

A Comparison of Civil Engineering Education at Beijing University of Architecture and University of Florida

Shuang Song¹ [Fazil T. Najafi²]

Abstract – Today's Civil Engineering education has changed dramatically to keep up with the rapid speed of world's new knowledge and technology. Civil Engineering program is aiming to educate students with more advanced knowledge, equipping them with broad range of knowledge to be highly skilled and be more competitive in today's and future market place. Thus, it is desirable for universities to communicate with each other and to compare their curriculums aiming to further improve Civil Engineering education. To better understand the differences in Civil Engineering education between two institutions, the paper compares admission and credits requirements, grading system, credit hours, type of course, and graduation requirements. Although there are some differences in Civil Engineering education, there are some similarities as well. Both institutions strive to enhance civil engineering education, and to cultivate the knowledge and skills required for the future endeavors of their graduating students.

Keywords: Civil Engineering Education

INTRODUCTION

This paper compares Civil Engineering curriculum at Beijing University of Architecture and Civil and Coastal Engineering Department at the University of Florida.

Beijing University of Architecture (BUA) is the only university in Beijing with emphasis in architectural engineering education. College of Civil Engineering was named a key discipline college in 2008, and won the title named "Beijing specialty". In 2011, College also won the honorary title named "National Engineering Graduate Education specialty engineering fields". BUA consist of 11 schools: 1) Architecture and City Planning school, 2) Civil Engineering school, 3) Environmental and Energy Engineering school 4) School of Electrical and Information Engineering, 5) Economics and Management College of Engineering, 6) Urban Institute of Surveying and Spatial Information, 7) Electrical and Mechanical and Automotive Engineering, 8) Liberal Art and Laws School, 9) Science school, 10) Sports, 11) Computer and Network Information School. Civil Engineering school at BUA generally consist of 5 departments: 1) Construction department, 2) City Roadway and Bridge Engineering department, 3) City Roadway and Bridge Engineering department, 4) Traffic Engineering department, 5) Construction Material department [1].

¹ University of Florida, Department of Civil and Coastal Engineering ,365 Weil Hall, PO Box 116580 Gainesville, Florida 32611, ss1989@ufl.edu

² University of Florida, Department of Civil and Coastal Engineering, 365 Weil Hall, PO Box 116580 Gainesville, Florida 32611, fnaja@ce.ufl.edu

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University of Florida (UF) has a long history of established research and educational. The civil and costal engineering departments are under the umbrella of the Engineering School of Sustainable Infrastructure & Environment (ESSIE) [2]. ESSIE is composed of following Departments: 1) Civil and Coastal Engineering Department, 2) Environmental Engineering Department. ESSIE offers 8 different Degrees: Environmental Engineering (B.S., M.S., M.E., Eng., and Ph.D.), Civil Engineering (B.S., M.S., M.E., and Ph.D.), Coastal and Oceanographic Engineering (M.S., M.E., and Ph.D.). ESSIE hosts the 8th largest Undergraduate Program in the Nation and the 3rd largest Graduate Program. ESSIE is leading research in Physical Infrastructure Protection; Hurricane and Tornado Engineering; Transportation, Coastal Engineering, Urban Water, and Coastal Ecology.

The purpose of this paper is to help educators in universities improve Civil Engineering education. By comparing various admission requirements such as, grading systems, credit requirements, credit hours, and type of course, educators have the opportunity to figure out certain aspects of Civil Engineering curriculum. These aspects include what curriculum they are offering, and what curriculum is more desirable for a particular Civil Engineering education. These findings are based on the number of students attending the particular class, student teacher evaluations of that particular professor, the grade distribution of the classes, and future career requirements.

Admissions at Beijing University of Architecture

In China, the university generally divided into two parts: science department and liberal arts department. Students who apply for Beijing University of Architecture must take the National Higher Education Entrance Examination (NHEEE). The maximum score of NHEEE is 750 in 2013 [3]. In China, there are different score requirements for any university admission. In 2012, the minimum requirement of Science department is 550 and the minimum admission requirement of Liberal arts department is 549 in Beijing. At BUA, the score range of students who enrolled in the university in science department is from 555 to 674, and in liberal arts department the score range is from 555 to 645 [4].

Table 1 presents the 2013 NHEEE admission requirement in Civil Engineering. The average score is 538 in construction department, 516 in city roadway and bridge engineering department, 508 in underground engineering department, 508 in traffic engineering department and 517 in construction material department [5].

TABLE 1 Civil Engineering admission requirement

Major	Department	Maximum scores	Minimum scores	Average enrollment scores
Civil Engineering	Construction department	593	507	538
	City Roadway and Bridge Engineering department	595	498	516
	Underground Engineering department	550	491	508
	Traffic Engineering department	572	477	508
	Construction Material department	569	481	517

Admission at University of Florida

The minimum admission requirement at the UF:

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- Graduation from a regionally accredited or state-approved secondary school or the equivalent.
- Sixteen academic units, including: English with substantial writing (4 years required) Mathematics in Algebra 1, formal geometry and algebra 2 (4 years required), Natural sciences with two units including laboratory (3 years required), Social Sciences (3 years required) and Foreign language that must be sequential (2 years required).
- A cumulative C average in the academic core, as computed by the university, at all institutions attended high school and college.
- Students taking dual enrollment courses must present a minimum 2.0 Grade Point Average (GPA) at every institution attended.
- A record of good conduct. Major or continuing difficulty with school or other officials may render an applicant ineligible regardless of academic qualifications.
- At least the minimum score in each section of the SAT: Critical Reading= 460 or American College Testing (ACT) with a minimum score of 19 on the Reading section, Mathematics=460 or ACT Mathematics=19 and Writing= 440 or ACT-English/Writing=18. Effective with the 2012 entering class, the university will begin considering the writing portion of the Scholastic Assessment Test (SAT).
- All applicants must submit the SAT or the ACT with Writing test. While UF cannot mix scores from old and new tests, the university will accept the highest sub scores from the new SAT if you took the new test multiple times. The university cannot mix or combine any ACT sub scores [6].

In the department of Civil Engineering at UF, the admission requirement requires students to get minimum grade of C .A minimum GPA of 2.0 is required for all civil engineering courses. Before graduating, all BSCE students must take the Fundamentals of Engineering exam. And each semester requirement:

- Semester 1
2.0 UF GPA required for semesters 1-5
2.5 GPA on all critical-tracking courses for semesters 1-5
Complete 1 of 6 tracking courses with a minimum grade of C within two attempts.
- Semester 2
Complete 1 additional critical-tracking course with a minimum grade of C within two attempts.
- Semester 3 and 4
Complete 2 additional critical-tracking courses with minimum grades of C within two attempts.
- Semester 5
Complete all 6 critical-tracking courses with minimum grades of C in each course within two attempts [6].

Comparison of admission between two universities

The differences of admission requirement between Beijing University of Architecture and Department of Civil Engineering at the University of Florida are:

- Selection process is different. Beijing University of Architecture requires NHEEE score. Students in China can take the NHEEE exam once a year. However, students in United States can take SAT several times in one year and they can have more opportunities to apply to different universities.

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- Student selection review process is different. Admission at BUA reviews NHEEE scores while University of Florida reviews GPA, SAT and ACT scores.

Grading system at Beijing University of Architecture

Table 2 presents grading criteria:

TABLE 2 Grading system at Beijing University of Architecture

First attempt		Second attempt	
GPA	Grade	GPA	Grade
5	90-99	5	90-99
4	80-89	2	80-89
3	70-79		70-79
2	60-69		60-69
0	<60(failure grade)	0	<60(failure grade)

Table 2 illustrates that if students are given a second attempt to earn a grade of 90% or above, they can receive a GPA of 5. If they do not earn 90%, their grades will be counted as 60% regardless of if their grade was actually higher. If their grades fall below 60%, then their GPA will be a zero and they will fail the course [7].

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Grading system at University of Florida

Table 3 presents grading criteria:

TABLE 3 Passing grades and grade points- credit earned prior to May 11, 2009-Summer A

Passing grade	A	B+	B	C+	C	D+	D	S
GPA	4.0	3.5	3.0	2.5	2.0	1.5	1	0

Comparison of grading system between two universities

Differences:

The range of grades in BUA and in UF is different, that is, the range of grade in BUA is from 0 to 100, while in UF the range of score is from A to S, which is represent by letter.

The passing grade of BUA is 60 while in UF it is C or GPA 2.0.

The courses in Beijing University of Architecture

General education courses: Cultivation of Ideological Morality and Fundamentals (3 credits), Conspectus of Chinese Contemporary History (2 credits), Basic Theory of Marxism (3 credits), Introduction to Mao Zedong Thought, Deng Xiaoping Theory and the “Three Represents” Theory (6 credits), Military Training (1 credit), College English band I (4 credits), College English band II (4 credits), College English band III (4 credits), College English band IV (4 credits), Computer and foundation of information technology (2 credits), Fundamentals of computer program design (2 credits), P.E. I (1 credit), P.E. II (1 credit), P.E. III (1 credit), P.E. IV (1 credit), Humanities courses (1 credit), Technology courses (1 credit), Sport and Health courses (1 credit).

Fundamental courses: Advanced Mathematics A (11 credits), Linear Algebra B (2 credits), Probability Theory and Mathematical Statistics B (3 credits), General Physics A (7 credits), Physics Laboratory (2 credits), Descriptive Geometry (3 credits), General Chemistry (2.5 credits), Environmental elective courses (1 credit), Management elective courses (1 credit) and Ethics elective courses (1 credit). The total required fundamental courses are 33.5 credits.

Subject fundamental courses: Graphing of Engineering B (2 credits), Introduction of Civil Engineering (1 credit), Theoretical Mechanics A (5 credits), Material Mechanics A (5 credits), Structural Mechanics A (7 credits), Engineering Measuring Practice (3 credits), Engineering Project Management (2 credits), Construction Regulation (1.5 credits), Engineering Economics (1.5 credits), Engineering Machine and Electricity A (2.5 credits), AutoCAD (1 credit) and elective courses (5.5 credits in total). The total required subject fundamental courses are 33.5 credits.

Major fundamental courses including: Numerical Methods (2 credits), Fluid Mechanics (2 credits), Soil Mechanics (2.5 credits), Engineering Geology (1.5 credits), and elective courses (6.5 credits in total).

Major elective courses including: Concrete and Masonry Structure (3 credits), Building Detection Techniques (1.5 credits), Architectural Design and Construction (3 credits), Building Construction (2 credits), High-rise Building Construction Design (3 credits), Foundation Design I (1.5 credits), Cost analysis of Construction Projects (1.5 credits), Introduction for Bridge (2 credits), Construction of Bridge (3.5 credits), Bridge Testing Techniques (1.5 credits), Roadway Alignment Design (3 credits), Road Foundation Engineering (3 credits), Traffic Engineering (1.5 credits), Foundation Design II (2 credits), Traffic Cost Analysis (1.5 credits), Masonry Structure (1.5 credits), Rock Mass Mechanics (2 credits), Underground Building Structure (3 credits), Underground Building Construction (2 credits), Planning and Design of Underground Space (2.5 credits), Foundation Design III (2 credits), Foundation Treatment (1 credit), Underground Construction on Cost Analysis (1.5 credits) and Architectural Design and

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Construction (1.5 credits). Practical courses including: Safety knowledge for University, Military Training (2.5 credits), Situation and Policies (2 credits), Volunteer labor (1 credit), Social Practice (3 credits), Social Works (1 credit), Science and Technology Week (2 credits), Graduation Education, Professional knowledge practice (1 credit), AutoCAD practice Week (1 credit), Engineering Measuring Practice (2 credits), Engineering Geology Practice (1 credit), Principle of Concrete Structural Design Practice (1.5 credits), Steel Structural Design Practice (1 credit), Production and Management Practice (4 credits), Graduation Practice (1 credit), Graduation Design (15 credits). The total required credits are 59.5 credits [8].

Civil Engineering Courses at University of Florida

Lower division and Engineering Fundamentals (63 credits) including:

Semester 1: Calculus I (4 credits), Chemistry I (3 credits), Chemistry Lab (1 credit), What is the Good Life (3 credits) and Social Science (3 credits).

Semester 2: Calculus II (4 credits), Physics with Calculus I (3 credits), Physics Lab (1 credit), Prof. Communication for Eng. (3 credits) and Introduction to Civil Engineering.

Semester 3: Calculus III (4 credits), Physics with Calculus II (3 credits), Physics II Lab (1 credit), Humanities (3 credits) and Social Science (3 credits).

Semester 4: Differential Equations (3 credits), Statics (3 credits), Thermodynamics (3 credits), Engineering Statistics (3 credits), and Humanities or Social Science (3 credits).

Semester 5: Dynamics (2 credits) and Mechanics of Materials (3 credits).

Required Civil Engineering Courses including 53 credits courses: Computer Methods in CE (4 credits), Experimentation (3 credits), Technical Drawing and Visualization (3 credits), CE Materials (4 credits), Professional Ethics (1 credit), CE Cost Analysis (3 credits), Methods of Management (4 credits), Soil Mechanics (4 credits), Geotechnical Engineering (3 credits), Hydrodynamics (4 credits), Hydraulics (3 credits), Water and Waste Water Treatment (3 credits), Structural Analysis (4 credits), Reinforced Concrete (3 credits), Route Geometrics (3 credits), Transportation Engineering (4 credits).

The advanced course offered by UF including: Construction Estimating, Construction Methods and Management, Construction Engineering Design, Retaining Wall/ Embankment Design, Foundation Engineering Design, Analysis of Structural Systems, Analysis and Design in Steel, Advanced Reinforced Concrete Design, Advanced Steel Design, Pavement Design, Public Works Engineering, Building Codes and Professional Practice, Surface Hydrology, Groundwater, Urban Storm-water Design, Water Resources Engineering, Urban Transportation Planning, Traffic Engineering, Transportation Systems Analysis and Subdivision Design. Undergraduate students must choose 4 courses from those advanced courses, and of those 4 courses one must be a design class. The design class including: Construction Engineering Design, Retaining Wall/Embankment Design, Foundation Engineering Design, Analysis and Design in Steel, Advanced Reinforced Concrete Design, Advanced Steel Design, Pavement Design, Urban Storm water Design and Subdivision Design. Also students are required to choose one of capstone design from Water-Transportation Design and Structures-Geotechnical-Construction Design.

UF also has Out-of Department elective courses including: Engineering Leadership, Entrepreneurship for Engineers, Engineering Innovation, Public Health Engineering, Solid Waste Containment Design, Storm water Control Systems, Potable Water Design, Wastewater System Design, Hydraulic Systems Design, Environmental and Engineering Geology, Hydrology and Human Affairs, Geology of Florida, Fluvial Morphology and Processes, Coastal Morphology and Processes, LEED's, International Sustainable Development, Preview of Urban and Regional Planning, Survey of Planning Information Systems (GIS), Wetlands, Water Resource Sustainability, GIS in Soil and water science, Mechanical Design, Control of Mechanical Engineering Systems, Heating and Air Conditioning System Design and Weather and Forecasting [9].

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Comparison of total credits upon graduation between two universities

TABLE 4 Credit requirement difference

Name	Beijing University of Architecture Architecture	University of Florida
Total credits	204.5	131
Elective courses	53.5	15
Required courses	158	53
Practical courses	46.5	9 hours summer attendance

Differences:

- BUA requires some courses that are quite different from UF: the Cultivation of Ideological Morality and Fundamentals, Conspectus of Chinese Contemporary History, Basic Theory of Marxism, Introduction to Mao Zedong Thought, Deng Xiaoping Theory and the “Three Represents” Theory, Military training.
- The required credits are different.

Similarities:

- It can be seen from Table 4 that the total number of credit hours, elective courses, required courses and practical courses are included in both institutions’ curriculum. However, the total number of credits required for each category varies significantly.

Graduation requirement at Beijing University of Architecture

The graduation requirements:

- If a student fail more than 24 credit hours of course work, they will not be eligible to graduate.
- Prior to graduation, students must have clear records of honesty showing that they did not give or receive unauthorized assistance in completing any of their exams.
- Students who failed in the P.E. exam will not be eligible to graduate until they pass the P.E. exam [10].

Graduation requirements at the University of Florida

A minimum grade of C is required with GPA of 2.0 for all civil engineering courses. Before graduating, all BSCE students are required to take the Fundamentals of Engineering (FE) exam. Students must complete 8 critical tracking courses that have a total of 27 credit hours. They are required to have a minimum of 2.5 GPA on all critical tracking courses and complete an additional 5 courses in semesters 1-5 [6].

At UF, all students are bonded and sign a written statement indicating in any of their exams that they will not give or receive unauthorized assistance in completing exams. They further state that the exam reflects a completely independent effort on their parts. They understand that violating their statements can result in a grade of zero for that exam. Furthermore, their graduation records should be free of any serious violations.

Comparison of graduation requirement between two universities

Differences between two universities:

- At Beijing University of Architecture, students with GPA of greater than 60 will graduate while at UF students will graduate with a minimum C grade and a GPA of 2.0.

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- Two universities have different requirement on particular exams. University of Florida requires students to take FE exam even if they do not pass while Beijing University of Architecture requires students to take P.E. exam and must pass before graduation.
- The total graduation credit requirements at UF are 131 credit hours while the total graduation credit requirements at BUA are 204.5 credit hours.

Similarity between two universities:

- Before graduating, students must have honesty record showing they are honest in exams.

CONCLUSION

This paper compared the differences in admissions, grading system, credit hours, type of course, and graduation requirements between Beijing University of Architecture and the University of Florida. Although there are some differences in Civil Engineering education, there are some similarities as well. Both institutions strive to enhance civil engineering education, and to cultivate the knowledge and skills required for the future endeavors of their graduating students. The curriculum differences and similarities should provide both institutions to learn from one another. For instance, practical training course credits opportunities are more at Beijing University of Architecture as compared to Civil Engineering at the University of Florida. At the Civil Engineering Department at UF, students are required to take the Fundamentals of Engineering exam. On the other hand, at Beijing University of Architecture such requirement does not exist. Beijing University of Architecture can reduce the total number of credit hours and focus more on exam such as FE similar to UF.

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Shuang Song

Graduate student at University of Florida studying Civil Engineering.

Dr. Fazil T. Najafi

Professor at University of Florida for Civil Engineering.