All team members are responsible for the overall quality of the work products of the group.
C. Students are expected to resolve conflicts within their group in a professional manner. Failure to do so will likely affect your final grade.

D. Students are expected to share the workload on their project in an equitable and professional manner. ***The instructors reserve the right to assign any student that fails to share the workload on their project in an equitable and professional manner an E in the class.***
E. All students will be required to share the design work in an equitable and professional manner. ***The instructors reserve the right to assign any student that fails to demonstrate their ability to complete their design work in a professional manner an E in the class.***
F. ***Students are expected to work a minimum of six (6) hours beyond the regularly scheduled lecture and design labs per week.*** Working more than six (6) hours per week does not guarantee a passing grade; working less than six (6) hours may result in work product of unacceptable quality and grades below your expectations.
G. Project management expectations.
    i. Teams should establish leadership roles to manage their group and project.
    ii. Teams have the option to reorganize their leadership roles throughout the course.
    iii. Teams are expected to meet formally each week, inside or outside of lab time, to discuss progress; minutes from each meeting must be retained and distributed to all team members.
    iv. All team members are expected to attend all team meetings or be noted as excused from the team meeting. The team members are responsible for determining acceptable reasons for excused absences from team meetings. Missing a significant number of team meetings will likely affect your final grade.
H. Students are expected to ***produce professional quality work products in format and content***.
I. Students are expected to ***acquire the necessary new knowledge to produce a professional quality work product.***

Academic Misconduct

"It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct. http://studentconduct.osu.edu/page.asp?id=1; http://studentlife.osu.edu/csc/."

Disability Services

The University strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can privately discuss options. You are also welcome to register with Student Life Disability Services to establish reasonable accommodations. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information:slds@osu.edu; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

Appendix E

Course Descriptions

CIVILEN 5320 – Intermediate Steel Design (3 credits)

Design of bolted and welded building connections; structural behavior in the nonlinear range; plastic analysis and design of steel structures.

CIVILEN 5350 – Intermediate Concrete Design (3 credits)

Analysis and design of reinforced concrete systems and components.

CIVILEN 5168 – Introduction to the Finite Element Method (3 credits)

Basic concepts, formulation, and application of finite element techniques for numerical solution of problems of engineering and scientific interest.

CIVILEN 5360 – Bridge Engineering (3 credits)

Types of bridges; aesthetics in bridge design; loads on bridges; selection of bridge type; AASHTO specifications for bridge design; design of steel bridges.

CIVILEN 5370 – Prestressed Concrete Design (3 credits)

Design applications for prestressed concrete members and structures. Basic concepts to be covered include flexural and shear design, stress analysis, deflections, and prestress losses.

CIVILEN 5510 – Durability and Condition Assessment of Reinforced Concrete Structures

This course provides an in-depth review of the most common processes affecting durability of portland cement concrete durability, and presents methods of assessing the quality of in-place concrete construction for vertical construction, roads and bridges, and geotechnical elements. Laboratory durability testing, on-site non-destructive evaluation techniques, and procedures for repair and rehabilitation will be discussed.

CIVILEN 5571 – Principles of Foundation Analysis and Design (3 credits)

Design methods (classical and numerical) will be presented for the analysis of excavations, earth structures, shallow and deep foundations. The course introduces: site investigation techniques, failure mechanisms and design techniques of footings, drilled shafts, sheet piles, driven piles, anchors, tiebacks, and MSE walls, as well as, stability and settlement calculations.

CIVILEN 6001 – Structural Engineering Studio 1 (3 credits)

*Proposed new course under development, see attached syllabi.

CIVILEN 6002 – Structural Engineering Studio 1 (3 credits)

*Proposed new course under development, see attached syllabi.

CIVILEN 6300 – Structural Dynamics (3 credits)

Concepts in structural dynamics and their applications in civil engineering type structures. Methods to determine dynamic response of single degree of freedom systems with free and forced vibrations, similar concepts in discrete and continuous multi-degree of freedom systems. Numerical methods to

determine response over time, industry standard analysis software. Prereq: Grad standing, or permission of instructor.

CIVILEN 6510 – Advanced Concrete Materials (3 credits)

Understanding of the development of chemical and mechanical properties of cementitious materials, as well as their strengths and limitations, is essential for civil engineers to be able to successfully design infrastructure that meets not only service requirements but also achieves the goals of being economical, efficient, durable, and sustainable. This course takes a materials science-based approach to understanding the materials and processes involved in hydration and property development of cementitious materials. Students will then apply that learning to understand how to designs systems which will prevent, and/or mitigate durability concerns common in concrete infrastructure.

CIVILEN 7320 – Structural Reliability (3 credits)

Fundamental concepts, theoretical developments, and simulation strategies for the assessment of the reliability of structures with applications in design and performance evaluation of new and existing structures and other engineered systems.

CIVILEN 7330 – Earthquake Engineering (3 credits)

Analysis and design of structures subject to seismic loading; case studies of behavior of structures during earthquakes; design of structures to minimize earthquake damage; earthquake-resistant systems for highrise buildings; vibration control.

CIVILEN 7350 – Advanced Reinforced Concrete (3 credits)

Advanced topics in reinforced concrete structural modeling, analysis, design and detailing.

MECHENG 5139 – Applied Finite Element Method (3 credits)

Overview of finite element method, description of finite element software, modeling requirements and techniques, analysis using general purpose software, and case studies.

MECHENG 5162 – Introduction to Laminated Materials (3 credits)

Introduction to anisotropic material behavior and failure assessment of laminated composite materials. Classical lamination theory, beams, plates and shells.

MECHENG 7100 – Introduction to Continuum Mechanics (3 credits)

Continuum mechanics in Cartesian and general coordinates, vectors and tensors in indicial and direct notation, analysis of deformation and stress, balance principles.

MECHENG 7163 – Advanced Strength of Materials and Elasticity Theory (3 credits)

Stress-Strain analysis of elastic solids: curved beams; non-symmetrical bending; non-circular torsion; beams on elastic foundations; load-deflection relations by energy methods; plane problems in elasticity theory; and applications to design

MBA 6201 – Organizational Behavior (1.5 credits)

This class is about building the critical managerial skills you need to excel in your career. We begin with a case study of an MBA's first job, which reveals several challenges and opportunities that you

might encounter as you begin your internships and ultimately, career. Through the rest of the sessions, we'll consider six roles you have to play as a leader and manager to work through the challenges that arise. In each session, we'll introduce these roles, and discuss how you can build up the skill associated with them.

MBA 6202 – Leadership (1.5 credits)

This course explores the behavior of individuals within organizations from the perspective of leadership. We will explore the general questions, what does it mean to be effective in the leadership role and how can we use influence to make needed changes in organizations, in society, and in ourselves. We will seek answers to these and related questions by taking an evidence-based approach, appealing to the results of rigorous, empirical studies undertaken by researchers in the fields of management and psychology.

MBA 6211 – Accounting and Decision Making (3 credits)

Examines the role of accounting and financial reporting by investors and managers for decision-making and performance evaluation.

MBA 6253 – Marketing (3 credits)

Focuses on the interrelated elements of the marketing mix, its relationship with the other functional areas of management, and marketing responses to the external environment.

MBA 6281 – Professional Development (1.5 credits)

Professional development and skill set enhancement in the areas of leadership, self-awareness, team-based work and ability to adapt to work life in the context of different organizational and global cultures.

MBA 6293 – Strategy Formulation and Implementation (3 credits)

Focus on the determination of the strategic direction of the firm and the management of the strategic process.

ENGR 6210 – Leadership and Team Effectiveness for Engineers (3 credits)

Introduction to topics in leadership and team effectiveness with a focus on applications for engineers.

ENGR 6220 – Financial and Managerial Accounting for Engineers (3 credits)

Provides an overview of the basic topics in financial and managerial accounting. The primary focus will be on helping engineering students understand the meaning of the numbers in financial statements, their relationship to one another, and learning how they are used in planning, decision-making and control towards achieving the objectives of an organization.

ENGR 6230 – Technology Strategy and Innovation for Engineers (3 credits)

How technology strategy may lead to creation/persistence of competitive advantage. In contrast to core strategy course, provides series of strategic frameworks for managing high-tech businesses.

Appendix F

Faculty Matrix

Name of Instructor	Rank or Title	Full Time or Part Time	Degree Titles, Institution, Year, Discipline	Years of Teaching Experience	Course(s) Taught in Program
Natassia Brenkus, P.E.	Assistant Professor	FT	PhD, University of Florida, 2016, Civil Engineering	4	Prestressed Concrete Design
Lisa Burris	Assistant Professor	FT	PhD, University of Texas, Austin, 2014, Civil Engineering	4	Advanced Concrete Materials
Jieun Hur, P.E.	Assistant Professor of Practice	FT	PhD, Georgia Tech, 2012, Civil Engineering	8	Earthquake Engineering
Anthony Massari, P.E.	Assistant Professor of Practice	FT	PhD, California Institute of Technology, 2017, Civil Engineering	14	Intermediate Steel Design, Structural Design Studio 1 & 2, Structural Dynamics
Daniel Pradel, P.E.	Professor of Practice	FT	Dr. of Engineering, University of Tokyo, 1987		Principles of Foundation Analysis and Design
Halil Sezen, P.E.	Professor	FT	PhD, University of California, Berkeley, 2002, Structural Engineering	19	Intermediate Concrete Design
Abdollah Shafieezadeh	Associate Professor	FT	PhD, Georgia Tech, 2011, Civil Engineering	10	Structural Dynamics
Open Position	Adjunct	PT	Bridge Engineering		Structural Design Studio 1 & 2
Jeffery Ford	Professor	FT	PhD, Ohio State University, 1975 Organizational Behavior	45	Leadership and Team Effectiveness
Marc Smith	Lecturer	FT	M.S., Ohio State University, 1997, Accounting	21	Accounting/Finance for Engineers
Michael Leiblein	Associate Professor	FT	PhD, Purdue University, 1997, Management	24	Technology Strategy & Innovation Management
Xue Wang	Associate Professor	FT	Ph.D., University of Chicago, 2005, Accounting	16	Accounting

Norm Colter	Senior Lecturer	FT	MBA, University of New Mexico, 1999	21	Accounting
Michael Easterday	Senior Lecturer	FT	Master of Financial Economics, Ohio University, 2015	12	Accounting

Appendix G

Faculty Curriculum Vitae

Natassia Brenkus

Education

Ph.D., Civil Engineering	University of Florida	December 2016
M.S., Civil Engineering	University of Florida	December 2013
B.S., Civil Engineering	University of Florida	December 2006

Academic experience

01/2016 - Present Assistant Professor, The Ohio State University

Non-academic experience

01/2010 - 12/2016 Graduate Research Assistant, University of Florida

01/2012 – 12/2012 Structures Research Lab Intern, Marcus Ansley Structures Research Center
Directed lab staff in the execution of experimental work. Developed procedures and assisted in construction of pumping equipment for injection of flexible fillers for post tendons. Assisted in construction and instrumentation of a variety of research projects.

04/2014 – 08/2014 Structures Research Lab Intern, Marcus Ansley Structures Research Center
Directed lab staff in the execution of experimental work related to graduate programs. Assisted in construction and instrumentation of a variety of research projects.

01/2006 – 12/2009 Design Engineer, Commercial Metals Co. Joist and Deck, Gainesville, FL

05/2005 – 12/2006 Engineering Intern, SMI Joist and Deck, Gainesville, FL

Certifications or professional registrations

E.I. License # # 1100011530
Bonded Post-Tensioning Level 1 Certification
Unbonded Post-Tensioning Level 1 Certification

Current membership in professional organizations

Member of American Concrete Institute
Reviewer for ASCE's Journal of Bridge Engineering

Honors and awards

UF Alumni Fellowship	Aug. 2012-Aug. 2016
PTI-AMSYSCO Scholarship	2014
Office of Research Travel Grants	2014; 2015

Important publications and presentations from the past five years

Abdullah, A.B.M., Rice, J.A., Brenkus, N.R., and Hamilton, H. R. "Full-Scale Experimental Investigation of Wire Breakage Detection in Deviated Multi-Strand Tendon Systems," *Journal of Civil Structural Health Monitoring,* 2015.

Brenkus, N.R., Wagner, D.J., and Hamilton, H. R. "Experimental Evaluation of Flexural Static and Fatigue Strength of an Innovative Splice for Prestressed Precast Concrete Girders," *ASCE Journal of Bridge Engineering,* accepted Oct. 2015.

Brenkus, N.R., Wagner, D.J. and Hamilton, H. R. "Experimental Evaluation of Shear Strength of an Innovative Splice for Prestressed Precast Concrete Girders," *ASCE Journal of Bridge Engineering,* accepted Oct. 2015.

Brenkus, N.R., and Hamilton, H. R. "A Field-spliced Prestressed Joint to Extend Spans of Simply Supported I-girders" *Precast/Prestressed Concrete Institute Conf. Proceedings,* 2014.

Brenkus, N.R., and Hamilton, H. R. "Proposed Minimum Steel Provisions for Prestressed and Nonprestressed Reinforced Sections," *ACI Structural Journal,* 2014.

Brenkus, N.R., Bhatia, R., Potter, W.A., and Hamilton, H. R. "Mock-up Injections of Flexible Filler Materials for Multi-strand Post-Tensioning Tendons," *Post-Tensioning Institute Journal,* 2015 (in preparation).

Brenkus, N.R., Abdullah, A.B.M., Bhatia, R., Hamilton, H. R., and Rice, J.A. "Replaceable Unbonded Tendons for Post-Tensioned Bridges," Report for the Florida Department of Transportation, (in preparation).

Bhatia, R., Brenkus, N.R., Hamilton, H. R. and Rice, J.A. "Replaceable Unbonded Tendons for Post-Tensioned Bridges – Task 1 Interim Report," Interim Report for the Florida Department of Transportation, 2015. (Available at www.dot.state.fl.us/structures/structuresresearchcenter/ActiveResearch).

Brenkus, N.R. and Hamilton, H. R. "Long Spans with Transportable Precast Prestressed Girders," Report for the Florida Department of Transportation, 2013. (Available at www.dot.state.fl.us/structures/structuresresearchcenter/CompletedResearch).

Professional Development Activities in Last Five Years

N/A

Lisa E. Burris

Assistant Professor, Ph.D.
Civil, Environmental, and Geodetic Engineering • The Ohio State University
470 Hitchcock Hall, 2070 Neil Ave, Columbus OH 43210 USA
614-688-3135/614-292-3780 • burris.189@osu.edu

Education

2014 **Ph.D. in Civil Engineering;** (Construction Materials Specialization);
University of Texas, Austin, TX
Dissertation: *Increasing the Reactivity of Zeolites Used as Supplementary Cementitious Materials*. Advisor: Maria Juenger

2011 **M.S. in Civil Engineering**; (Transportation Materials Specialization)
Kansas State University, Manhattan, KS;
Thesis: *Diffusivity and Resistance to Deterioration from Freezing and Thawing of Optimized Ternary Concrete Mixture Blends*. Advisor: Kyle Riding

2009 **B.S. in Architectural Engineering**; Kansas State University, Manhattan, KS.

Appointments and Professional Experience

January 2017-Present	Assistant Professor; Department of Civil, Environmental, and Geodetic Engineering, The Ohio State University, Columbus, OH.
August 2014–December 2016	Postdoctoral Fellow; Department of Civil and Environmental Engineering, Georgia Institute of Technology, Atlanta, GA;
May 2016-July 2016	Visiting Researcher;, Ecole des Ponts, ParisTech, Champs-sur-Marne, France; in collaboration with Matthieu VanDamme and Patrick Dangla.

Selected Publications

- Suraneni, P., **Burris, L**., Shearer, C., Hooton, R.D., "The ASTM C618 Fly Ash Specification: Comparison with Other Specifications, Shortcomings, and Solutions," Accepted for publication 15 June 2020, ACI Materials Journal. DOI:10.14359/51725994
- Acarturk, B.C., Burris, L.E., "Effects of combination of retarders on CSA cement systems," Proceedings of *Cement-based Materials Tailored for a Sustainable Future*, 7-8 May 2020, Istanbul, Turkey.
- Burris, L.E., Alpati, P., Kurtis, K.E., Hajibabaee, A., Ley, M.T., "Understanding shrinkage in alternative binder systems," *ACI Special Publication*, 2019, In Print.
- Kurtis, Kimberly, Alapati, Prasanth, Burris, Lisa, "Alternative Cementitious Materials: An Evolution or Revolution." *Public Roads Magazine,* Vol. 83, No. 3, 2019, FHWA-HRT-20-001.
- Burris, L.E., Kurtis, K.E., "Influence of Set Retarding Admixtures on Calcium Sulfoaluminate Cement Hydration and Property Development," *Cement and Concrete Research*, V014, February 2018, 105-113, doi.org/10.1016/j.cemconres.2017.11.005.
- Burris, L.E., Kurtis, K.E., "Performance of Alternative Binders in Sulfate Environments," *ACI Special Publication 317*, 2017, 1-18.
- Burris, L. E., Alapati, P., Ley, M.T., Berke, N., Moser, R.D., Kurtis, K.E., "Novel Alternative Cementitious Materials for Development of the Next Generation of Sustainable Transportation Infrastructure, *FHWA Techbrief*, 2015, http://www.fhwa.dot.gov/advancedresearch/pubs/16017/index.cfm.
- Burris, L. E., Kurtis, K.E., "Alternative Cementitious Materials – Challenges and Opportunities" *ACI Special Publication 305-27*, 2015, 1-7.
- Burris, L. E., Juenger, M.C.G., "The Effect of Acid Treatment on the Reactivity of Natural Zeolites used as Supplementary Cementitious Materials," *Cement and Concrete Research*, 79 (2016) 185-193.

doi:10.1016/j.cemconres.2015.08.007
- Burris, L. E., Juenger, M., "Milling as a Pretreatment Methods for Increasing the Reactivity of Natural Zeolites for Use as SCMs," *Cement and Concrete Composites*, 65 (2016) 163-170. doi:10.1016/j.cemconcomp.2015.09.008
- Clement J. Cros, Alexandra L. Terpeluk, **Lisa E. Burris**, Neil E. Crain, Richard L. Corsi, Maria C.G. Juenger, "Effect of weathering and traffic exposure on removal of nitrogen oxides by photocatalytic coatings on roadside concrete structures," *Materials and Structures*, 48, 10 (2015) 3159-3171. DOI:10.1617/s11527-014-0388-2
- Burris, L.E., Riding, K., "Diffusivity of Ternary Mixture Blend Concrete," *ACI Materials,* 111, 4 (2014) 373-382. doi:10.14359/51686826

Selected Professional Activities

Teaching and Advising

- Instructor for *Civil Engineering Materials, Concrete Durability and Condition Assessment,* and *Advanced Concrete Materials* courses at Ohio State.
- Advisor for American Concrete Institute (ACI) Student Organization, and Concrete Canoe, Sp 2019-Present.
- Organizer: Civil, Environmental, and Geodetic Engineering Departmental Graduate Student Seminar and Distinguished Speaker Series.
- OSU Civil, Environmental, and Geodetic Department Presenter organizer and Exhibit presenter, "Hot Concrete, Cool Science," Columbus ASCE STEM Fair. Sp 2017, 2018, 2019
- Mentorship – Maria Somsy, Cristo Rey Professional Work Study Program, Fall 2017-Sp 2018

Service

- American Concrete Institute Central Ohio Chapter, *Board Member, Fall 2017-Current*
- American Concrete Institute, *National Member, Sp 2009-Present*
  - Committee 232 – Fly Ash in Concrete, *Voting Member (beginning August 2019)*
  - Committee 242 – Alternative Cements, *Voting Member (beginning Nov 2020)*
  - Committee 123 – Research, *Voting Member (beginning Nov 2014)*
  - ACI Convention Research in Progress Poster Session Moderator, American Concrete Institute Convention, Sp 2018
  - ACI Convention Open Topic Presentation Session Moderator, American Concrete Institute Convention, 11/2014-10/2016
  - ACI Convention Workability Student Competition Judge, American Concrete Institute Convention, Fall 2016
  - Committee 231 – Properties of Concrete at Early Ages, *Associate Member (beginning Nov 2015)*
  - Committee 201 – Durability of Concrete, *Associate Member (March 2009-April 2018)*
  - Committee 236 – Materials Science of Concrete, *Associate Member (beginning March 2009)*
  - Task Group (ITG1 Advanced Analysis Techniques) *Secretary, Sp 2018-Current*
- American Ceramics Society, *Member, Sp 2012-Present*
  - Contributor to Cements Division promotional video: https://www.youtube.com/watch?v=g0msyO9i9T4 Session Moderator, 5th Advances in Cement-based Materials: Characterization, Processing, Modeling and Sensing Conference, Summer 2014American Concrete Institute Central Texas Chapter, *Member, Sp 2011-2014*
- CIVILEN 3310 – Structural Analysis "Art and Engineering" Design Expo Judge, Sp 2018

JIEUN HUR, Ph.D., PE

Assistant Professor of Practice
Department of Civil, Environmental and Geodetic Engineering
The Ohio State University
211B Bolz Hall, 2036 Neil Ave, Columbus, OH 43210
Phone: 614-292-2987, Email: hur.55@osu.edu

RESEARCH AND SERVICE INTERESTS

Structural analysis and design, 3D high-fidelity modeling and dynamic analysis, structural health monitoring (SHM), probabilistic modeling and statistic methods

EDUCATION

2012 **PhD** (Civil/Structural Engineering), Georgia Institute of Technology, Atlanta, GA
2006 **MS** (Civil/Structural Engineering), Georgia Institute of Technology, Atlanta, GA
1998 **BS** (Architectural Engineering), Ewha Womans University, Seoul, Korea

RESEARCH AND PROFESSIONAL EXPERIENCE

04/2019-present Assistant Professor of Practice, Ohio State University, Columbus, OH
04/2013-03/2019 Visiting Assistant Professor, Ohio State University, Columbus, OH
08/2006-08/2012 Graduate Research Assistant, Georgia Institute of Technology, Atlanta, GA
08/2006-08/2012 Graduate Teaching Assistant, Georgia Institute of Technology, Atlanta, GA
06/2000-06/2005 Project (Structural) Engineer, Mirae ISE Co., Ltd., Seoul, Korea
01/1998-05/2000 Structural Engineer, Shinhwa Engineering Co., Ltd., Seoul, Korea
2013-present Registered Professional Engineer (PE) in Civil Engineering, California, USA
2003-present Registered Professional Structural Engineer (PE), Korea
Honored as "*The Youngest Professional Engineer (PE) in South Korea in 2003*"

Selected PUBLICATIONS

1. Fereshtehnejad, E., Shafieezadeh, A., **Hur, J.** (2021). "Optimal budget allocation for bridge portfolios with element-level inspection data: A constrained integer linear programming formulation". Structure and Infrastructure Engineering, doi:10.1080/15732479.2021.1875489
2. Zamanian, S.; **Hur, J**.; Shafieezadeh, A. (2020). A high-fidelity computational investigation of buried concrete sewer pipes exposed to truckloads and corrosion deterioration. Engineering Structures, 221, doi:10.1016/j.engstruct.2020.111043
3. Fereshtehnejad, E., **Hur J.** & Shafieezadeh A., (2019) "An Integer Linear Programming Formulation for Optimal Budget Allocation for Bridge Portfolios with Element-Level Inspection Data". *Structure and Infrastructure Engineering,* under review.
4. Schmuhl D.T., Loos S., **Hur J.** & Shafieezadeh A.,(2018) "Time-dependent probabilistic capacity degradation assessment of prestressed concrete piles in marine environment". *Structure and Infrastructure Engineering,* Mar 2,1-14.
5. El Khoury, O., Kim, C., Shafieezadeh, A., **Hur, J.,** Heo, G. (2018). "Mitigation of the seismic response of multi-span bridges using MR dampers: Experimental study of a new SMC-based controller". JVC/Journal of Vibration and Control, 24 (1), 83-83. doi:10.1177/1077546316633540

6. Fereshtehnejad, E., **Hur, J.**, Shafieezadeh, A., Brokaw, M., Noll, B., Backs, J., & Waheed, A. (2018). "Systematic Procedures for the Analysis of Agency and User Costs of Bridge Repair Actions", *Transportation Research Record*, 0361198118797807.

7. Fereshtehnejad, E., **Hur, J.**, Shafieezadeh, A., & Brokaw, M., (2017), "Ohio Bridge Condition Index: A multi-level cost-based performance index for bridge systems", *Transportation Research Record: Journal of the Transportation Research Board*, 17-05306.

8. Fereshtehnejad, E., **Hur, J.**, Shafieezadeh, A., & Brokaw, M., (2017), "Ohio Bridge Condition Index: A novel cost and condition based index for assessment of bridges", Proceedings of the 11th *International Bridge and Structure Management Conference*, Mesa, Arizona, April 26-27, 2017.

9. Guler, A. **Hur, J.**, Denning, R., Aldemir, T., & Sezen, H., October 2-7, (2016) "Aging Effects on Safety Margins of Passive Components in Seismic Events" *13th International Conference on Probabilistic Safety Assessment and Management (PSAM 13)*, Seoul, Korea

10. **Hur J**., Sezen H., Denning R., & Aldemir T. October 2-7, (2016), "Assessment of the Effect of Structural Model Fidelity on the Failure Probability of Nonstructural Components." *PSAM13 13th International Conference Probabilistic Safety Assessment and Management,* Seoul, Korea

11. **Hur, J**., Guler, A., Sezen, H., Aldemir, T., & Denning, R. (2016) "Assessment Of Conservatism In The Separation Of Variables Approach To Seismic Probabilistic Risk Assessment", The International Congress on Advances in Nuclear Power Plants (ICAPP), San Francisco, CA

12. El-Khoury O., Kim C.G., Shafieezadeh A., **Hur J.**, Heo G.H. (2015). "Experimental study of the semi-active control of a nonlinear two-span bridge using stochastic optimal polynomial control". Smart Materials and Structures, 24, 065011. doi:10.1088/0964-1726/24/6/065011

SOFTWARE SYSTEMS:

Shafieezadeh, A., **Hur, J.**, and Fereshtehnejad, E., OBCI: A Software Package for Optimal Risk-Based Management of Massive Transportation Asset Portfolios, Developed for Ohio Department of Transportation as the product of the project (State Job # 27174): "A Bridge Condition Index for Transportation Asset Management in Ohio", Delivered in July 2018.

SYNERGISTIC ACTIVITIES:

1. Technical Panel of National Academy of Sciences (NAS) National Cooperative Highway Research Program (NCHRP) since 2019 for NCHRP 14-45, "Guidelines for Response Planning, Assessment, and Rapid Restoration of Service of Bridges in Extreme Events."; A Technical Committee Member of ASCE 7, 2014-2016 (Standard for Seismic Certification of Nonstructural Components using Shake Table)

2. Moderator of conferences and symposiums: A symposium organizer, the *12th International Conference on Applications of Statistics and Probability in Civil Engineering* (ICASP 12), Seoul, Korea, 2019; U.S.A.-Korea Conference (UKC) 2018 Queens, New York, USA, 2018; A session Moderator, Structures Congress, Portland, Oregon, USA, 2015; A session Moderator, 11th International Conference on Structural Safety & Reliability (ICOSSAR), Columbia University, New York, US, *2013*

3. STEM Outreach Activities: Committee member of Central Ohio Miniature Bridge Building Competition (COMBBC), Columbus, Ohio, 2019-present; Introducing civil/structural engineering to K-12 students with different methods: TEK8 program, KIPP, Columbus, Ohio, 2017 & 2018; STEM Expo for k-8 students, The Metro School, Columbus, Ohio, 2014; Technology, Engineering and Computing (TEC) Camp, Atlanta, GA, 2009, 2011; Fernbank Museum of Natural History - "Scouts Day", Atlanta, GA, 2010

Anthony Massari, PhD, P.E., LEED AP

Assistant Professor of Practice
Department of Civil, Environmental and Geodetic Engineering
The Ohio State University

470 Hitchcock Hall
2070 Neil Avenue
Columbus, OH 43210

RESEARCH INTERESTS

- Tall Building Analysis, Performance and Design
- Earthquake Engineering and Applications to Large Scale Systems
- High Performance Structures and Materials
- Resilient Infrastructure
- Structural Health Monitoring
- Non-Destructive Evaluation of Structures using Accelerometers
- Smart City Networks for Rapid Emergency Response

EDUCATION

Ph.D. in Civil Engineering, California Institute of Technology, Conferred June 2018
Pasadena, CA
Research Focus: Implementation of dense low cost accelerometers to determine damage states of large scale structures and improvement of state-of-the-art earthquake design and analysis procedures in the United States.
Research Advisor: Thomas Heaton

M.S. Applied Mechanics, California Institute of Technology, Conferred May 2014
Pasadena, CA

M.S. Engineering with focus in Structural Engineering and Mechanics of Materials, University of California, Berkeley, Conferred May 2008
Berkeley, CA

B.S. Civil and Environmental Engineering, The New Jersey Institute of Technology, Conferred May 2007
Summa Cum Laude, Top of Civil Engineering Class, Albert Dorman Honors College Graduate
Newark, NJ

INDUSTRIAL EXPERIENCE

Senior Engineer
Thornton Tomasetti (2006-2012)
New York, NY - Newark, NJ

Structural engineer for a variety of high end athletic facilities, commercial, residential, and academic institutions around the world. Daily responsibilities included structural analysis, design, analytical and graphical modeling, project coordination with architects and planners, and management of engineering staff

Highlighted projects include:

- New Meadowlands Stadium, Rutherford NJ: Steel and foundation analysis and design for 80,000+ person football stadium. Additional studies into vibrational anomalies involving footfall excitation.
- Florida Polytechnic, Lakeland FL: Structural design and analysis for the award-winning Innovation Science and Technology Building, a signature building designed by Santiago Calatrava consisting of a significant movable structure.
- Hudson Yards Development, New York NY: Tower and platform design for high-rise development.
- Additional representative projects shown below:

Athletic Facilities
Sun Life Stadium Office Expansion, Miami, FL
Prudential Center, Newark, NJ
New Meadowlands Stadium, Rutherford NJ

Academic Institutions
Millennium Science Complex, Univ. Park, PA
Manhattan College Dormitory, Riverdale, NY
Florida Polytechnic, Lakeland, FL

Commercial/Residential
Hudson Yards Development, New York, NY
Diamond of Istanbul, Istanbul, Turkey
Downtown Jebel Ali Zone, Dubai, UAE
Rivali Park, Mumbai, India
Al Raha Beach Development, Abu Dhabi, UAE
Novartis Office Park, Parsippany, NJ
Five Crescent Drive, Philadelphia, PA
731 Lexington Avenue Renov., New York, NY

ACADEMIC EXPERIENCE

Assistant Professor of Practice - The Ohio State University (2017 – present)
Visiting Associate - The California Institute of Technology (2020 – present)
Adjunct Professor - New Jersey Institute of Technology (2008 – 2017)
Graduate Student Instructor - University of California, Berkeley (2007)

SELECTED ACADEMIC ACCOLADES

2016 Earthquake Engineering Research Institute Travel Grant Recipient
2015 Earthquake Engineering Research Institute Travel Grant Recipient
2012 California Institute of Technology Housner Fellowship Recipient

SELECTED PROFESSIONAL/ACADEMIC PRESENTATIONS

Massari, A.; Kohler, M.; "*Dense Building Instrumentation Applications for City-wide Structural Health Monitoring and Resilience*" speaker presenting conference paper for the 2017 World Conference on Earthquake Engineering (Santiago, Chile)

Massari, A.; Kohler, M.; Heaton, T.; Kanamori, H.; Hauksson, E.; Clayton, R.; Guy, R.; Bunn, J.; Chandy, M.; "*Using Building Seismic Strong Motion Data to Quantify Urban Blast Pressure Fields*" speaker presenting at the 2015 American Geophysical Union Annual Fall Meeting (San Francisco, CA)

Massari, A.; "*Challenges in Design and Construction of Millennium Science Complex*" talk presented to Pennsylvania State University, Architectural Engineering Program 2010 (State College, PA)

SELECTED PUBLICATIONS FROM RESEARCH INITIATIVES

Massari, A. (2019) *"Sliding of Nonstructural Components and their Effect on Seismic Response of Structures"* Proceedings of International Conference on Natural Hazards & Infrastructure, Chania, Greece

Massari, A.; Kohler, M.; Clayton, R.; "*Damage Detection by Template-Matching of Scattered Waves*" Seismological Society of America – Bulletin of the Seismological Society of America (2018) 108 (5A): 2556-2564.

Massari, A; et al; "*Dense Building Instrumentation Applications for City-wide Structural Health Monitoring and Resilience*" (conference paper for World Conference of Earthquake Engineering, 2017).

PROFESSIONAL ACTIVITIES AND REGISTRATIONS

- Associate member of ASCE 41 Seismic Retrofit Of Existing Buildings Standards Committee
- Past Co-Chair of the American Society of Civil Engineers Infrastructure Resilience Division Emerging Technologies:
- Licensed Professional Engineer in the State of California
- Leadership in Energy and Environmental Design Accredited Professional (LEED AP)
- American Society of Civil Engineers (Member, Practitioning Advisor)

THE OHIO STATE UNIVERSITY

College of Engineering
Department of Civil, Environmental and Geodetic Engineering
491-C Hitchcock Hall
2070 Neil Avenue
Columbus, OH 43210

Prof. Daniel Pradel, PE, GE, DGE

Education
Postdoc., Geotechnical Eng., University of California, Los Angeles (UCLA), 1989
Dr. Eng., Civil Eng., Univ. of Tokyo (Japan), 1987
Diploma of Civil Engineer, Swiss Institute of Technology (EPFL), 1982

Certifications or Professional Registrations
State of California Registered Geotechnical Engineer (G.E. 2242)
State of California Registered Civil Engineer (R.C.E. 47734)
State of Nevada Registered Civil Engineer (R.C.E. 12285)
State of Hawaii Registered Civil Engineer (R.C.E. 12243)
State of Utah Registered Civil Engineer (R.C.E. 9252352-2202)
Registered Engineer in Switzerland Number 2/16791.
Post-Disaster Safety Assessment Program (SAP) Evaluator, State of California (No. SAPV61821)

Professional Summary
Dr. Pradel specializes in slope stabilization, geotechnical earthquake engineering, and numerical modelling (e.g., using finite elements/differences). Dr. Pradel has 30+ years of consulting engineering experience, as well as extensive academic experience. He has worked on projects located in four continents, including regional transportation projects, dams, slope stabilizations, deep excavations, and foundation designs. He has more than 50 publications involving innovative design approaches based on his consulting practice (e.g., design procedures for landslide stabilizing piles, design of subway station walls for the Silicon Valley Rapid Transit system, deep foundations for projects in Los Angeles, dewatering stabilization technologies, and design of MSE walls using extremely lightweight backfills); his publications also describe findings from major case histories, such as the 2005 La Conchita landslide, 2017 Hurricane Maria in Puerto Rico, and the 2011 Tohoku Earthquake in Japan.

Academic Experience

8/2016 – present	Professor of Practice (Geotechnical), The Ohio State University
9/1997 – 6/2016	Adjunct Assoc. Professor, UCLA
9/1997 – 6/1997	Lecturer, UCLA

Professional Experience

5/1982 – 4/1984	*Civil Engineer in the Dam Design Dept.,* Motor-Columbus Consulting Engineers (Baden, Switzerland): Performed analyses for the static and seismic design of several earth and concrete dams and their related structures (bottom outlet, diversion tunnel, spillway, etc.), including El Cajon arch dam, Honduras, Paute Mazar gravity dam, Ecuador, and other dams in Peru, Argentina, Indonesia and Switzerland.
7/1989 – 8/1997	*Senior to Chief Engineer (Geotechnical),* Lockwood-Singh & Assoc. (Los Angeles, CA): Performed numerous geotechnical investigations and

analyses of earth failure mechanisms including landslides, seismicity, soil-structure interaction, groundwater and seepage, subsidence, slope failure, foundation engineering, for mostly residential projects.

9/1997 – 4/2011 *Chief Engineer (Geotechnical),* Praad Geotechnical Inc. (Los Angeles, CA): As co-founder and Principal, I directed and performed geotechnical investigations and analyses related to transportation projects (e.g., Silicon Valley Rapid Transit), dams (e.g., Leniham Dam), landslide stabilizations, as well as foundation design for commercial and residential projects, along the West Coast of the USA, Japan and Latin-America.

5/2011 – 8/2015 *Principal Engineer and Group Manager (Geotechnical),* Group Delta Consultants (Torrance, CA): As manager of the Numerical Modelling group, I directed and performed numerical analyses for the seismic design of large transportation projects in Canada (ELRT) and California (e.g., for BART, LA Metro, viaduct for the 605/10 freeways near Los Angeles, CA), and performed numerous causation and landslide investigations (mostly in Utah and California).

8/2011 – 8/2015 *Vice-President (Geotechnical),* Shannon & Wilson (Glendale, CA): I directed and performed various geotechnical investigations or analyses related to large transportation projects (e.g., Queenstown Airport in New Zealand, LA Metro, LAX, etc.), sinkholes (Louisiana), commercial buildings, and distress causation investigations (e.g., subsidence, flooding, and landslides).

Selected Honors and awards

Fellow of the American Society of Civil Engineers (ASCE)
Diplomate of ASCE's Academy of Geo-Professionals (No. 1135)
Associate Editor, ASCE Journal of Geotechnical & Geoenvironmental. Engineering
Co-Editor of the 2013 ASCE-GI national GeoCongress in San Diego, California
Chair of the ASCE-GI Awards Committee
Invited speaker at OTEC, ASCE and DFI conferences/events in USA, Mexico, and Canada.

Selected Publications

Pradel D. and Miguel Pando (2019), "Effects of scour, landslides and debris flows in Puerto Rico during Hurricane Maria,", 2nd Int. Conf. on Nat. Hazards & Infrast., Chania, Greece
Pradel D. (2019), "La Conchita Landslide: Case History and Remedial Measures", ASCE Geo-Congress Proceedings, Philadelphia, PA, 290-300.
Deane R. T., Pradel D. and Buenker J.M. (2017), "Emergency Stabilization of the White Point Landslide", ASCE GeoCongress, Orlando, FL.
Tiwari B., Pradel D., et al. (2018) "Landslide Movement at Lokanthali, during the 2015 Earthquake in Gorkha, Nepal", ASCE Journal of Geotechnical and GeoEnvironmental Engineering, Vol.144(3).
Pradel D., Wartman J., Tiwari B. (2014), "Impact of anthropogenic changes on liquefy. along the Tone River during the 2011 Tohoku Earthquake", ASCE Nat. Haz. Rev. Vol.15 13-26.

Halil Sezen

Education

Ph.D. University of California, Berkeley, Structural Engineering, 2002
M.S. Cornell University, Ithaca, New York, Civil Engineering, 1996
B.S. Middle East Technical University, Ankara, Turkey, Civil Engineering, 1993

Academic experience

2014 to Present Professor, The Ohio State University, Columbus, Ohio
2009 – 2014 Associate Professor, The Ohio State University, Columbus, Ohio
2002 – 2009 Assistant Professor, The Ohio State University, Columbus, Ohio
1997 – 2002 Graduate Research Assistant, University of California, Berkeley
1995 – 1996 Exchange Scholar/Graduate Teaching Assistant, Stanford University, California
1994 – 1995 Graduate Student Researcher, Cornell University, Ithaca, New York
1993 – 1994 Graduate Student Researcher, Middle East Technical University, Ankara, Turkey
2/2011 – 6/2011 Visiting Professor, National Taiwan University, Taipei, Taiwan
11/2010 – 1/2011 Visiting Professor and JSPS Research Fellow, Osaka University, Japan

Professional registration

2003 to Present Registered Professional Civil Engineer, P.E., State of Ohio

Current membership in professional organizations

American Society of Civil Engineers, American Concrete Institute, Prestressed/Precast Concrete Institute, Ohio Society of Professional Engineers, and National Society of Professional Engineers

Honors and awards

2017 Fellow, Structural Engineering Institute
2016 Fellow, American Society of Civil Engineers
2014 Fellow, American Concrete Institute
2011 Visiting Professor Fellowship, by the National Science Council of Taiwan to conduct research at National Taiwan University.
2010 JSPS Invitation Fellowship for Research in Japan (Osaka University), Japan Society for the Promotion of Science.
2009 and 2010, Finalist, Outstanding Paper award. Journal of Performance of Constructed Facilities
2009 Lumley Research Award, College of Engineering, The Ohio State University
2007 PCI Daniel P. Jenny Research Fellowship
2005 Finalist, NOVA Innovation Award, Construction Innovation Forum.

Service activities over the past five years (within and outside of the institution)

Outside of the University

- *Associate Editor*, Journal of Structural Engineering (American Society of Civil Engineers, ASCE)
  Responsible Editor, Earthquake Spectra (Earthquake Engineering Research Institute)
  Editorial Board Member: Engineering Structures (Elsevier), Advances in Concrete Construction, Advances in Civil Engineering, Challenge Journal of Structural Mechanics
- *Technical committee activities and membership*:
  ASCE Committee 41, Seismic Rehabilitation of Existing Buildings Standard
  ASCE Disproportionate Collapse Technical Committee
  ACI (American Concrete Institute) Committee 369, Seismic Repair and Rehabilitation
  ACI-ASCE Committee 441, Reinforced Concrete Columns
  ACI-ASCE Committee 445, Shear and Torsion
  ACI Committee 341, Earthquake Resistant Concrete Bridges
  PCI (Prestressed/Precast Concrete Institute), Structural Integrity Committee

- Project Panel Member, Transportation Research Board, National Cooperative Highway Research Program, NCHRP project (2012-2016)
- Trustee, Franklin County Chapter of the Ohio Society of Professional Engineers, OSPE (member of Board of Trustees as a Professional Engineer in Higher Education, PEHE) (2010-2014)

College of Engineering Committees

- Promotion and Tenure Committee (2014-2016)
- Faculty Awards Committee (2014-2015)
- Faculty Professional Leave Advisory Committee (2013-2015)
- Discovery Theme Initiative/Proposal: Materials for Sustainability (2014)
- College of Engineering Strategic Planning Task Force – Advanced Materials (2012)
- College of Engineering Honors Committee (2008-2010, 2011-2013)

Department of Civil, Environmental and Geodetic Engineering Committees

- Promotion and Tenure Committee (2014-present)
- Chair - Faculty Search Committee (2016-2017) Structures
- Chair - Faculty Search Committee (2016-2017) Infrastructure Resilience
- Chair - Faculty Search Committee (2015-2016). Two new faculty members hired.
- Executive Committee (2013-2015)
- Organizer, T.H. Wu lectureship series (2014-2015)
- Chair - Faculty Search Committee (2012-2013)
- Faculty Search Committee (one faculty hired in 2011-2012)
- Faculty Search Committee (for three faculty search, 2006-2007)
- Undergraduate Studies Committee (2004-2005, 2008-2010, and 2011-2013)
- Undergraduate Honors Advisor (2008-2010, 2011-2013)
- Graduate Studies Committee (2005-2008)
- Recruitment and Outreach Committee (2007-2009)
- Ad-hoc Graduate Program Semester Conversion Committee (2011-2012)
- Ad-hoc Undergraduate Curriculum Evaluation Committee (2005-2006)

Important publications and presentations from the past five years

2 edited books; 3 chapters published in edited books; 51 peer reviewed journal articles; 7 technical reports and bulletins; 62 papers in conference proceedings; 20 posters and abstracts; and 18 keynote speaker, invited talk and panel discussion.

Selected Publications

- Sezen H. (Editor) 2012. *Earthquake Engineering*. InTech. ISBN 978-953-51-0694-4, pp. 336
- Li K., Sezen H., and Wood C. April 6-8, 2017. "Progressive Collapse Performance of Buildings and Contribution of Load Bearing and Infill Walls." *ASCE Structures Congress,* Denver, Colorado
- Morone D. J., and Sezen H. 2014. "Simplified Collapse Analysis using Data from Reinforced Concrete Building Experiment." *ACI Structural Journal*, Vol. 111, No. 4, 925-934
- Sezen H., Song B. I., and Giriunas K. A. 2014. "Progressive Collapse Testing and Analysis of a Steel Frame Building." *Journal Constructional Steel Research*, Vol. 94, 76-83
- Lodhi M. S., and Sezen H. 2012. "Estimation of Monotonic Behavior of Reinforced Concrete Columns Considering Shear-Flexure-Axial Load Interaction." *Earthquake Engineering & Structural Dynamics*, Vol. 41, No. 15, 2159-2175

Professional Development Activities in Last Five Years: N/A

Abdollah Shafieezadeh

Education

Ph.D., Civil/Structural Eng.	Georgia Institute of Tech.	August 2011
M.S., Civil/Structural Eng.	Utah State University	August 2008
M.S., Civil/Structural Eng.	University of Tehran	August 2006
B.S., Civil Engineering	University of Tehran	August 2003

Academic experience

8/2012 – present	Assistant Professor, Ohio State	Full Time
8/2011 – 8/2012	Postdoctoral Associate, Georgia Tech	Full Time

Non-academic experience

N/A

Certifications or professional registrations

Engineering in Training

Current membership in professional organizations

American Association for Wind Engineering
Earthquake Engineering Research Institute
American Society of Civil Engineers
Structural Engineering Institute

Honors and awards

College of Engineering Lumley Research Award (2017)
MacArthur Foundation's Science, Technology, and Security Initiative & Sam Nunn School of International Affairs at Georgia Tech, Sam Nunn Security Fellowship (2011)

Service activities over the past five years (within and outside of the institution)

Outside of the University

2012 – present	Reviewer, NSF Grant Proposals (seven panels)
2012 – present	Reviewer, Journal Articles (over 45 papers)
2015 – present	Guest Editor, Shock and Vibration Journal
2016	Reviewer, Ontario Research Fund, Ontario, Canada

University Committees

2016 – present	Member, Faculty Advisory Board, Global Water Initiative

College of Engineering Committees

2016 – 2017	Member, Faculty Search Committee – Resilient Infrastructure
2015 – present	Member, Planning Committee for Center for Reliability and Resilience
2015 – 2017	Reviewer, Graduate Fellowship for Diversity
2014 – 2016	Member, Undergraduate Honors Committee
2014 – 2015	Member, Faculty Search Committee – Smart Urban Systems

Department of Civil, Environmental and Geodetic Engineering Committees

2016 – present	Member, Graduate Studies Committee
2013 – present	Academic Advisor, Undergraduate Steel Bridge Team
2016 – 2017	Member, Faculty Search Committee – Structure
2015 – 2016	Member, Faculty Search Committee – Structure
2015 – 2016	Member, Undergraduate Studies Committee
2014 – 2016	Advisor, Undergraduate Honors
2014 – 2015	Member, Faculty Search Committee – Infrastructure
2012 – 2014	Member, Strategic Planning Committee

Important publications and presentations from the past five years

El-Khoury O., and Shafieezadeh A., 2017, "Reliability-Based Control Algorithms for Nonlinear Hysteretic Systems Based on Enhanced Stochastic Averaging of Energy Envelope", *Earthquake Engineering and Structural Dynamics*, DOI 10.1002/eqe.2909.

Fereshtehnejad E., Hur J., Shafieezadeh A., and Brokaw M., 2017, "Ohio Bridge Condition Index: A Multi-Level Cost-Based Performance Index for Bridge Systems", *Transportation Research Record: Journal of the Transportation Research Board*, 17-05306, In press.

Kale O., Padgett J., and Shafieezadeh A., 2017, "A Ground Motion Prediction Equation For Novel Peak Ground Fractional Order Response Intensity Measures", *Bulletin of Earthquake Engineering*, DOI 10.1007/s10518-017-0122-x, pp. 1 – 25.

Fereshtehnejad E., Shafieezadeh A., 2017, "A Randomized Point-Based Value Iteration POMDP Enhanced with a Counting Process Technique for Optimal Management of Multi-State Multi-Element Systems", *Structural Safety*, Vol. 65, pp. 113 – 125.

Mohammadi Darestani Y., Shafieezadeh A., and DesRoches R., 2016, "An Equivalent Boundary Model for Effects of Adjacent Spans on Wind Reliability of Wood Utility Poles in Overhead Distribution Lines", *Engineering Structures*, Vol. 128, pp. 441 – 452.

Fereshtehnejad E., and Shafieezadeh A., 2016, "Multiple Hazard Incidents Lifecycle Cost Assessment of Structural Systems Considering State-Dependent Repair Times and Fragility Curves", *Earthquake Engineering and Structural Dynamics*, Vol. 45, pp. 2327 – 2347.

Fereshtehnejad E., Banazadeh M., and Shafieezadeh A., 2016, "System Reliability-Based Seismic Collapse Assessment of Steel Moment Frames Using Incremental Dynamic Analysis and Bayesian Probability Network", *Engineering Structures*, Vol. 118, pp. 274 – 286.

El-Khoury O., Kim C. G., Shafieezadeh A., Hur J. E., Heo G. H., 2016, "Mitigation of the Seismic Response of Multi-Span Bridges Using MR Dampers: Experimental Study of a New SMC-Based Controller", *Journal of Vibration and Control*, 1077546316633540.

El-Khoury O., Kim C. G., Shafieezadeh A., Hur J. E., Heo G. H., 2015, "Experimental Study of The Semi-Active Control of a Nonlinear Two Span Bridge Using Stochastic Optimal Polynomial Control", *Smart Materials and Structures*, Vol. 24, 065011.

Shafieezadeh A., and Ivey Burden L., 2014, "Scenario-Based Resilience Assessment Framework for Critical Infrastructure Systems: Case Study for Seismic Resilience of Seaports", *Reliability Engineering and System Safety*, Vol. 132, pp. 207 – 219.

Professional Development Activities in Last Five Years

N/A

Name: Norman H. Colter, MBA, CPA
Rank: Senior Lecturer
Department: Accounting & MIS
College: Max M. Fisher College of Business-The Ohio State University

COLLEGIATE AND PROFESSIONAL EDUCATION

Master of Business Administration
Concentrations: Accounting and Management Information Systems
University of New Mexico, Albuquerque, NM 1999

Bachelor of Business Administration
Concentration: General Management
Eastern New Mexico University, Portales, NM 1994

Associate in Arts
Concentration: Liberal Arts
New Mexico Military Institute, Roswell, NM 1988

ACADEMIC EMPLOYMENT

Senior Lecturer – Accounting Department
University of New Mexico
August 2001 to 2018

Adjunct Instructor – Accounting Department
University of New Mexico
August 2000-August 2001

Graduate/Research Assistant
University of New Mexico
August 1996-May 1999

PROFESSIONAL CERTIFICATIONS

Certified Public Accountant-State of New Mexico
(Maintained license since November 1999)

State of New Mexico Public Education Department-Business Manager License -Level 2

BUSINESS AND PROFESSIONAL EXPERIENCE

Program Coordinator/Academic Advisor
College Enrichment Program
University of New Mexico
June 2000 – July 2001

Staff Accountant
KPMG, LLP, El Paso, TX
June 1999 – June 2000

Director of Student Housing
Eastern New Mexico University-Roswell, Roswell, NM
1991 – 1995

MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS

American Accounting Association
American Institute of Certified Public Accountants
Chartered Institute of Management Accountants
New Mexico Society of CPAs
Association of Latino Professionals in Finance and Accounting (ALPFA)
Association of Certified Fraud Examiners
Association of Information Systems
New Mexico Association of School Business Officials
National Association of Black Accountants (NABA)

HONORS

Accounting Educator of the Year in NM (NMSCPAs)
UNM College All-Star Faculty (Selected by UNM athletes)
Graduate Fellowship, University of New Mexico (1998 and 1999)
Ernst & Young Foundation Scholarship – ASM (1998)
Graduate Scholars Fellowship, University of New Mexico (1997)

AREAS OF EXPERTISE

Financial Accounting
Managerial Accounting
Accounting Information Systems

Michael Easterday, CPA, CMA, CIA

Education

Ohio University, *Athens, Ohio* May 2015
Master of Financial Economics
Ohio University, *Athens, Ohio* June 2005
Bachelor of Business Administration, *magna cum laude* Majors: Accounting & Business Prelaw • Minor: English Literature

Certifications

Certified Public Accountant, *Ohio* License #44756 • Issued 6/15/07
Certified Management Accountant Certificate #52942 • Issued 3/29/17
Certified Internal Auditor Serial #129546 • Issued 3/27/14
Certification in Risk Management Assurance Serial #14804 • Issued 8/9/14
Notary Public, State of Ohio Commission Expires 6/30/2024

Academic Experience

Ohio State University, *Columbus, OH* August 2018 - Present
Sr. Lecturer

- *Auditing Principles and Procedures* - senior-level Accounting Specialization required course.
- *Cost Accounting* - junior-level Accounting Specialization required course.
- *Accounting for Decision Making* – graduate-level course in the Working Professionals MBA program.

Ohio University, *Athens, OH* January 2012 - August 2019
MBA Instructor

- *Accounting for Executives* – graduate-level course in the Professional and Online MBA programs.

Columbus State Community College, *Columbus, OH* April 2009 - June 2012
Adjunct Instructor

- Instructed an array of undergraduate level courses including: Financial Accounting, Managerial Accounting, Audit Principles I & II, Governmental Accounting, and Business Ethics.

Academic Service and Committees

Accounting Association, *faculty advisor* September 2019 - Present

- Serve as advisor to Ohio State on-campus student organization.

Committee for Academic Relations, IMA, *member, Vice-Chair (current)* July 2016 - Present

- Committee work includes reviewing endorsement applications submitted by colleges and universities to the Institute of Management Accounting (IMA) Higher Education Endorsement Program.

Deloitte Audit Innovation Campus Challenge, *faculty advisor* September 2018 - Present

- Serve as advisor to undergraduate student team competing in an annual case competition concerning innovations in the auditing and assurance industry.

Presentations

IMA *Faculty Friday* webinar, *co-presenter* June, 28 2019

- Subtitle: "Differentiate your accounting curriculum through IMA's Higher Education Endorsement Program."

Honors and Awards

UITL New Faculty FIT Teaching and Learning Endorsement Summer 2019

- University Institute for Teaching and Learning Endorsements are awarded to individuals across Ohio State to acknowledge their dedicated and substantial effort in continued professional learning in instructional development representing in-depth, sustained, and recognized approaches to pedagogical improvement and excellence.

Michael Easterday, CPA, CMA, CIA

2015 Dr. Glenn Sumners Student Medal Award July 5, 2015

- Recognition from the Institute of Internal Auditors for achieving the highest overall examination score of any student candidate who became a Certified Internal Auditor during the 2014 examination period.

2014 Ohio University School of Accountancy, Young Alumnus Award April 23, 2014

- Recognition from the Ohio University Chapter of Beta Alpha Psi and the School of Accountancy for outstanding work and achievements within ten years of graduation.

Professional Experience

NiSource, *Columbus, OH* August 2014 - July 2018
Lead Internal Auditor

- Responsible for planning and conducting financial and operational audits including preparation of fieldwork documentation and draft audit reports. Facilitate communication of findings to company management and assist with remediation efforts or other management requests as necessary.

Office of Budget and Management, State of Ohio, *Columbus, OH* July 2009 - August 2014
Internal Audit Manager

- Planned and conducted State Agency audits including federal grants, state grants, and general operating efficiencies. Prepared final audit reports for communication to agency management, and assisted management in formulating remediation plans.
- Supervised staff throughout engagements. Prepared performance evaluations and assisted staff with professional development.
- Co-developed an Internal Audit Plan for compliance and operational risk audits of American Recovery and Reinvestment Act stimulus dollars awarded to the State of Ohio.

Deloitte & Touche, LLP, *Columbus, OH* September 2005 - April 2009
Senior Accountant

- Supervised field audit engagements for both private and public entities for the purpose of opining on clients' financial reports. Facilitated communication with client management to relay findings and discuss field audit issues.
- Performed audit procedures related to the implementation of Sarbanes-Oxley legislation.
- Served as a facilitator instructing the basics of D&T audit approach and client service to first-year level professionals at a national training seminar.

Professional Affiliations

Institute of Internal Auditors, *member*
American Institute of CPAs, *member*
Institute of Management Accountants, *member*
Ohio Society of CPAs, *member*

Community Involvement

Options for Supported Housing, Board of Directors, *member, Treasurer (current)* December 2018 - Present

- Provide oversight, direction, and fiduciary duties for the good of the organization. (Options for Supported Housing is a social enterprise non-profit providing safe, quality community housing that improves quality of life for people with developmental disabilities.)

Ohio University Alumni Association, Central Ohio Chapter, *member, President (2010-2013)* October 2007 - June 2016

- Plan and coordinate activities aimed at engaging alumni in the central Ohio area for social and professional networking purposes. Supervise annual events for the purpose of fund raising for an alumni scholarship endowment fund.

United Cerebral Palsy of Central Ohio, Board of Directors, *member* August 2008 - December 2010

Deloitte IMPACT Day Committee, *Office Lead (2007, 2008), Project Lead (2006)* December 2005 - April 2009

- Directed a committee of 20 D&T professionals to coordinate an annual community service day involving the volunteer time of roughly 250 professionals from the Columbus office at various NFP organizations.

Xue Wang

Ohio State University, Fisher College of Business
2100 Neil Avenue
Columbus, OH 43210

Ph: (614) 688-1330
Fax: (614) 291-2118
Email: xue.wang@fisher.osu.edu

Education

UNIVERSITY OF CHICAGO — Chicago, IL
Graduate School of Business
M.B.A., August 26, 2005
Ph.D. in Accounting, December 9, 2005.

UNIVERSITY OF IOWA — Iowa City, IA
M.A. in Economics, July 28, 2000.

Employment

THE OHIO STATE UNIVERSITY — Columbus, OH
Associate Professor of Accounting, Fisher College of Business, July 2012-present.

EMORY UNIVERSITY — Atlanta, GA
Assistant Professor of Accounting, Goizueta Business School, July 2005-June 2012.

Refereed Publications

Bradshaw, Mark, Brandon Lock, Xue Wang, and Dexin Zhou, 2020, "Soft Information in the Financial Press and Analyst Revisions," *The Accounting Review*, Forthcoming.

Engel, Ellen, Feng Gao, and Xue Wang, 2019, "The Importance of Role-Specific Performance and Sociopolitical Factors for Chief Financial Officer Employment Outcomes," *Accounting Horizons*, 33(1), 61-81.

Wang, Isabel, Xue Wang, and Dan Wangerin, 2017, "Consquences of Increased Compensation Disclosure Transparency: Evidence from CEO Pay in Acquiring Firms," *Journal of Accounting, Auditing and Finance*, Forthcoming.

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Working Papers

"Deregulation and Board Policies: Evidence from Performance and Risk Exposure Measures Used in Bank CEO Turnover Decisions," June 2020 (with Rachel Hayes and Xiaoli Tian). Under second round review at *The Accounting Review*.

"Hedge Fund Activism in Corporate Bond Market: Evidence from Bondholders' Responses to Delay in Financial Reporting," December 2020 (with Yu Gao and Abbie Smith). Revising for second round review at *Contemporary Accounting Research*.

"Does Trade Secret Protection Influence Cost Structure? Evidence from the Adoption of the Inevitable Disclosure Doctrine," September 2020 (with Feng Gao and Benda Ying).

"Shareholder Lawsuits and CEO Turnover Decisions," December 2020 (with Rachel Hayes and Xiaoxia Peng).

"An Examination of Firm-Manager Match Quality in the Executive Labor Market," December 2020 (with Matthew Ma and Jing Pan).

"Earnings Management through Capitalizing Operating Costs: Evidence from Accounting for Policy Acquisition Costs in the Insurance Industry," December 2020 (with Diana Choi).

Jeffrey D. Ford
Curriculum Vita

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EDUCATION

Ph.D.	August 1975	The Ohio State University, Organizational Behavior
M.B.A.	March 1973	The Ohio State University, Marketing
B.S.	June 1971	University of Maryland, Marketing

ACADEMIC AND PROFESSIONAL EXPERIENCE

Professor of Management, The Ohio State University, 2010 to present
Associate Professor of Management, The Ohio State University, 1983 to 2010
Associate Professor of Administrative and Behavioral Studies, Indiana University, 1980-83
Assistant Professor of Administrative and Behavioral Studies, Indiana University, 1976-80
Assistant Research Professor, Rutgers - The State University of New Jersey, 1975-76

PUBLICATIONS

Books:

Ford, J.D. and L.W. Ford. The Four Conversations: Daily Communication that Gets Results. San Francisco: Berrett-Koehler (August, 2009).

Ford, J.D. and L.W. Ford. Deadline Busting: How to be a Star Performer in Your Organization. New York: iUniverse, 2005.

Book Chapters:

Ford, J.D. and L.W. Ford, "The Leadership of Change: A View from Recent Empirical Evidence." In W. Pasmore, R. Woodman, and A. Shani (Eds.) Research in Organization Change and Development, Emerald Publishing, 20(2012), 1-36.

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Articles:

Ford, J. D. and L. W. Ford. "Stop Blaming Resistance to Change and Start Using It." *Organizational Dynamics*, 39(1)(2010), 24-36.

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Ford, J.D. and L.W. Ford. "The Role of Conversations in Producing Intentional Change in Organizations," *Academy of Management Review*, 20 (1995), 541-570. Awarded Best Published Paper by the Organizational Communication Division of the Academy of Management, 1995.

Ford, J.D. and L.W. Ford. "Logics of Identity, Contradiction, and Attraction in Change," *Academy of Management Review*, 19 (1994), 756-785.

MARC H. SMITH

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EXPERIENCE

09/01 – present — **The Ohio State University**, Columbus, OH
Senior Lecturer
- Responsible for teaching all levels of undergraduate accounting classes

09/01 – present — **Ohio Humanities Council**, Columbus, OH
Business Manager
- Manage the $1 million annual budget for the Council
- Responsible for all financial aspects of the Council including bank deposits, bank reconciliations, payroll, accounts payable, accounts receivable, maintaining ledgers and journals, and working closely with external auditors on the year-end financial statement audit
- Responsible for completing financial reports required by the federal government

09/99 – 08/01 — **Otterbein College**, Westerville, OH
Visiting Professor
- Responsible for teaching all MBA-level accounting classes

04/99 - 09/99 — **Huntington Bancshares Incorporated**, Columbus, OH
Internal Auditor - Senior
- Responsible for financial audits such as audits of payroll and fixed assets
- Conducted a review of general ledger accounts to determine appropriateness of use and educated employees on the proper way to use these accounts
- Responsible for the supervision and review of temporary workers and interns

07/97 - 03/99 — *Internal Auditor - Staff*
- Participated in establishing a company-wide general ledger certification program
- Performed audits in the areas of corporate finance, information systems, securities accounting, and investments

EDUCATION

The Ohio State University, Max M. Fisher College of Business, Columbus, OH
M.S. in Accounting, June 1997

Westminster College, New Wilmington, PA
B.A. in Accounting, June 1993

CERTIFICATION

CPA, Ohio (1997, currently inactive)

HONORS AND AWARDS

Ohio Board of Regents Faculty Innovator Award, 2009
Undergraduate Teaching Award, Ohio State – Mansfield Campus, 2008
Undergraduate Teaching Award, Ohio State – Columbus Campus, 2007
Undergraduate Teaching Award, Ohio State – Mansfield Campus, 2002
University Fellowship, Ohio State, 1994 – 1997

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Education

Purdue University, Krannert Graduate School of Management, Ph.D.
Rensselaer Polytechnic Institute, Lally School of Businesss, M.B.A.
Rensselaer Polytechnic Institute, B.S., Electrical Engineering

Professional Positions

Assistant to Associate Professor, Fisher College of Business; Ohio State University.
Visiting Professor, Copenhagen Business School (Fall, 2012).
Instructor to Assistant Professor, University of South Carolina.
Consultant, Andersen Consulting.
Systems Engineer, Johnson Controls.

Professional Awards

Academic Research Awards

- *Academy of International Business*. 2015 Best Paper Award Finalist (with Kiran Awate).
- *Academy of Management* 2009 Chan Hahn Best Paper Award Finalist in Operations Management (with John Gray & Aleda Roth).
- *Academy of Management* 2007 Distinguished Paper Award in Business Policy & Strategy (with Tammy Madsen).
- *Academy of Management* 2005 Distinguished Paper Award in Business Policy & Strategy (with Tammy Madsen).
- *Academy of Management* / Free Press 1996-1997 Best Dissertation Award in Business Policy & Strategy Finalist.
- *Academy of Management* Honorable Mention for 1996 Best Paper Award in Technology & Innovation Management (with Carolyn Woo).
- *Academy of Management* 1994 Glueck Best Paper Award in Business Policy & Strategy (with Tim Folta).

Academic Research Grants

- Koch Foundation. 2016-2018: Grant for research and teaching in innovation & entrepreneurship. ($1,369,254). Declined.
- National Science Foundation. 2011-2015. PI on "Outsourcing, offshoring, and performance." Proposal 1133043 Funded by Division of Social and Economic Sciences, Innovation and Organization Sciences Program ($341,721).
- Ohio State University. 2010-2015: Co-PI, Food Innovation Center ($3,750,000).

Academic Teaching Awards

- Outstanding Core MBA Professor, Professional MBA Classes of 2000 and 2002.

Other Academic Awards

- *Academy of Management Review* developmental reviewer of the year award, 2018.
- *Strategic Management Journal* outstanding editorial board member, 2010, 2017, 2018.
- *Academy of Management* BPS Division outstanding reviewer, 2001, 2004 through 2007.

Publications

- Leiblein, MJ, JJ Reuer, and TR Zenger. 2018. "Assessing Key Dimensions of Strategic Decisions." *Strategy Science*. Vol 3(4): 555-557. DOI.org/10.1287/stsc.2018.0073
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- Madsen, TL and MJ Leiblein. 2015. "Resource stocks, innovation, & persistent heterogeneity." *Journal of Management Studies*. Vol. 52(8): 1097-1127. DOI: 10.1111/joms.12154
- James, S, MJ Leiblein, S Lu. 2013. "How firms capture value from their innovations." *Journal of Management*. Vol. 39(5): 1123-1155. DOI: 10.1177/0149206313488211
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  - Reprinted in Oviatt, BM and PP McDougall., International Entrepreneurship. Edward Elgar Publishing, 2007.
- Leiblein, MJ and DJ Miller. 2003. "An empirical examination of transaction- and firm-level influences on the vertical boundaries of the firm," *Strategic Management Journal,* Vol. 24(9), pp. 839-859. DOI: 10.1002/smj.340
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  - Recognized in 2004 as Best Article written by an HEC Professor.
  - Reprinted in Leiblein, MJ and A Ziedonis 2011, Technology Strategy & Innovation Management, Edward Elgar.

Appendix H

College of Engineering
Budget for New Graduate Degree Program
Master of Structural Engineering
FY2022-FY2026

		FY2022	FY2023	FY2024	FY2025	FY2026
Projected Enrollment						
Cohort 1		5	5	10	10	15
Cohort 2			5	5	10	10
Full Time Equivalent (FTE) Enrollment		5	10	15	20	25
PMSE Projected Tuition		$17,120	$17,291	$17,464	$17,639	$17,815
Projected Program Income						
Tuition Revenue		$85,600	$172,912	$261,962	$352,775	$445,379
University Tax (24%)			-$20,955	-$21,372	-$21,795	-$22,225
TOTAL PROJECTED PROGRAM INCOME		$85,600	$151,957	$240,590	$330,980	$423,154
Program Expenses						
Instruction						
Faculty		$17,500	$17,500	$17,500	$17,500	$17,501
GTA Support		$71,454	$72,169	$72,891	$73,620	$74,356
	Sub Personnel	*$88,954*	*$89,669*	*$90,391*	*$91,120*	*$91,857*
Operating Expenses						
New Facilities/Building/Space Renovation		$10,000	$0	$0	$0	$0
Tuition Scholarship Support		$7,400	$14,800	$22,200	$29,600	$37,000
Additional Technology or Equipment Needs		$5,000	$0	$5,000	$0	$0
Other Expenses		$15,000	$15,000	$15,000	$15,000	$15,000
	Subtotal OpEx	*$37,400*	*$29,800*	*$42,200*	*$44,600*	*$52,000*
	Total Expenses	***$126,354***	***$119,469***	***$132,591***	***$135,720***	***$143,857***
Annual Total Net Revenue for PMSE Program		**($40,754)**	**$32,488**	**$107,999**	**$195,260**	**$279,297**

*Does not include student assessments, subsidies, or fees such as General, Rec, COTA, Student Activities, etc.

Budget Justification

Projected Enrollment. Rationale – something about recruiting participants from OSU UG, as well as working professionals (PT). Mention pre-marketing in AY21-22 after OSU approval to line up first cohort.

Projected Tuition. Student tuition is established at $1070 per credit-hour for the 30 credit-hour course to give a total tuition charge of $32,100 for part time student. An increase of 1% per year in the tuition charge is assumed.

University Tax. The university tax rate of 39% is applied to tuition charges.

Personnel: The Master of Structural Engineering program design intentionally draws upon expertise existing within the Civil, Environmental and Geodetic Engineering. Thus, instructor support is limited to the hiring of a part-time lecturer to provide expertise for the Studio Course that is not presently available in the Department. A total of $17,500 is allocated each year for two semesters of instructor support for the Studio Course which will be co-taught with an OSU instructor.

Non-instruction: Funds are allocated during each year of the program to provide two half-time (20 hr/wk) Graduate Teaching Associates to support instructor grading and office hour needs. GTA support is calculated assuming a 9-month academic year appointment at $21,280 with 11.5% fringe rate and $12,000 academic year tuition costs. An increase of 1% per year in stipend support and tuition charges is assumed.

New Facilities: A total of $10,000 is allocated in Year 1 to facilitate conversion of a Departmental classroom into a space that supports synchronous instruction.

Tuition Scholarship Support: Funds are allocated to support half of the added tuition expense for OSU students who choose to complete the BS/MS degree and move onto the Masters of Structural Engineering. Such students are assumed to account for 40% of the full-time Masters of Structural Engineering student enrollment each year with a per student scholarship of $3700.

Additional Technology Needs: Funds in the amount of $5000 are allocated in Year 1 to add technology to a Departmental classroom. Funds in the amount of $5000 are allocated in Year 3 to add instructor support of tablet devices.

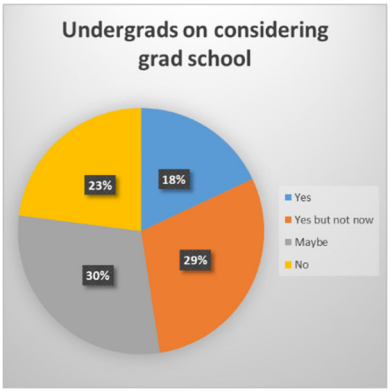
Other expenses: Other expenses are the cost of marketing the program with support by the College of Engineering Office of Distance Education. This will consist of a combination of print and digital marketing, social media marketing and targeted email campaigns.

Appendix I – Survey Results for Evidence of Need

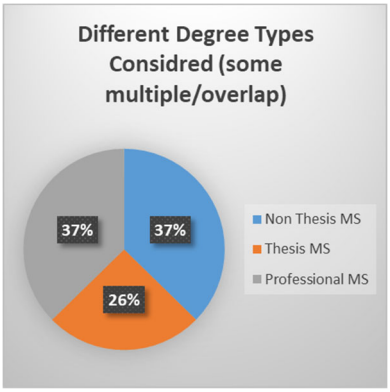
A survey was conducted to gauge interest in the Master of Structural Engineering program among potential future students, as well as the need of industry. This data, coupled with interactions with the CEGE Advising Board are the drivers behind the need for a program like the Master of Structural Engineering. The survey was conducted among current and past students, as well as local employers who have expressed interest in OSU's students in the past.

Below is a summary of the results along with insights gained.

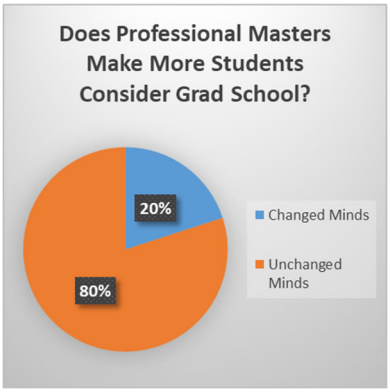
Senior students in CEGE soon to be graduating (65 respondents)



First, we asked all correspondents if they were considering graduate studies. We determined that many of our students have plans or ambitions of attending graduate school (47%) while another portion is uncertain (30%).



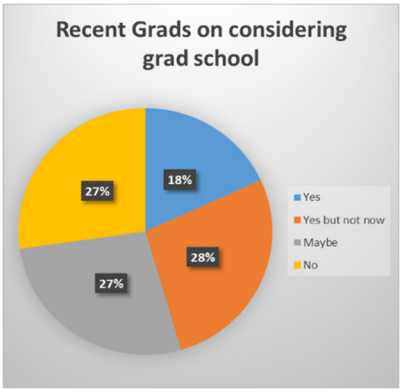
In the population of students that were either planning to, considering or unsure about graduate school, many of them prefer a non-thesis and/or professional program (63%) as opposed to a more traditional research based Master of Science program.



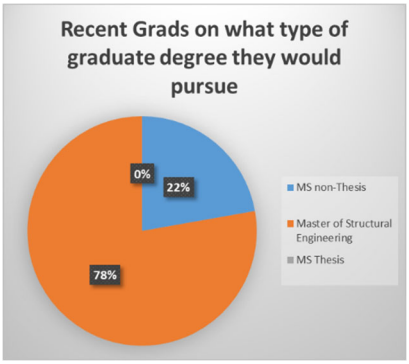
In the original group of students, we determined that there was a population of students who were not considering graduate school, but would consider it if there was professional program like the Master of Structural Engineering (20%). This represents a new market of students previously unavailable to the department.

The above shows a general interest in students pursuing graduate school in one form or another, but learned in the group of prospective students is the fact that many do not have plans for research oriented positions after graduate school, and instead are looking to broaden their technical skills as a practicing engineer (i.e. would rather pursue a Non-Thesis or Professional graduate track). What was also of interest is that the group of students considering a non-research oriented track are split evenly between either a professional masters (one including business/management skill development and technical skill) and a more traditional non-thesis (technical skill development) track. This demonstrates an interest in the population of realizing the inherent value of developing skills beyond the technical in engineering.

Recent Graduates (0-2 years out of BS) (11 respondents)



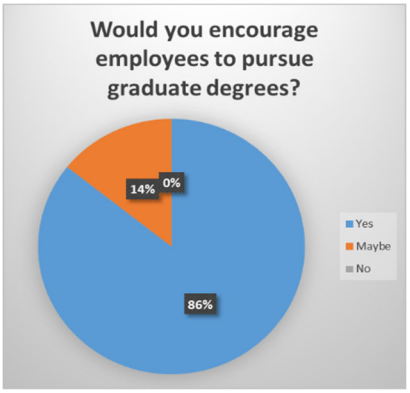
We asked our recent graduates if they were considering returning to school for graduate studies. We determined that many of our students have plans or ambitions of attending graduate school (46%) while another portion is uncertain (27%).



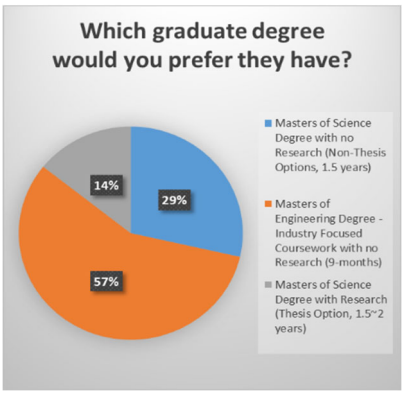
When asking these students about what type of degree program they would pursue, overwhelming there was an interest in either a non-thesis or professional program.

The above shows a general interest in recent graduating B.S. students in the pursuit of graduate study. As all of these students are working professionals, it is worth nothing that 100% of respondents would prefer a non-thesis (22%) or professional program (78%). More insight again is gained by the fact that the fundamental difference between the two programs is the inclusion of business skill and acumen. The value of these skills is recognized in our B.S. graduates working in practice, and they are interested in pursuing a program like the one proposed.

Local Employers (7 respondents)



Local employer were asked, generally, if they would encourage their employees to pursue graduate education. Here it is observed that none of the surveyed employers did not encourage, and in this case 1 respondent might be encouraged to do so if the program fit the needs of his or her business needs.



When asked what type of program they would prefer to hire from, 86% preferred a non-thesis program. Noted is that in that group, most also valued the added experience of business acumen and skills associated with the Master of Structural Engineering, while others preferred to instead have more technical training.

Local employers are certainly looking for students with advanced degrees, and a majority of them prefer a non-research oriented program. Looking closer into the second question, it is worth noting that not all employers value the professional acumen elements of the Master of Structural Engineering as much as they do the technical expertise. This is an important insight, as depending on the employer, they may either be looking for labor or for leaders. Going back to the recent B.S. graduates results, it appears that 78% of this group see themselves as leaders and wanting to have more than just technical skill sets.

Civil Engineers

PRINTER-FRIENDLY

Summary

Summary

Quick Facts: Civil Engineers	
2020 Median Pay	$88,570 per year $42.58 per hour
Typical Entry-Level Education	Bachelor's degree
Work Experience in a Related Occupation	None
On-the-job Training	None
Number of Jobs, 2020	309,800
Job Outlook, 2020-30	8% (As fast as average)
Employment Change, 2020-30	25,300

What Civil Engineers Do

Civil engineers design, build, and supervise infrastructure projects and systems.

Work Environment

Civil engineers generally work in a variety of locations and conditions. It is common for them to split their time between working in an office and working outdoors at construction sites so that they can monitor operations or solve problems onsite. Most work full time.

How to Become a Civil Engineer

Civil engineers need a bachelor's degree in civil engineering, in one of its specialties, or in civil engineering technology. They typically need a graduate degree and licensure for promotion to senior positions. Although licensure requirements vary by state, civil engineers usually must be licensed if they provide services directly to the public.

Pay

The median annual wage for civil engineers was $88,570 in May 2020.

Job Outlook

Employment of civil engineers is projected to grow 8 percent from 2020 to 2030, about as fast as the average for all occupations.

About 25,000 openings for civil engineers are projected each year, on average, over the decade. Many of those openings are expected to result from the need to replace workers who transfer to different occupations or exit the labor force, such as to retire.

State & Area Data

Explore resources for employment and wages by state and area for civil engineers.

Similar Occupations

Compare the job duties, education, job growth, and pay of civil engineers with similar occupations.

More Information, Including Links to O*NET

Learn more about civil engineers by visiting additional resources, including O*NET, a source on key characteristics of workers and occupations.

What They Do ->

What They Do

What Civil Engineers Do

About this section

Civil engineers conceive, design, build, supervise, operate, construct and maintain infrastructure projects and systems in the public and private sector, including roads, buildings, airports, tunnels, dams, bridges, and systems for water supply and sewage treatment. Many civil engineers work in planning, design, construction, research, and education.

Duties

Civil engineers typically do the following:

- Analyze long range plans, survey reports, maps, and other data to plan and design projects
- Consider construction costs, government regulations, potential environmental hazards, and other factors during the planning and risk-analysis stages of a project
- Compile and submit permit applications to local, state, and federal agencies, verifying that projects comply with various regulations
- Oversee and analyze the results of soil testing to determine the adequacy and strength of foundations

- Analyze the results of tests on building materials, such as concrete, wood, asphalt, or steel, for use in particular projects
- Prepare cost estimates for materials, equipment, or labor to determine a project's economic feasibility
- Use design software to plan and design transportation systems, hydraulic systems, and structures in line with industry and government standards
- Perform or oversee surveying operations to establish building locations, site layouts, reference points, grades, and elevations to guide construction
- Manage the repair, maintenance, and replacement of public and private infrastructure

Civil engineers design major transportation projects.

Civil engineers also must present their findings to the public on topics such as bid proposals, environmental impact statements, or property descriptions.

Many civil engineers hold supervisory or administrative positions ranging from supervisor of a construction site to city engineer, public works director, and city manager. As supervisors, they are tasked with ensuring that safe work practices are followed at construction sites.

Other civil engineers work in design, construction, research, and teaching. Civil engineers work with others on projects and may be assisted by civil engineering technicians.

Civil engineers prepare permit documents for work on projects in renewable energy. They verify that the projects will comply with federal, state, and local requirements. These engineers conduct structural analyses for large-scale photovoltaic, or solar energy, projects. They also evaluate the ability of solar array support structures and buildings to tolerate stresses from wind, seismic activity, and other sources. For large-scale wind projects, civil engineers often prepare roadbeds to handle large trucks that haul in the turbines.

Civil engineers work on complex projects, and they can achieve job satisfaction in seeing the project reach completion. They usually specialize in one of several areas.

Construction engineers manage construction projects, ensuring that they are scheduled and built in accordance with plans and specifications. These engineers typically are responsible for the design and safety of temporary structures used during construction. They may also oversee budgetary, time-management, and communications aspects of a project.

Geotechnical engineers work to make sure that foundations for built objects ranging from streets and buildings to runways and dams, are solid. They focus on how structures built by civil engineers, such as buildings and tunnels, interact with the earth (including soil and rock). In addition, they design and plan for slopes, retaining walls, and tunnels.

Structural engineers design and assess major projects, such as buildings, bridges, or dams, to ensure their strength and durability.

Transportation engineers plan, design, operate, and maintain everyday systems, such as streets and highways, but they also plan larger projects, such as airports, ship ports, mass transit systems, and harbors.

The work of civil engineers is closely related to the work of environmental engineers.

<- Summary

Work Environment ->

Work Environment

Work Environment

About this section

Civil engineers held about 309,800 jobs in 2020. The largest employers of civil engineers were as follows:

Engineering services	50%
State government, excluding education and hospitals	12
Local government, excluding education and hospitals	10
Nonresidential building construction	6
Federal government, excluding postal service	3

Though civil engineers must work in an office setting to produce their plans, they must also spend much time on site to oversee construction.

Civil engineers work in a variety of locations and conditions. When working on designs, civil engineers may spend most of their time indoors in offices. However, construction engineers may spend much of their time outdoors at construction sites monitoring operations or solving onsite problems. Some jobs may require frequent relocation to different areas and offices in jobsite trailers.

Civil engineers who function as project managers may work from cars or trucks as they move from site to site. Many civil engineers work for government agencies in government office buildings or facilities. Occasionally, civil engineers travel abroad to work on large engineering projects in other countries.

Work Schedules

Civil engineers typically work full time and some work more than 40 hours per week. Engineers who direct projects may need to work extra hours to monitor progress on the projects, to ensure that designs meet requirements, and to guarantee that deadlines are met.

<- What They Do

How to Become One ->

How to Become One

How to Become a Civil Engineer

About this section

Civil engineers need a bachelor's degree. They typically need a graduate degree and a license for promotion to senior positions. Although licensure requirements vary from state to state, civil engineers usually must be licensed if they provide services directly to the public.

Education

Civil engineers typically need a bachelor's degree in civil engineering, civil engineering technologies, or a related field, such as construction. Programs in civil engineering and civil engineering technology include coursework in math, statistics, engineering mechanics and systems, and fluid dynamics, depending on the specialty. Courses include a mix of traditional classroom learning, work in laboratories, and fieldwork. Programs may include cooperative programs, also known as co-ops, in which students gain work experience while pursuing a degree.

A degree from a program accredited by ABET is needed to earn the professional engineer (PE) license. In many states, a bachelor's degree in civil engineering technology also meets the academic requirement for obtaining a license.

Further education after the bachelor's degree, along with the PE license and previous experience, is helpful in getting a job as a manager. For more information on engineering managers, see the profile on architectural and engineering managers.

Civil engineers need a bachelor's degree in civil engineering, one of its specialties, or civil engineering technology.

Important Qualities

Decisionmaking skills. Civil engineers often balance multiple and frequently conflicting objectives, such as determining the feasibility of plans with regard to financial costs and safety concerns. Urban and regional planners often look to civil engineers for advice on these issues. Civil engineers must be able to make good decisions based on best practices, their own technical knowledge, and their own experience.

Leadership skills. Civil engineers take ultimate responsibility for the projects that they manage or research that they perform. Therefore, they must be able to lead planners, surveyors, construction managers, civil engineering technicians, civil engineering technologists, and others in implementing their project plan.

Math skills. Civil engineers use the principles of calculus, trigonometry, and other advanced topics in mathematics for analysis, design, and troubleshooting in their work.

Organizational skills. Only licensed civil engineers can sign the design documents for infrastructure projects. This requirement makes it imperative that civil engineers be able to monitor and evaluate the work at the jobsite as a project progresses. That way, they can ensure compliance with the design documents. Civil engineers also often manage several projects at the same time, and thus must be able to balance time needs and to effectively allocate resources.

Problem-solving skills. Civil engineers work at the highest level of the planning, design, construction, and operation of multifaceted projects or research. The many variables involved require that they possess the ability to identify and evaluate complex problems. They must be able to then use their skill and training to develop cost-effective, safe, and efficient solutions.

Speaking skills. Civil engineers must present reports and plans to audiences of people with a wide range of backgrounds and technical knowledge. This requires the ability to speak clearly and to converse with people in various settings, and to translate engineering and scientific information into easy-to-understand concepts.

Writing skills. Civil engineers must be able to communicate with others, such as architects, landscape architects, urban and regional planners. They also must be able to explain projects to elected officials and citizens. Civil engineers must be able to write reports that are clear, concise, and understandable to those with little or no technical or scientific background.

Licenses, Certifications, and Registrations

Licensure is not required for entry-level positions as a civil engineer. A Professional Engineering (PE) license, which allows for higher levels of leadership and independence, can be acquired later in one's career. Licensed engineers are called professional engineers (PEs). A PE can oversee the work of other engineers, approve design plans, sign off on projects, and provide services directly to the public. State licensure generally requires

- A degree from an ABET-accredited engineering program
- A passing score on the Fundamentals of Engineering (FE) exam
- Relevant work experience, typically at least 4 years working under a licensed engineer
- A passing score on the Professional Engineering (PE) exam

The initial FE exam can be taken after earning a bachelor's degree. Engineers who pass this exam commonly are called engineers in training (EITs) or engineer interns (EIs). After meeting work experience requirements, EITs and EIs can take the second exam, called the Principles and Practice of Engineering.

Each state issues its own licenses. Most states recognize licensure from other states, as long as the licensing state's requirements meet or exceed their own licensure requirements. Several states require continuing education for engineers to keep their licenses.

The American Society of Civil Engineers offers certifications in coastal engineering, geotechnical engineering, ports engineering, water resources engineering, and other fields. Additionally, civil engineers can become certified in building security and in sustainability.

Advancement

Civil engineers with ample experience may move into senior positions, such as project managers or functional managers of design, construction, operation, or maintenance. However, they would first need to obtain the Professional Engineering (PE) license, because only licensed engineers can assume responsibilities for public projects.

After gaining licensure, a professional engineer may seek credentialing that demonstrates his or her expertise in a civil engineering specialty. Such a credential may be helpful for advancement to senior technical or even managerial positions.

<- Work Environment

Pay ->

Pay

Pay

About this section

The median annual wage for civil engineers was $88,570 in May 2020. The median wage is the wage at which half the workers in an occupation earned more than that amount and half earned less. The lowest 10 percent earned less than $56,160, and the highest 10 percent earned more than $144,810.

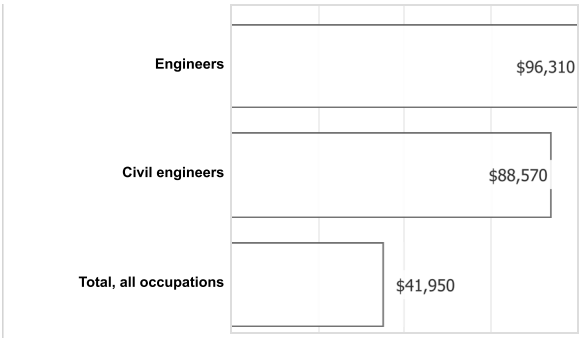
In May 2020, the median annual wages for civil engineers in the top industries in which they worked were as follows:

Civil Engineers

Median annual wages, May 2020

Federal government, excluding postal service	$99,750
Local government, excluding education and hospitals	95,760
Engineering services	89,460
State government, excluding education and hospitals	84,670
Nonresidential building construction	76,230

Civil engineers typically work full time and some work more than 40 hours per week. Engineers who direct projects may need to work extra hours in order to monitor progress on projects, to ensure that designs meet requirements, and to guarantee that deadlines are met.



Note: All Occupations includes all occupations in the U.S. Economy.
Source: U.S. Bureau of Labor Statistics, Occupational Employment and Wage Statistics

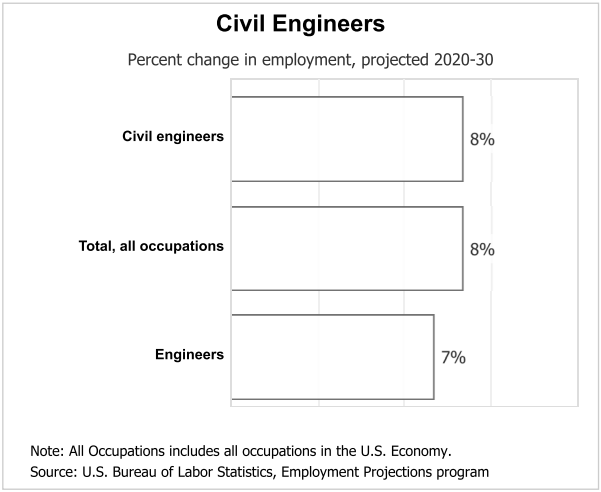
<- How to Become One
Job Outlook ->
Job Outlook

Job Outlook

About this section

Employment of civil engineers is projected to grow 8 percent from 2020 to 2030, about as fast as the average for all occupations.

About 25,000 openings for civil engineers are projected each year, on average, over the decade. Many of those openings are expected to result from the need to replace workers who transfer to different occupations or exit the labor force, such as to retire.



Note: All Occupations includes all occupations in the U.S. Economy.
Source: U.S. Bureau of Labor Statistics, Employment Projections program

Employment

As current U.S. infrastructure experiences growing obsolescence, civil engineers will be needed to manage projects to rebuild, repair, and upgrade bridges, roads, levees, dams, airports, buildings, and other structures.

A growing population likely means that new water systems will be required while, at the same time, aging, existing water systems must be maintained to reduce or eliminate leaks. In addition, more waste treatment plants will be needed to help clean the nation's waterways. Civil engineers will continue to play a key part in all of this work.

The work of civil engineers will be needed for renewable-energy projects. Thus, as these new projects gain approval, civil engineers will be further involved in overseeing the construction of structures such as wind farms and solar arrays.

Although state and local governments continue to face financial challenges and may have difficulty funding all projects, some delayed projects will have to be completed to build and maintain critical infrastructure, as well as to protect the public and the environment.

Employment projections data for civil engineers, 2020-30

Occupational Title	SOC Code	Employment, 2020	Projected Employment, 2030	Change, 2020-30		Employment by Industry
				Percent	Numeric	
Civil engineers	17-2051	309,800	335,100	8	25,300	Get data
SOURCE: U.S. Bureau of Labor Statistics, Employment Projections program						

<- Pay
State & Area Data ->
State & Area Data

State & Area Data

About this section

Occupational Employment and Wage Statistics (OEWS)

The Occupational Employment and Wage Statistics (OEWS) program produces employment and wage estimates annually for over 800 occupations. These estimates are available for the nation as a whole, for individual states, and for metropolitan and nonmetropolitan areas. The link(s) below go to OEWS data maps for employment and wages by state and area.

- Civil engineers

Projections Central

Occupational employment projections are developed for all states by Labor Market Information (LMI) or individual state Employment Projections offices. All state projections data are available at www.projectionscentral.com . Information on this site allows projected employment growth for an occupation to be compared among states or to be compared within one state. In addition, states may produce projections for areas; there are links to each state's websites where these data may be retrieved.

CareerOneStop

CareerOneStop includes hundreds of occupational profiles with data available by state and metro area. There are links in the left-hand side menu to compare occupational employment by state and occupational wages by local area or metro area. There is also a salary info tool to search for wages by zip code.

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Similar Occupations ->
Similar Occupations

Similar Occupations

About this section

This table shows a list of occupations with job duties that are similar to those of civil engineers.

	OCCUPATION	JOB DUTIES	ENTRY-LEVEL EDUCATION	2020 MEDIAN PAY
	Architects	Architects plan and design houses, factories, office buildings, and other structures.	Bachelor's degree	$82,320
	Civil Engineering Technologists and Technicians	Civil engineering technologists and technicians help civil engineers plan, design, and build infrastructure and development projects.	Associate's degree	$54,080
	Construction Managers	Construction managers plan, coordinate, budget, and supervise construction projects from start to finish.	Bachelor's degree	$97,180
	Environmental Engineers	Environmental engineers use the principles of engineering, soil science, biology, and chemistry to develop solutions to environmental problems.	Bachelor's degree	$92,120
	Landscape Architects	Landscape architects design parks and other outdoor spaces.	Bachelor's degree	$70,630
	Mechanical Engineers	Mechanical engineers design, develop, build, and test mechanical and thermal sensors and devices.	Bachelor's degree	$90,160
	Surveyors	Surveyors make precise measurements to determine property boundaries.	Bachelor's degree	$65,590
	Urban and Regional Planners	Urban and regional planners develop land use plans and programs that help create communities, accommodate population growth, and revitalize physical facilities.	Master's degree	$75,950

<- State & Area Data

More Info ->

More Info

Contacts for More Information

About this section

For information about general engineering education and career resources, visit

American Society for Engineering Education

Technology Student Association

For information about engineering summer camps, visit

Engineering Education Service Center

For more information about licensure, visit

National Council of Examiners for Engineering and Surveying

National Society of Professional Engineers

For information about accredited programs in civil engineering and civil engineering technology, visit

ABET

For more information about civil engineers, visit

American Society of Civil Engineers

CareerOneStop

For a career video on civil engineers, visit

Civil Engineers

O*NET

Civil Engineers

Transportation Engineers

Water/Wastewater Engineers

<- Similar Occupations

SUGGESTED CITATION:

Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook, Civil Engineers, at https://www.bls.gov/ooh/architecture-and-engineering/civil-engineers.htm (visited September 08, 2021).

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