Civil Engineering Master's Programs: A Comprehensive Review of Types and Requirements

And

A Review and Update of CEE 498: Construction Project Management

By

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Civil Engineering Master's Programs: A Comprehensive Review of Types and Requirements – An Executive Summary

The purpose of this report was to describe the range of existing civil engineering master's programs by providing fundamental and statistical information on domestic ABET accredited civil engineering master's programs. With such a diverse range of available programs, misinformation is commonplace in regards to the available programs to fulfill further education in a master's degree format in civil engineering. A full version of this report can be found in Appendix 1.

Researched and written by Tom Lennox (ASCE), Dion Coward (ASCE), Jeff Russell (UW-Madison), and Josh Rogers (UW-Madison), a comprehensive database of available master's programs and specializations was compiled. Surveys were sent to department head's via the ASCE Department Head Listserve on November 2, 2010. This listserve contains 227 institutions, 41 of which have baccalaureate-level programs online, leaving 186 institutions with master's programs. Our total response of 121 institutions results in a response rate of 65%. For these responses, 232 individual programs were reported. For clarification purposes, Schools and Universities are referred to as institutions and individual degrees are referred to as "Programs."

The survey responses were organized into a detailed spreadsheet database. With differences in reporting language, minor editing was done to make an accurate analysis and comparison possible. For the focus of the paper, the following table (Table 1) lists specific items we compared and analyzed.

Table 1: Data from Survey of Interest

Dataset of Interest
Total number of institutions surveyed
Total number of master's programs
Response to Question #11 (Thesis or Project or Courses-Only Options?)
GRE Required?
Minimum GRE?
Number of Master's degree awarded?
Required credit hours -- thesis option?
Required credit hours -- project option?
Required credit hours -- course only option?
Maximum credits for thesis?
Maximum credits for project?
MOST Common Instructional Delivery Mode
% FULL-time students (most common delivery mode)
NEXT Most Common Instructional Delivery Mode
% FULL-time students (next most common delivery mode)
% of Students Without Baccalaureate Engineering Degree
Number of Ph.D.'s
Specializations
Names of programs

Out of the 232 reported programs, a variation of degree titles reported. The most common reported titles were, in order, Master of Science (159), Master of Engineering (39), Master of Science in Engineering (14), and Master of Civil Engineering (8). The range of titles varied considerably depending on the program, institution, target students, and desired outcome. In addition to degree titles, options to attain the reported master's degree varied as well. An overwhelming majority of these programs indicated that a thesis and/or project option was available for the degree.

Degree credits were reported as well. These responses were available for three categories: Thesis, Project, and Course-Only. For these, the vast majority indicated that 30 credits are required for the reported program. It is interesting to note that despite the most common value of 30 credits, both project-based and course-only based programs reported more instances of required credits above 30. To deliver these credits, campus-based face-to-face instruction prevails to be the most dominant instructional delivery method, with on-line on/off-campus instruction as the next most common.

Of the 232 reported programs, 155 indicated that the GRE is required for entry. Minimum GRE scores ranged from 900 to 1200, with the greatest concentration (76.7%) from 1000 to 1100.

Due to the broad scope of the civil engineering discipline, we asked the respondent to describe their program by selecting from several specialties. A vast range of responses were collected, with the top three responses being environmental (167), structures (154), and geotechnical engineering (137). A full table of responses can be found in the full report in Appendix 1.

To conclude, there is a wide range of existing civil engineering master's programs in the United States. It is an erroneous belief that all engineering master's programs fit a very narrow description; i.e., requiring ten advanced engineering courses complemented by a compulsory thesis of three to nine credit hours. Based upon the data received from 121 civil engineering departments, the authors believe that –

- While most of the master's programs are named "Master of Science," many use the titles of "Master of Engineering" or "Master of Civil Engineering."
- Exclusively "thesis option only" programs are rare; most master's programs are (1) "thesis or project" or (2) "thesis or course-only." Many graduate programs of the same name and at the same institution have three different options.
- While a common minimum required GRE score for entry to a civil engineering master's degree is 1,100, many programs require 1,000 and some programs require as low as 900.
- By far the most common total semester credit hour requirement is 30. If a thesis is a component of the program, these credits are typically included within this total of 30.
- Campus-based face-to-face instruction is the most common instructional delivery mode; off-campus and on-campus on-line instruction are the next most common.
- The top five specialization areas for civil engineering master's programs are, in order, environmental, structures, geotechnical, water resources, and transportation.

A Review and Update of CEE 498: Construction Project Management

An Introduction to the course

The CEE 498 course, Construction Project Management, is currently offered in two flavors: An in-class traditional course, and an online video course with an optional discussion. The purpose of this report is to identify potential improvements to the video course formatted class.

This class in its current state contains 42 video lectures, weekly optional recitation sessions (discussions), two exams (midterm and a final), and homework assignments. Depending on the session taken (Spring vs Summer), there are 4 to 9 homework assignments. These homework assignments cover the basic topics of the current lectures, and encourage the student's thinking as to how to apply course topics to real-world situations.

Following is a list of homework topics for each version of the class, Spring (16 weeks) and Summer (8 weeks):

- Spring:
    - Homework 1: Guest Lecture Reflection
    - Homework 2: Project Management Case Study
    - Homework 3: Contractor Failure and Prequalification
    - Homework 4: Cash Flow
    - Homework 5: Scheduling
    - Homework 6: Risk and Risk Management
    - Homework 7: Risk and Risk Management
    - Homework 8: Communication
    - Homework 9: Leadership
- Summer:
    - Homework 1: Guest Lecture Reflection
    - Homework 2: Project Management Case Study
    - Homework 3: Contractor Prequalification and Cash Flow
    - Homework 4: Estimating and Scheduling
    - Homework 5: Risk and Risk Management

With the exception of the Communication and Leadership homework assignments in the spring session, all of the homeworks are duplicated and offered in the summer session in a combined and compressed format. Key concepts from all of the homeworks are still prevalent in these compressed versions, however depth and repetition of simple calculations and concepts isn't stressed as much.

A new aspect to the course was tested in the summer sessions of 2010 and 2011 was the addition of weekly online quizzes. These quizzes had a 10-minute time limit and tested the student's retention of key concepts from the lectures.

Exams are administered in take-home format. The midterm exam covers the first 23 lectures and contains short answer problems, calculation problems, and identifying key concepts and terms. This exam is worth 100 points and contains roughly 15-20 questions. The students have one week to complete the exam, and is targeted to take roughly two hours to complete. The final exam is an essay response, asking two questions: Identify career objectives and goals, and expand upon a couple key concepts from the course that will assist you in professional development, and to identify two things that could be done to improve the course. This final portion of the final exam provides the instructors with feedback on the course that

might not be possible to attain from the departments course evaluations. It is from these responses that recommendations will be made for improvements for the class.

The course syllabus for the spring session can be found in Appendix 2, and the syllabus for the summer session can be found in Appendix 3.

Input from past students

There have been many requests by students as to how to improve the class. One of the main requests have been to organize the materials better. As the course textbook and lecture slides are often in Adobe Portable Document Format (PDF), the most common request is to have these documents searchable, as they are not in the current state. In addition, it has been requested that the pages be rotated for easier reading. Some pages are rotated 90 degrees clockwise, while others are rotated 90 degrees counter-clockwise. It has also been asked that references from the lectures to the documents be made more clear. Often, students found the tracking of lecture notes, attachments, and appendixes difficult to tackle, and spent a fair amount of time tracking down the correct document.

After requesting student feedback from the Spring 2011 semester, there were many requests to move the discussion section to a day later in the week. During this session, the discussion section was held on Mondays from 11:00am to 11:50am. Many students found this time frame to work positively for them as it gave them a frame of reference for what the week's lectures will hold for them, and what they will need to concentrate on paying attention to. On the contrary, many students did not like this time setting as it did not allow them to come to class with questions on topics discussed in lecture. For the Summer 2011 session, I opted to investigate this further by offering two class time offerings, Mondays from 5pm to 6pm, and Wednesday from 4pm to 5pm. Via class email, I asked students who could attend these times to respond to me as to which time they would prefer. The responses were split fairly evenly, with most students preferring the Wednesday discussion. By using the Wednesday discussion, I found that with the students that could (and did) attend, they were better prepared and participated more in class discussions on the topics at hand.

One interesting recommendation brought forward was implement a weekly blog post on the course website. The student identified this tool from an experience in a class in the Engineering Professional Development department. This tool was used to relate the students personal opinions and experienced with lecture material. These posts are public to the class, and the student was able to read other opinions and expand their knowledge and comprehension of the topics at hand. Another similar recommendation was the implementation of a class chat room to facilitate the discussion needs for those completing the class off-campus.

Class interaction has been brought up as well in the final exam comments. Responses ranged from group projects, group activities, site visits, and workshops. While many of these are very much appropriate and able to be completed in the traditional classroom format, planning for these in a distance learning and optional discussion classroom has proved to be difficult with the class size being approximately 80 students in the spring session, and approximately 60 students in the summer session.

Thoughts on Improvements

As to my recommendations, the primary concern I have is that the lectures are too outdated. With more up to date content, the lectures can draw students in more, and possibly bring about new subjects to discuss. A common issue brought up by students is that the lectures are slow and outdated. With most being filmed circa 2004, it is understandable that some updating is needed. Filming these lectures with more current statistics, information, and topics would be much more beneficial to the students.

Another aspect that could be addressed is the introduction of more guest lecturers in both the lectures and the discussions. These sessions seemed to have a more effective impact on the students as they found the information more applicable to the real world, and not just an academic setting. From the course evaluations as well as the final exam feedback, students gave very positive comments on having individuals from the field lecture on topics. The two favorite lecturers appear to be Tom Gunkel, CEO of M.A. Mortenson Construction for this video presentation on leadership for homework 1, and Norm Doll for his leadership presentation.

The quiz aspect of the course was found to be a major hurdle for me. With such broad topics, finding questions that could accurately give the students feedback on their progress was found to be pretty difficult. The questions already put forth by my predecessor, Alex Rexrode, seemed well thought out, however there is room for improvement. Also more time seemed like it would assist the students more. Another difficult aspect of the quizzes was the very strict grading that was done by the eCOW2 quiz system. Any spelling issue resulted in an incorrect answer, as well as answers that may have been acceptable, but not in the answer database for the question. This resulted in many requests for the quizzes to be re-graded manually which caused some displeasure with many of the students.

In regards to content, the course textbooks and lecture attachments are disorganized in their current format. The quality of scanning of documents makes most pages very difficult to read, and not being able to search the documents for topics makes them very difficult to sue for the students. I recommend having all of the course text book gone through, and "cleansed". This would include proper reorganizing, removing un-necessary content, and re-typing for easier reading.

Recommended Course of Action

For a recommended course of action, there are many opportunities to improve the class. Following is a brief outline of action points I believe should be addressed immediately:

- Organization of materials improved
- Readability of materials improved
    - Retype when necessary
    - Make PDF's searchable
- New homework assignments
    - Updated Financial homework and data
    - New Risk Management assignment
    - Implement productivity assignment
    - Last Planner/Pull Scheduling assignment
- Update IT lecture, or remove completely

Another significant point is the IT and technology lectures. With the rapid evolution of technology, it is difficult to plan ahead a lecture on current and potentially future technology in the construction industry. One option would be to re-film this lecture with new and updated technologies every 2 years or so, or to remove the topic completely. One proposition I have is to adapt the creativity and innovation lectures to address technological evolution, and thus cutting the IT and Technology lectures from the class. With this action, the main terminology of technology in the industry can still be addressed, but also give lecture space for potentially new topics, such as those that I will list in the following segment.

While some of these points have been discussed, one of the more significant action points I feel that requires addressing is the homework. Through the years, it has become obvious that completed homework assignments have been passed on. Having taken this class three years ago myself (Summer 2008), I can see that a large portion of the assignments have been recycled with little change. While attempts to curtail copying have been made with changing values or questions, I feel that entirely new assignments should be utilized when moving ahead.

In addition, I believe more steps could be made to improve this course. These following action points are items that I believe should be addresses, although may not be crucial to the class's success:

- New lectures topics
    - Lean/Six Sigma
    - BIM
    - Sustainability
- More guest lecturers
    - In discussions: Go over more significant issues such as leadership development, safety
    - In lectures: Have industry specialists come in and lecture materials on areas of expertise
- Re-film majority of lectures
    - Most content is out of date
    - Request for Norm Doll to present Leadership topic(s)
- Possibly split course
    - Two halves – People + Process = Product (Course Mantra)
    - Public vs Private
    - Possible credit limitations for taking both parts

With the advent of Lean, Six Sigma, Building Information Modeling, and Sustainability gaining momentum quickly in the industry and other class offerings in the Civil and Environmental Engineering Department here at the University of Wisconsin – Madison, I believe these topics should be covered in this course. To maintain the overview –like course atmosphere, keeping up to date with significant coursework in the department is crucial. With ecological sustainability covered briefly in a variety of lectures throughout the course, this particular topic could become its own lecture as the industry becomes more ecologically and sustainably conscious.

One concern I have moving forward with the class is participation in the optional discussions. While these are emphasized as optional from the beginning, I found that after the first discussion in both sessions that attendance dropped significantly, by 50% or more in some cases. I am not sure if this has to do with my

personal teaching or communication issues (my stutter) that influenced these students decisions to not attend, but I would recommend finding a way to emphasize attending more. After grading and getting to know the students that attended discussions, I could see a clear gap between the two groups of students, those that attended and did not attend discussions. For those that attended, it was significantly noticeable that they comprehended the subject matters more, performed better, and seemed to get more out of the class on the whole.

With these action items addressed, I feel that this course can be brought up to speed with current class offerings.

Appendix 1 - Civil Engineering Master's Programs: A Comprehensive Review of Types and Requirements Report

Civil Engineering Master's Programs: A Comprehensive Review of Types and Requirements

Abstract

This paper provides fundamental, yet essential, statistical information on domestic civil engineering master's programs based upon a survey of 121 civil engineering departments completed in March 2011. The paper describes the range of existing civil engineering master's programs to include their names, types (research, project, and/or course only), entry requirements, number of credits required for degree, mode of delivery (on-campus vs. off-campus and face-to-face vs. on-line), and areas of specialization. As a "benchmark" of key quantifiable characteristics, the data provided in this paper will be of particular use to engineering faculty in reviewing their own master's programs. This data will also be useful to students and engineering practitioners in understanding the diverse array of domestic master's programs currently available.

Introduction

For several decades, educators and practitioners in the civil engineering community have been calling for reform of civil engineering education. The combination of the increase in the civil engineering Body of Knowledge (BOK), the need for technical specialization, the convergence of science and engineering knowledge, the growth in global markets, and the reduction in baccalaureate-level credit hours have motivated the profession to think about the preparation of future professional engineers. At the Civil Engineering Education Conference (CEEC '95) of the American Society of Civil Engineers (ASCE) in June 1995, some of the educational leaders of the profession believed that it was time to begin the necessary reformation. Their call for action ultimately resulted in the passage of ASCE Policy Statement 465—Academic Prerequisites for Licensure and Professional Practice by the ASCE Board of Direction in October 1998. This policy states, in part, that, education beyond the baccalaureate degree will be necessary for entry into the professional practice of civil engineering in the future. Additional education can take many forms including a master's degree, or no less than 30 coordinated graduate or upper-level undergraduate technical and/or professional practice credits or the equivalent agency/organization/professional society courses which have been reviewed and approved as providing equal academic quality and rigor with at least 50 percent being engineering in nature.

While pursuing the implementation of ASCE Policy Statement 465, the authors have found that many engineering practitioners and students do not understand the diverse range of domestic master's programs that exist today. Many incorrectly believe that all engineering master's programs fit a very narrow description; i.e., requiring ten advanced engineering courses complemented by a compulsory thesis of three to nine credit hours. Even some engineering faculty share this common, but mistaken, belief. This misinformation could result from the scarcity of comparative statistics related to engineering graduate programs. This situation may exist because most graduate programs are not accredited by a single national organization;

e.g., ABET, Inc. The authors know of no single national-level repository for the types of statistics provided in this paper.

The purpose of this paper is to provide fundamental, yet essential, statistical information on domestic civil engineering master's programs. It is based upon a survey of 121 civil engineering departments completed in March 2011. The paper will describe the range of existing civil engineering master's programs to include their names, types (research, project, and/or course only), entry requirements, number of credits required for degree, mode of delivery (on-campus vs. off-campus and face-to-face vs. on-line), and areas of specialization. As a "benchmark" of key quantifiable characteristics, the data provided in this paper should be of particular use to engineering faculty in reviewing their own master's programs. This data will also be useful to students and engineering practitioners in understanding the diverse array of domestic master's programs currently available.

Background – Some Historical Statistics

An overview of the historical statistics related to engineering degrees over the last several decades is an appropriate background to this study. Appendix 1 details the number of baccalaureate and master's degrees awarded since the mid-1960's in the following three categories:

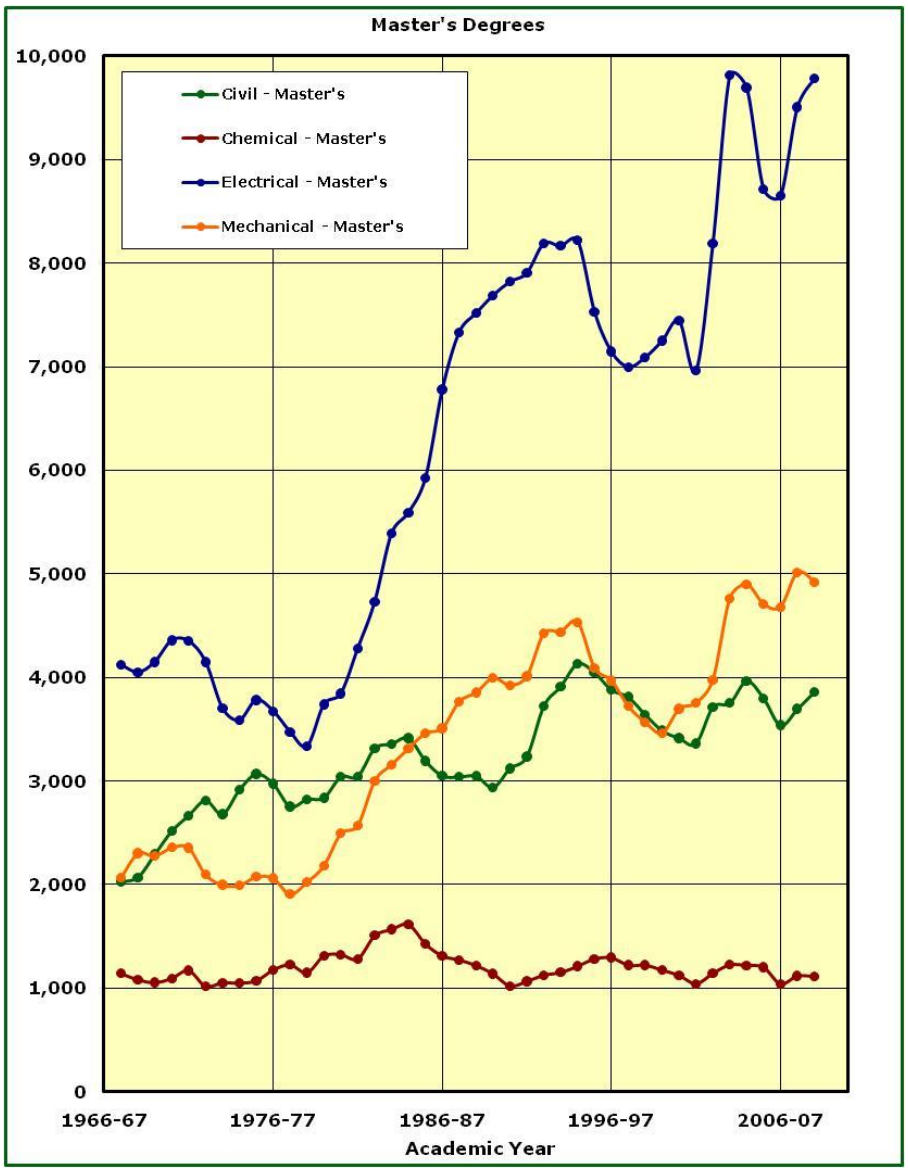
1. Civil Engineering only.
2. The "Big Four" Engineering Disciplines (Electrical, Mechanical, Civil, and Chemical, and treated collectively).
3. All Engineering Disciplines.

In each of these three categories, Appendix 1 lists the number of baccalaureate degrees (B), number of master's degrees (M), and the master's/baccalaureate ratio (M/B) for the year listed. The data used in this appendix was extracted from the annual surveys of the Engineering Workforce Commission of the American Association of Engineering Societies (AAES/EWC). Individuals seeking further information about these surveys and other related survey data should visit the web site of the AAES/EWC (www.ewc-online.org/).

Analysis of this data shows that the number of engineering master's degrees awarded since AY 1967-68 has more than doubled. While the number of master's degrees has doubled, the M/B ratio has remained relatively constant. Specifically, the M/B ratio averaged approximately 40% for both civil engineering (individually) and the "Big Four" (collectively) for the latest twenty years of data. It is noteworthy that the M/B ratio for all engineering disciplines (which includes the "Big Four") over this same period is approximately 50%. It is logical to conclude that this comparatively higher M/B ratio for all engineering disciplines might mean that (a) the number of Master's degrees are influenced by an influx in international students interested in graduate study and research, (b) a higher proportion of the students of the "newer" and smaller engineering disciples are pursuing advanced degrees, and/or (c) many of the "Big Four" baccalaureate students are changing the focus of their studies while pursuing an advanced degree. An analysis of these trends is beyond the scope of the present study.

While there has been a doubling of master's degrees over the last forty years, the growth has not followed a linear path. This is depicted for the "Big Four" disciplines in Figure 1. Essentially all disciplines exhibited a minimum in the mid-1970s, a maximum in the early 1990s, a minimum near 2000, a short period of growth afterward, and little sustained growth in the last few years. Civil engineering master's degrees have generally followed these trends with increases over each of the last two years. Since civil engineering baccalaureate degrees have increased for each of the last five years (to an all-time record high in AY 2008-2009), the authors are optimistic that there will be a corresponding increase in civil engineering master's degrees over at least the next three years.

Figure 1: Master's Degrees for Civil, Mechanical, Electrical, and Chemical from 1966 to 2007



Survey

For the purposes of this paper, we have used the two following definitions:

1. Schools and Universities that returned the completed survey are referred to as "Institutions."
2. Individual degrees reported are referred to as "Programs."

Using these definitions, each institution can have one or more programs. In this paper, each program is listed individually. The survey encompassed data about the institution as well as their individual programs, and was adaptable to fit a wide range of program options. The survey can be found in Appendix 2 with instructions in Appendix 3. As can be seen, the survey was set up to report multiple programs per institution, allowing simple yet accurate responses.

To distribute the survey, an e-mail correspondence was sent to ASCE's Department Head Listserve on November 2, 2010. A copy of this email, along with the supplemental instructions sent with the survey, can be found in Appendix 4 and 5. By using ASCE's Department Head Listserve, the survey went directly to the department heads/chairs to ensure accurate and relevant results. This Listserve currently contains 227 institutions, 41 of which have only baccalaureate-level programs, leaving 186 institutions with master's programs. Our total response of 121 institutions results in a response rate of 65%. For these 121 institutions, 232 individual programs were reported.

Within the responses received, the language was somewhat varied. It required minor editing to make possible accurate analysis and comparison. This included converting quarterly credits to semester-based credits, incorporating uniform abbreviations, and using comparable naming conventions.

Results

The survey responses were organized into a detailed spreadsheet database. To narrow the focus of this paper, we decided to report on selected response types. Table 1 lists those specific items.

Table 1: Data from Survey of Interest

Dataset of Interest
Total number of institutions surveyed
Total number of master's programs
Response to Question #11 (Thesis or Project or Courses-Only Options?)
GRE Required?
Minimum GRE?
Number of Master's degree awarded?
Required credit hours -- thesis option?
Required credit hours -- project option?
Required credit hours -- course only option?
Maximum credits for thesis?
Maximum credits for project?
MOST Common Instructional Delivery Mode
% FULL-time students (most common delivery mode)
NEXT Most Common Instructional Delivery Mode
% FULL-time students (next most common delivery mode)
% of Students Without Baccalaureate Engineering Degree
Number of Ph.D.'s
Specializations
Names of programs

Naming of these programs is diverse; however, the key terms used to define the programs are Master of Science and Master of Engineering. Our findings concluded that while the majority of the responses were labeled as Master of Science, the range of names varied considerably depending on the program, the institution, target students, and desired outcome. Following is a table of the various program names.

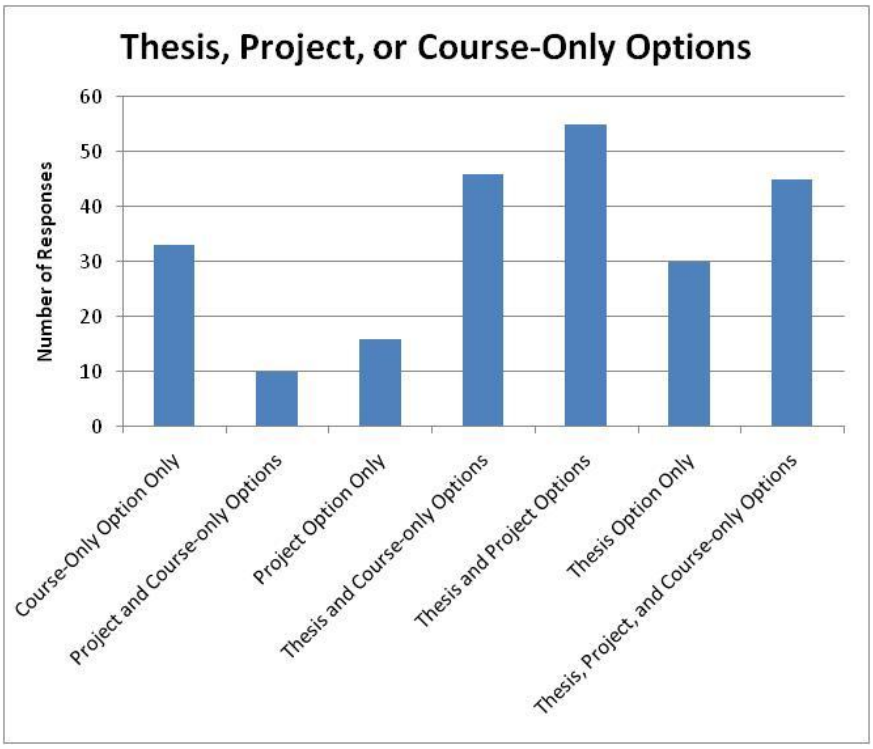
Table 2: Master's Degree Titles

Degree Name	Number of Responses
Master of Science	159
Master of Engineering	39
Master of Science in Engineering	14
Master of Civil Engineering	8
Master of Engineering Management	4
Master of Construction Engineering Management	2
Master of Applied Science	1

Degree Name	Number of Responses
Master of Business & Engineering	1
Master of Civil and Environmental Engineering	1
Master of Environmental Science	1
Master of Ocean Engineering	1
Master of Science & Master of AEST	1
Master of Science & Master of Civil Engineering	1
Master of Science in Civil Engineering (MSCE)	1
Master of Science w/ MBA	1
Master of Science w/ MCRP	1
Professional Master of Science in Project Management	1
SMP in Sustainable and Resilient Infrastructure	1
Blended BS+MS Program	1
Interdisciplinary MS in CPM	1

One of the key aspects that we studied was how the master's degree is attained: thesis, project, and/or course-only study. From the reported programs, we found that the overwhelming majority of the programs are categorized as thesis and/or project options.

Figure 2

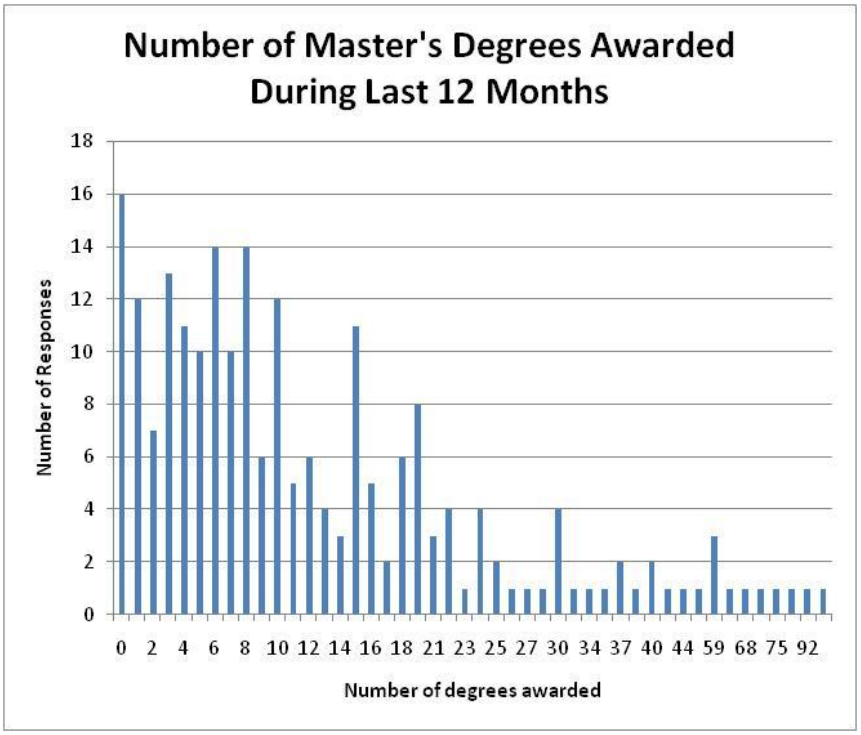


We also investigated the admission requirements of the program. Of the 232 reported programs, 155 reported that the GRE is required for entry. The minimum GRE score for admission ranged from a combined score of 900 and 1200, with the greatest concentration, 76.7% of reported values, from 1000 to 1100. Our findings are illustrated in Figure 3.

Figure 3

We also analyzed the number of master's degrees awarded per program. The results are summarized in Figure 4, provided a wide range of values, from 0 to 99, with the majority of responses between 0 and 15. The programs reporting a "0" represented programs which are in a transition phase from a baccalaureate-only program to a baccalaureate and master's program, programs of a high degree of specialization, or new programs.

Figure 4



We also studied the required number of credits for the programs. In a vast majority of cases, the value is 30 credits. It is interesting to note that, despite the common value of 30 credits, both project-based and course-only based programs reported more instances of required credits above 30. However, the thesis option proved to be rather centralized. These findings are illustrated in Figures 5-7.

Figure 5

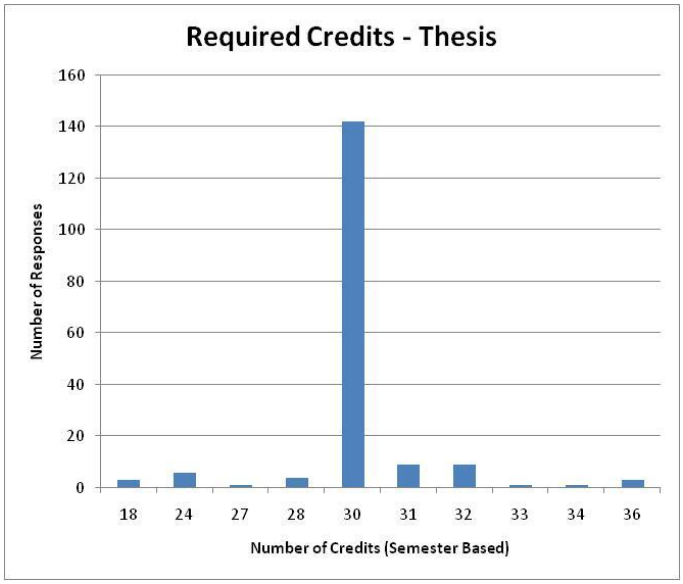


Figure 6

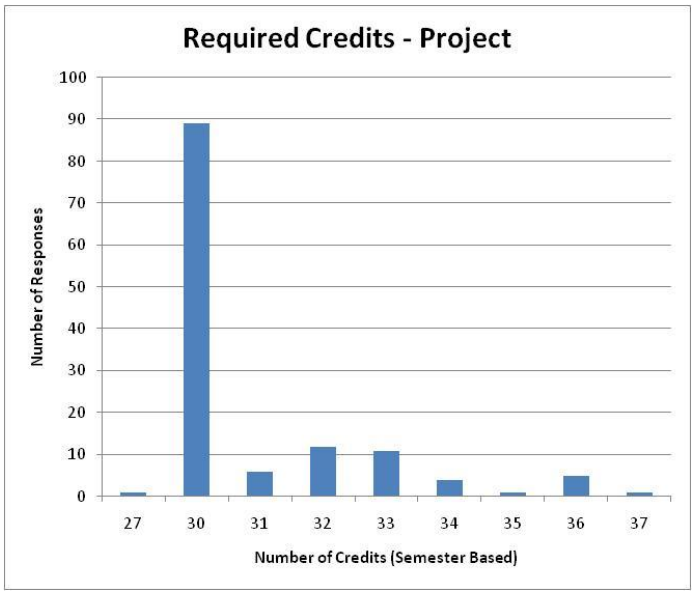
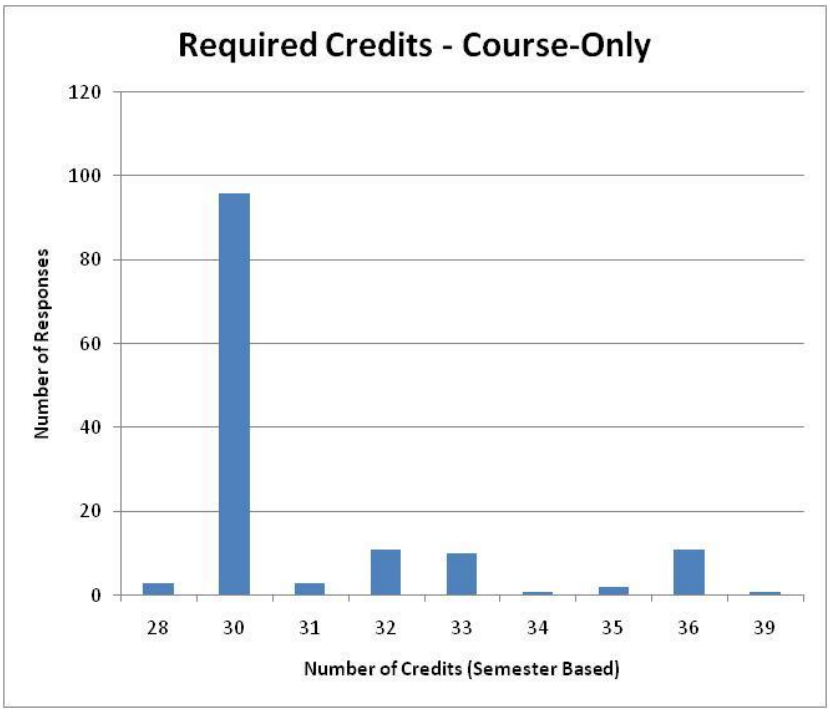
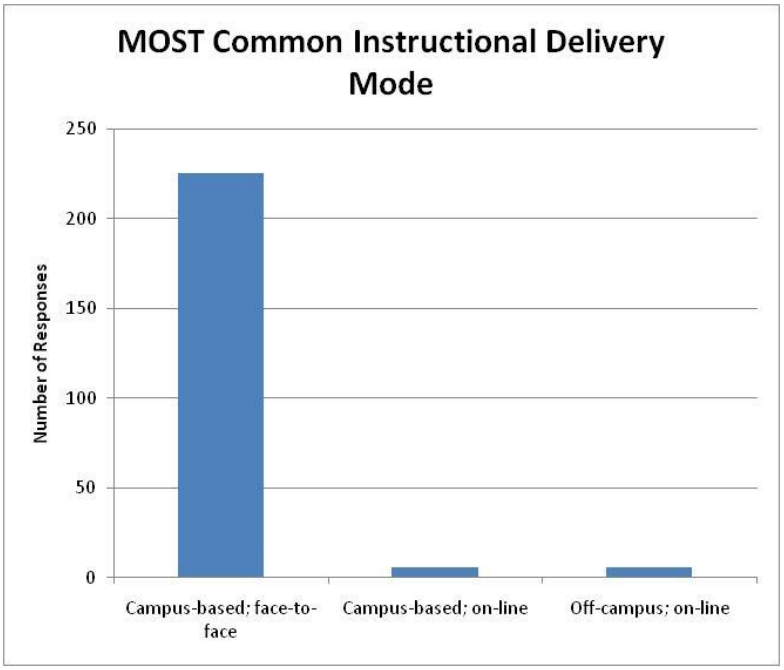


Figure 7



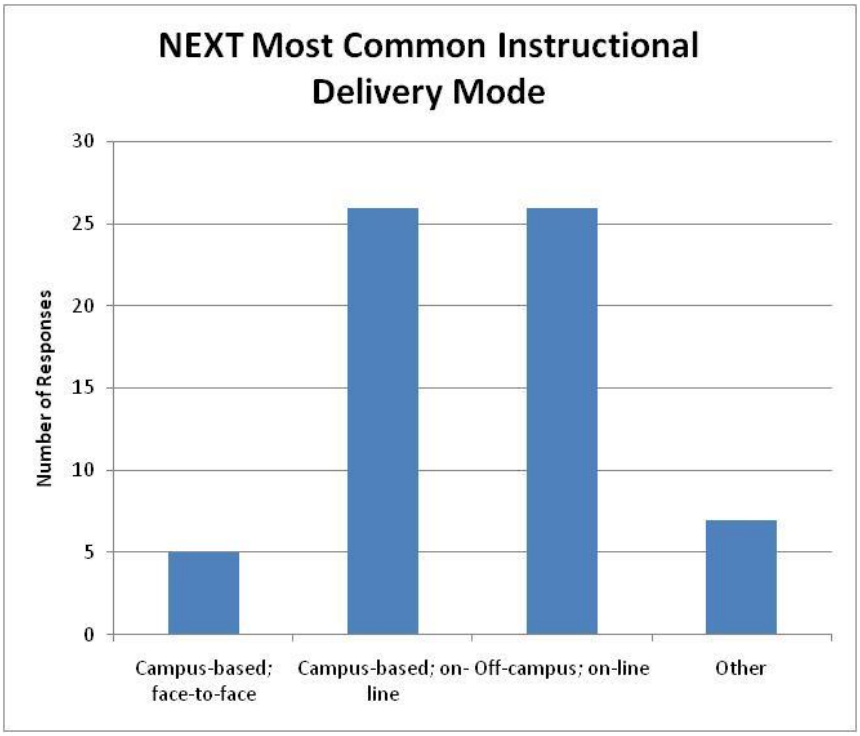
The predominant instructional delivery method was campus-based face-to-face instruction, with 219 responses. Also notable was that the majority of these responses, 96, accounted for 100% of the full-time students. Note that these responses are not for just campus-based face-to-face instruction, but for all delivery methods that were reported as most common.

Figure 8



It is notable that the second most common delivery methods are on-line based, with a combined 50 of 62 total responses. Also noteworthy is that a significant number of these responses reported that 10% or fewer of the students were full-time. This accounts for 25 of 44 responses.

Figure 9



Due to the broad scope of the civil engineering discipline, we asked the respondent to describe their program by selecting from several specialties. In addition to the choices provided in the survey, there was space for the respondent to fill in additional program specialties. Table 3 lists the responses.

Table 3: Master's Degree Specializations

Specialization	Responses
Environmental	167
Structures	154
Geotechnical Engineering	137
Water Resources	139
Transportation	120
Civil Engineering (General)	99
Hydraulics/Fluid Mechanics	94
Hydrology	93
Construction	74
Geo-Environmental	72
Mechanics/Applied Mechanics	56

Specialization	Responses
Civil Infrastructure Systems	53
Engineering Management	40
Materials Science	36
Ocean Engineering	21
City Planning/Urban Development	12
Municipal/Public Works	12
Surveying/Geomatics	12
Engineering Geology	10
Public Health	9
Railway	9

From this table, it is evident that there are several popular choices for specialties, most notably environmental, structures, geotechnical, water resources, and transportation.

Conclusion

There is a wide range of existing civil engineering master's programs in the United States. It is an erroneous belief that all engineering master's programs fit a very narrow description; i.e., requiring ten advanced engineering courses complemented by a compulsory thesis of three to nine credit hours. Based upon the data received from 121 civil engineering departments, the authors believe that –

- While most of the master's programs are named "Master of Science," many use the titles of "Master of Engineering" or "Master of Civil Engineering."

- Exclusively "thesis option only" programs are rare; most master's programs are (1) "thesis or project" or (2) "thesis or course-only." Many graduate programs of the same name and at the same institution have three different options.

- While a common minimum required GRE score for entry to a civil engineering master's degree is 1,100, many programs require 1,000 and some programs require as low as 900.

- By far the most common total semester credit hour requirement is 30. If a thesis is a component of the program, these credits are typically included within this total of 30.

- Campus-based face-to-face instruction is the most common instructional delivery mode; off-campus and on-campus on-line instruction are the next most common.

- The top five specialization areas for civil engineering master's programs are, in order, environmental, structures, geotechnical, water resources, and transportation.

Acknowledgements

The authors would like to thank the respondents of the survey.

Appendix 1: **Trends** in Baccalaureate and Master's Degree in Engineering (AY 1967-68 to AY 2008-09)

AY	Civil			Civil + Elect + Chem + Mech			All Engineering Disciplines		
	B	M	M/B %	B	M	M/B %	B	M	M/B %
1967-68	5446	2030	37.3%	26899	9362	34.8%			
1968-69	5943	2070	34.8%	29169	9505	32.6%			
1969-70	6476	2292	35.4%	31245	9774	31.3%			
1970-71	6604	2517	38.1%	31341	10330	33.0%			
1971-72	6987	2668	38.2%	31659	10548	33.3%		17356	
1972-73	7671	2813	36.7%	31534	10083	32.0%		17152	
1973-74	8176	2681	32.8%	30658	9435	30.8%	41607	15895	38.2%
1974-75	7957	2915	36.6%	28477	9546	33.5%	38210	15773	41.3%
1975-76	7947	3069	38.6%	27872	10000	35.9%	38134	16506	43.3%
1976-77	8248	2976	36.1%	29173	9891	33.9%	40247	16561	41.1%
1977-78	9168	2755	30.1%	33277	9368	28.2%	46091	16182	35.1%
1978-79	10030	2825	28.2%	38156	9337	24.5%	52598	16033	30.5%
1979-80	10346	2840	27.5%	42644	10079	23.6%	58742	17229	29.3%
1980-81	10547	3042	28.8%	45430	10708	23.6%	62935	17914	28.5%
1981-82	10330	3046	29.5%	47641	11185	23.5%	67000	18543	27.7%
1982-83	10484	3317	31.6%	53057	12557	23.7%	72482	19909	27.5%
1983-84	9877	3361	34.0%	55271	13484	24.4%	76934	21519	28.0%
1984-85	9468	3416	36.1%	55999	13941	24.9%	77892	22502	28.9%
1985-86	8798	3197	36.3%	56166	14015	25.0%	78178	23027	29.5%
1986-87	8388	3052	36.4%	54771	14657	26.8%	75735	24290	32.1%
1987-88	7714	3041	39.4%	51773	15417	29.8%	71386	25611	35.9%
1988-89	7688	3050	39.7%	49697	15645	31.5%	68824	26412	38.4%
1989-90	7587	2940	38.8%	47563	15765	33.1%	65967	27034	41.0%
1990-91	7748	3123	40.3%	45844	15893	34.7%	63986	27754	43.4%
1991-92	8413	3236	38.5%	45336	16223	35.8%	63653	28540	44.8%

AY	Civil			Civil + Elect + Chem + Mech			All Engineering Disciplines		
	B	M	M/B %	B	M	M/B %	B	M	M/B %
1992-93	9196	3725	40.5%	46567	17468	37.5%	65001	31104	47.9%
1993-94	9842	3916	39.8%	46645	17677	37.9%	64946	31943	49.2%
1994-95	10267	4136	40.3%	46679	18107	38.8%	64749	32235	49.8%
1995-96	10920	4051	37.1%	46005	16959	36.9%	65267	31012	47.5%
1996-97	11119	3883	34.9%	45551	16298	35.8%	65091	30574	47.0%
1997-98	10475	3813	36.4%	42880	15757	36.7%	63262	30212	47.8%
1998-99	9748	3643	37.4%	41279	15528	37.6%	62500	30229	48.4%
1999-00	8750	3489	39.9%	40426	15380	38.0%	63635	30453	47.9%
2000-01	8219	3416	41.6%	39873	15683	39.3%	65195	32008	49.1%
2001-02	8185	3364	41.1%	40216	15123	37.6%	68648	31983	46.6%
2002-03	8595	3717	43.2%	42228	17031	40.3%	75031	36611	48.8%
2003-04	8477	3753	44.3%	42232	19558	46.3%	76003	40593	53.4%
2004-05	8857	3968	44.8%	43055	19784	46.0%	76003	41087	54.1%
2005-06	9432	3801	40.3%	44049	18428	41.8%	76103	38451	50.5%
2006-07	9875	3540	35.8%	44437	17914	40.3%	75823	37805	49.9%
2007-08	10862	3697	34.0%	46755	19337	41.4%	77107	40122	52.0%
2008-09	11274	3861	34.2%	45419	19679	43.3%	75320	41967	55.7%
Change Since 1968-69	90%	87%	-2%	56%	107%	33%			
Change Since 1978-79	12%	37%	22%	19%	111%	77%	43%	162%	83%
Change Since 1988-89	47%	27%	-14%	-9%	26%	38%	9%	59%	45%
Change Since 1998-99	16%	6%	-8%	10%	27%	15%	21%	39%	15%
Change Since 2003-04	33%	3%	-23%	8%	1%	-6%	-1%	3%	4%
Average Since 1978-79	9404	3460	37%	46247	15633	34%	68903	29184	42%

Appendix 2: Survey

	Please complete a separate column for EACH unique master's program sponsored by your department!	Master's Program #1
1	Name of Master's Program	
2	Institution	
3	Department	
4	Zip Code (5 digit)	
5	Web Site for Additional Information	
6	Minimum baccalaureate GPA for entry (if applicable)	
7	Is the GRE required for entry to this master's program?	
8	Minimum GRE Score for entry (if applicable)?	
9	# Master's Degrees Awarded During Last 12 Months	
10	Thesis or Project or Courses-Only Options?	
11	Required Credit Hours for the Master's Degree if with --	No Input Required in This Cell
12	Thesis Option (if applicable)?	
13	Project Option (if applicable)?	
14	Course-Only Option (if applicable)?	
15	Maximum Credits Awarded for Thesis (if an option)?	
16	Maximum Credits Awarded for Project (if an option)?	
17	MOST Common Instructional Delivery Mode	
18	% FULL-time students (most common delivery mode)	
19	NEXT Most Common Instructional Delivery Mode	
20	% FULL-time students (next most common delivery mode)	
21	% of Students Without Baccalaureate Engineering Degree	
22	Ph.D. Program(s)?	
23	Number of Ph.D. Degrees Awarded During Last 12 Months	
24	Master's Areas of Specialization:	No Input Required in This Cell
25	Civil Engineering (General)	
26	Civil Infrastructure Systems	
27	City Planning/Urban Development	
28	Construction	
29	Engineering Geology	
30	Engineering Management	
31	Environmental	
32	Geo-Environmental	
33	Geotechnical Engineering	
34	Hydraulics/Fluid Mechanics	
35	Hydrology	
36	Materials Science	
37	Mechanics/Applied Mechanics	
38	Municipal/Public Works	
39	Ocean Engineering	
40	Public Health	
41	Railway	
42	Structures	
43	Surveying/Geomatics	
44	Transportation	
45	Water Resources	
46	Other #1 -- Please specify	
47	Other #2 -- Please specify	
48	Other #3 -- Please specify	
49	Other #4 -- Please specify	
50	Other #5 -- Please specify	
51	Other #6 -- Please specify	
52	Contact information of person preparing this survey:	No Input Required in This Cell
53	Preferred Title (Dr., Prof., Mr., Ms., etc.)	
54	First Name	
55	Middle Initial	
56	Last Name	
57	Email	
58	Telephone	
59	Today's Date	
60	Optional Remarks	

Appendix 3: Survey Instructions

Row	Response
1	Official name of the master's program that is described in this column? This name should be unique -- differentiating this master's program from others that you will be describing in the other columns! Please enter "UNDERGRAD ONLY" if appropriate.
2	Name of your university? If you entered "UNDERGRAD ONLY" in Row 2, please complete this cell -- and the next two cells below ONLY.
3	Full name of your department? If you entered "UNDERGRAD ONLY" in Row 2, please complete this cell -- and the cell below.
4	Five digit zip code of your department's official address? If you entered "UNDERGRAD ONLY" in Row 2, please complete this cell -- and the two cells above ONLY. No other data is requested or required of "UNDERGRAD ONLY" programs.
5	Best URL for information regarding this master's program? In most cases, this will be the address of your Department's web site.
6	If there is a minimum GPA for ENTRY into this master's program, please specify. If there is no specific minimum, please enter "None."
7	Please enter "yes" or "no" -- or choose one of the responses from the pull-down menu.
8	If there is a minimum GRE score for ENTRY into this master's program, please specify. If there is no specific minimum GRE score, please enter "None." If the GRE is not required, please enter "NA."
9	As of today's date, how many degrees have been awarded for this master's program within the last 12 calendar months?
10	Which of the responses in the pull-down menu best describes the nature of this master's program regarding thesis, project, or course-only options?
11	No Input
12	If a THESIS option is available, what is the TOTAL number of credits (including the thesis credits) required for a master's degree with the THESIS option? If the THESIS option is not available, please leave BLANK.
13	If a PROJECT option is available, what is the TOTAL number of credits (including the project's credits) required for a master's degree with the PROJECT option? If the PROJECT option is not available, please leave BLANK.
14	If a COURSE-ONLY option is available, what is the TOTAL number of credits required for a master's degree with the COURSE-ONLY option? If the COURSE-ONLY option is not available, please leave BLANK.
15	If a THESIS option is available, what is the maximum number of credits (of the total required for the master's degree) that can be awarded for THESIS research?
16	If a PROJECT option is available, what is the maximum number of credits (of the total required for the master's degree) that can be awarded for the PROJECT?
17	What is the most common delivery method of the master's-level instruction?
18	What is the approximate percentage of FULL-TIME students in this master's program who are in the "MOST common" instructional delivery mode?
19	What is the second most common delivery method of the master's-level instruction?
20	What is the approximate percentage of FULL-TIME students in this master's program who are in the "NEXT most common" instructional delivery mode?
21	What is the APPROXIMATE percentage of students in this master's program who do NOT have their baccalaureate degree in an engineering discipline?
22	Does your department have Ph.D. programs in civil engineering or closely related fields? Please enter "yes" or "no" -- or choose one of the responses from the pull-down menu.

Row	Response
23	As of today's date, how many PhD. degrees have been awarded by your department/program within the last 12 calendar months?
24	No Input
25	"Yes" indicates that a student CAN study this specialization (or one that is very closely related) while pursuing the master's program named in Row 2; "No" (or a BLANK) indicates that a student CANNOT study this specialization in this master's program.
26	"Yes" indicates that a student CAN study this specialization (or one that is very closely related) while pursuing the master's program named in Row 2; "No" (or a BLANK) indicates that a student CANNOT study this specialization in this master's program.
27	"Yes" indicates that a student CAN study this specialization (or one that is very closely related) while pursuing the master's program named in Row 2; "No" (or a BLANK) indicates that a student CANNOT study this specialization in this master's program.
28	"Yes" indicates that a student CAN study this specialization (or one that is very closely related) while pursuing the master's program named in Row 2; "No" (or a BLANK) indicates that a student CANNOT study this specialization in this master's program.
29	"Yes" indicates that a student CAN study this specialization (or one that is very closely related) while pursuing the master's program named in Row 2; "No" (or a BLANK) indicates that a student CANNOT study this specialization in this master's program.
30	"Yes" indicates that a student CAN study this specialization (or one that is very closely related) while pursuing the master's program named in Row 2; "No" (or a BLANK) indicates that a student CANNOT study this specialization in this master's program.
31	"Yes" indicates that a student CAN study this specialization (or one that is very closely related) while pursuing the master's program named in Row 2; "No" (or a BLANK) indicates that a student CANNOT study this specialization in this master's program.
32	"Yes" indicates that a student CAN study this specialization (or one that is very closely related) while pursuing the master's program named in Row 2; "No" (or a BLANK) indicates that a student CANNOT study this specialization in this master's program.
33	"Yes" indicates that a student CAN study this specialization (or one that is very closely related) while pursuing the master's program named in Row 2; "No" (or a BLANK) indicates that a student CANNOT study this specialization in this master's program.
34	"Yes" indicates that a student CAN study this specialization (or one that is very closely related) while pursuing the master's program named in Row 2; "No" (or a BLANK) indicates that a student CANNOT study this specialization in this master's program.
35	"Yes" indicates that a student CAN study this specialization (or one that is very closely related) while pursuing the master's program named in Row 2; "No" (or a BLANK) indicates that a student CANNOT study this specialization in this master's program.
36	"Yes" indicates that a student CAN study this specialization (or one that is very closely related) while pursuing the master's program named in Row 2; "No" (or a BLANK) indicates that a student CANNOT study this specialization in this master's program.
37	"Yes" indicates that a student CAN study this specialization (or one that is very closely related) while pursuing the master's program named in Row 2; "No" (or a BLANK) indicates that a student CANNOT study this specialization in this master's program.
38	"Yes" indicates that a student CAN study this specialization (or one that is very closely related) while pursuing the master's program named in Row 2; "No" (or a BLANK) indicates that a student CANNOT study this specialization in this master's program.

Row	Response
39	"Yes" indicates that a student CAN study this specialization (or one that is very closely related) while pursuing the master's program named in Row 2; "No" (or a BLANK) indicates that a student CANNOT study this specialization in this master's program.
40	"Yes" indicates that a student CAN study this specialization (or one that is very closely related) while pursuing the master's program named in Row 2; "No" (or a BLANK) indicates that a student CANNOT study this specialization in this master's program.
41	"Yes" indicates that a student CAN study this specialization (or one that is very closely related) while pursuing the master's program named in Row 2; "No" (or a BLANK) indicates that a student CANNOT study this specialization in this master's program.
42	"Yes" indicates that a student CAN study this specialization (or one that is very closely related) while pursuing the master's program named in Row 2; "No" (or a BLANK) indicates that a student CANNOT study this specialization in this master's program.
43	"Yes" indicates that a student CAN study this specialization (or one that is very closely related) while pursuing the master's program named in Row 2; "No" (or a BLANK) indicates that a student CANNOT study this specialization in this master's program.
44	"Yes" indicates that a student CAN study this specialization (or one that is very closely related) while pursuing the master's program named in Row 2; "No" (or a BLANK) indicates that a student CANNOT study this specialization in this master's program.
45	"Yes" indicates that a student CAN study this specialization (or one that is very closely related) while pursuing the master's program named in Row 2; "No" (or a BLANK) indicates that a student CANNOT study this specialization in this master's program.
46	Do you have a master's program in a specialization that is not in the list above? If yes, please enter the name of that specialization? If no, please leave BLANK.
47	Do you have a master's program in a specialization that is not in the list above? If yes, please enter the name of that specialization? If no, please leave BLANK.
48	Do you have a master's program in a specialization that is not in the list above? If yes, please enter the name of that specialization? If no, please leave BLANK.
49	Do you have a master's program in a specialization that is not in the list above? If yes, please enter the name of that specialization? If no, please leave BLANK.
50	Do you have a master's program in a specialization that is not in the list above? If yes, please enter the name of that specialization? If no, please leave BLANK.
51	Do you have a master's program in a specialization that is not in the list above? If yes, please enter the name of that specialization? If no, please leave BLANK.
52	No Input
53	Self-explanatory!
54	Self-explanatory!
55	Self-explanatory!
56	Self-explanatory!
57	Self-explanatory!
58	Self-explanatory!
59	Self-explanatory!
60	Please enter any additional remarks or comments that will help the reader understand this master's program. If you need additional room, feel free to include an attachment to your email response back to ASCE.

Appendix 4: Survey Correspondence Email

Dear Department Head/Chair:

Hello! ASCE is working on a database that should be of great benefit to you and your department. We are working to develop an inventory of domestic master's-level programs in civil engineering and closely > related disciplines. This database of master's programs will be maintained on the ASCE website and marketed to students, faculty, and practicing engineers as an informational resource.

We need your help in collecting some basic data on your master's programs. Attached is an excel spreadsheet ("DH Survey -- Masters Degree 110210.xls") listing the information we are seeking. You have two different options for providing the requested data:

1. You (or your designee) can complete the attached excel spreadsheet and email it back to us. This is probably the most efficient option. If this option is chosen, please see the attached instructions ("Supplemental Instructions--Masters Survey--110210.pdf").

2. Alternatively, you can provide us with the name and contact information of a knowledgeable person in your department. One of our group members will contact and interview this person.

It is our goal to have a database that includes ALL domestic master's-level programs offered in civil engineering or closely related fields. We hope you will participate.

To accomplish our project on schedule, we request that you respond to this email with your information and/or contact person **by close of business Tuesday, November 23rd**. If you have questions, please contact me at dcoward@asce.org or 703-295-6267.

Thank you for considering this request.

Regards,
Dion

Mr. Dion K. Coward
Manager, Educational Activities
American Society of Civil Engineers
1801 Alexander Bell Drive
Reston, VA 20191

Excellence in Civil Engineering Education
For more information, visit www.asce.org/exceed

Appendix 5: Survey Supplemental Instructions Provided with Correspondence E-mail

SUPPLEMENTAL INSTRUCTIONS -- ASCE MASTER'S SURVEY

1. Many departments have more than one type of master's programs. For example, you may have a Master of Science program and a Master of Engineering program. Please use separate columns of the spreadsheet to describe each of your unique programs. And ALL of the data in a given column should apply ONLY to the specific program named in the cell in Row 2 of that column. Be particularly sensitive to quantitative answers (e.g., degrees awarded). This should only apply to the master's program being described in that column of the spreadsheet.

2. The spreadsheet is currently designed to accept data for up to three of your unique master's programs. If you have more than three unique master's programs, please copy and paste Column D to add additional columns.

3. All cells have a pop-up with an explanatory note. These notes may help you understand the data being requested.

4. Many cells have a pull-down menu describing the acceptable choices for that cell. If a pull-down menu is available, recommend that it be used.

5. Do not be concerned if your input for a given cell does not "fit" into that cell. The spreadsheet is a tool for receiving your input– the final database will be formatted so that the user can view all of the data that you are posting.

6. It is understood that some of your input numbers are approximate.

7. Thank you for your help and support. We hope that this database will be of assistance to you, your program(s), and your prospective students.

November 2, 2010

Appendix 2 – CEE 498 Spring 2011 Course Syllabus

CEE 498 CONSTRUCTION PROJECT MANAGEMENT

Spring 2011

Video Class

Instructor:	Prof. Jeffrey S. Russell
Office:	2205 Engineering Hall
Telephone:	(608) 262-7244 (Office)
	(608) 223-1135 (Home)
Fax:	(608) 265-9860
E-mail:	russell@engr.wisc.edu
Office Hours:	By Appointment

TA:	Josh Rogers
Office:	1205 Engineering Hall
E-mail:	rogers2@wisc.edu
Office Hours:	Tuesdays and Thursdays 3:00pm – 4:00pm or by appointment

Discussion Section: Mondays
11:00am – 11:50am
1227 Engineering Hall

Course Objective:

To introduce the characteristics and concepts of the construction industry, the facility delivery process, labor productivity, construction costs, scheduling, cost accounting, and emerging technologies relevant to the construction industry.

Course Description:

The course includes a combination of lectures, assigned readings, individual assignments, exams, and a final exam. The lectures provide the conceptual framework for the course and supplement the assigned readings. It will be to the student's advantage to read the assignment prior to the lecture date so that questions that may arise can be discussed to a greater extent. The student is expected to have a good understanding of the lecture and reading materials, whether the material is presented in class or not.

Requirements:

Students currently enrolled must have a junior standing or have consent of the instructor.

Assignment:

All (9) assignments must be completed individually.

Exams:

One Mid-Term Exam (Posted: **Friday, March 4th**) and one Final Exam (Posted: **Monday, May 2nd**) will be posted on the course website for your convenience. These exams will be due one week after they are distributed.

Evaluation:

Assignments (40%) / Mid-Terms Exam (40%) / Final Exam (20%)

Due Dates:

Due dates for the (9) assignments and (2) exams will be throughout the semester and announced in discussion. You may also reference the due dates on the course website. All assignments and exams are due and should be turned in at the beginning of discussion. *If you are unable to attend discussion, assignments maybe uploaded electronically in .pdf format to the course website in their respective drop box.*

Course Materials:

Course materials are composed of

- Class Note: the electronic textbook
- Lecture Materials: presentation slides and supplementary readings & materials ordered by lecture schedule
- Additional Materials: suggested reference to read

All materials are available on course Webpage:

http://www.engr.wisc.edu/cee/courses/cee498.html

Suggested Reference:

- Hendrickson and Au, "Project Management for Construction", Electronically accessible at *http://pmbook.ce.cmu.edu/*
- A Guide to the Project Management Body of Knowledge
  Copy available on course webpage

Course Website:

http://www.engr.wisc.edu/cee/courses/cee498.html

Appendix 3 – CEE 498 Summer 2011 Course Syllabus

CEE 498 CONSTRUCTION PROJECT MANAGEMENT

Summer 2011

Video Class

Instructor:	Prof. Jeffrey S. Russell
Office:	2205 Engineering Hall
Telephone:	(608) 262-7244 (Office)
	(608) 223-1135 (Home)
Fax:	(608) 265-9860
E-mail:	russell@engr.wisc.edu
Office Hours:	By Appointment

TA:	Josh Rogers
Office:	1205 Engineering Hall
E-mail:	rogers2@wisc.edu
Office Hours:	By Appointment

Discussion Section: Wednesdays 4:00pm-5:00pm
Room 2255, Engineering Hall

Course Objective:

To introduce the characteristics and concepts of the construction industry, the facility delivery process, labor productivity, construction costs, scheduling, cost accounting, and emerging technologies relevant to the construction industry.

Course Description:

The course includes a combination of lectures, assigned readings, individual assignments, exams, and a final exam. The lectures provide the conceptual framework for the course and supplement the assigned readings. It will be to the student's advantage to read the assignment prior to the lecture date so that questions that may arise can be discussed to a greater extent. The student is expected to have a good understanding of the lecture and reading materials, whether the material is presented in class or not.

Requirements:

Students currently enrolled must have a junior standing or have consent of the instructor.

Assignments:

All (5) assignments must be completed individually.

Quizzes:

Quizzes will be administered online each week to test your knowledge and comprehension of the key points discussed within the video lectures and assigned readings. They must be completed before the beginning of the following week's discussion period. You will have 10-15 minutes to complete the weekly quiz. Quizzes must be completed individually.

Exams:

One Mid-Term Exam (Posted: **Monday, July 12**) and one Final Exam (Posted: **Monday, August 2**) will be posted on the course website for your convenience. These exams will be due one week after they are distributed.

Due Dates:

Due dates for the (5) assignments and (2) exams will be throughout the semester and announced in discussion. You may also reference the due dates on the course website. All assignments and exams are due and should be turned in at the beginning of discussion. Late assignments will be penalized 10% per business day. No exceptions. *If you are unable to attend discussion, assignments maybe uploaded electronically in .pdf or .doc format to the course website in their respective drop box.*

Evaluation:

Online Weekly Quizzes (10%) / Assignments (30%) / Mid-Terms Exam (40%) / Final Exam (20%)

Grading:

A – 100% to 93%, AB – 92% to 85%, B – 84% to 80%, BC - 79% to 75%, C - 74% to 60%, D < 60%

Course Materials:

Course materials are composed of

- Class Note: the electronic textbook
- Lecture Materials: presentation slides and supplementary readings & materials ordered by lecture schedule
- Additional Materials: suggested reference to read

All materials are available on course Webpage:

http://www.engr.wisc.edu/cee/courses/cee498.html

Suggested Reference:

- Hendrickson and Au, "Project Management for Construction", Electronically accessible at *http://pmbook.ce.cmu.edu/*
- A Guide to the Project Management Body of Knowledge
  Copy available on course webpage

Course Website:

http://www.engr.wisc.edu/cee/courses/cee498.html