APPENDIX E

STUDENT LEARNING OUTCOMES VS. COURSE LEARNING OUTCOMES

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(Associated Course Learning Outcomes are listed below the ACCE Student Learning Outcomes)

CMGT 11000: Introduction to Construction Management (White)

6. Analyze professional decisions based on ethical principles. (assessed and evaluated)
   - Analyze decisions in construction based on ethical principles
7. Analyze construction documents for planning and management of construction processes. (supporting course)
   - Interpret a set of standard construction drawings.
   - Utilize construction document related tools.
10. Apply electronic technology to manage the construction process. (assessed and evaluated)
    Interact with a 3-dimensional building model utilizing BIM (building information modeling).
   - Describe, define and interpret data derived from BIM
   - Manipulate digital information via BIM
18. Understand the basic principles of sustainable construction. (assessed and evaluated)
   - Understand sustainable construction and related environmental issues

CMGT 12000: Construction Materials and Methods (White)

8. Analyze methods, materials, and equipment used to construct projects. (supporting course)
   - Recognize and identify forces acting on a building and their relationship to materials.
   - Become familiar with fundamental construction materials.
   - Differentiate construction materials based on
     - Inherent properties
     - Content / ingredients
     - Applications
     - Installation methods
15. Understand construction quality assurance and control. (supporting course)
   - Understand the importance of building codes.

CMGT 15000: Surveying (Conley)

9. Apply construction management skills as a member of a multi-disciplinary team. (supporting).
   - Effectively and efficiently perform tasks within a group
10. Apply electronic-based technology to manage the construction process. (supporting).
   - Perform field measurements using basic and modern surveying equipment
11. Apply basic surveying techniques for construction layout and control. (assessed and evaluated).
   - Perform basic surveying procedures
   - Verify accuracy and precision of survey field data through calculations
   - Obtain measurements with degree of accuracy required for task
   - Gain understanding of the role of surveying in construction

CMGT 21000: Quantity Survey (White)

4. Create construction project cost estimates. (supporting course)
   - Utilize an organized methodology to accurately estimate material quantities.
7. Analyze construction documents for planning and management of construction processes. (supporting course)
   - Interpret construction drawings and specifications as they apply to construction materials.
   - Understand common construction terminology.
8. Analyze methods, materials, and equipment used to construct projects. (supporting course)
   - Identify the fundamental components of construction materials.
9. Apply construction management skills as an effective member of a multi-disciplinary team. (supporting course)
   - Work within a team environment to generate a building take-off report.

CMGT 25000: Mechanical and Electrical Systems (Song)

19. Understand the basic principles of structural behavior. (supporting course).
    - Identify significant elements of mechanical and electrical systems which cause their usability due to structural issues in buildings.
20. Understand the Basic Principles of Mechanical, Electrical, and Piping Systems. (assessed & evaluated)
    - Understand key components of mechanical and electrical systems in buildings
    - Distinguish basic mechanism of heating and cooling systems
    - Perform basic calculations related to
        - Piping systems
        - Heating and cooling systems
    - Electricity systems

CMGT 26000: Statics (Song)

8. Analyze methods, materials, and equipment used to construct projects. (supporting course)
    - Describe key components of structural systems in buildings
    - Define the pros and cons of structural systems in buildings
19. Understand the basic principles of structural behavior. (supporting course)
    - Understand which types of loads should be taken into account in the analysis of structural behaviors in buildings
    - Perform basic calculations related to force systems
    - Understand and distinguish basic mechanisms of structural systems

CMGT 31000: Cost Estimating (Ray)

4. Create construction project cost estimates. (assessed and evaluated)
    - Create Detailed Project Cost Estimates
    - Create Conceptual Estimates
9. Analyze methods, materials, and equipment used to construct projects. (supporting course)
    - Analyze Labor, Crew and Equipment Rates
10. Apply electronic-based technology to manage the construction process. (supporting course)
    - Create Detailed Project Cost Estimates Using Microsoft Excel and Stack
12. Understand different methods of project delivery and the roles and responsibilities of constituencies involved in the design and construction process. (supporting course)
    - Understand Construction Project Delivery Methods
18. Understand the basic principles of sustainable construction. (supporting course)
    - Understanding Sustainable Material Procurement and Job Site Waste Management

CMGT 32000: Scheduling and Project Control (Bastin)

5. Create a construction project schedules. (assessed and evaluated)
    - Create: Project Schedules
10. Apply electronic-based technology to manage the construction process (supporting course).
    - Use MS Project to create a project schedule including project controls.
16. Understand construction project control processes (assessed and evaluated).
    - Explain and perform duration-cost trade-off.
    - Explain and perform project updating.
    - Explain and perform resource leveling.
    - Explain and perform the earned value approach.

CMGT 33000: Construction Contract Admin. & Specs (White)

6. Analyze professional decisions based on ethical principles. (supporting course)
    - Develop a detailed understanding of project organizational plans, roles and responsibilities.
7. Analyze construction documents for planning and management of construction processes. (assessed and evaluated)

- Develop a familiarity with key project documentation & procedures including:
  - Submittals
  - Purchase orders
  - Pay applications
  - Requests for information
  - Change orders
  - Field documentation
  - Transmittals

10. Apply electronic-based technology to manage the construction process. (supporting course)
    - Acquire a working knowledge of web-based project management software.

12. Understand different methods of project delivery and the roles and responsibilities of all constituencies involved in the design and construction process. (assessed and evaluated)
    - Study different project delivery methods (contracts), including their components, language and ramifications.

17. Understand the legal implications of contract, common, and regulatory law to manage a construction project. (assessed and evaluated)
    - Study different project delivery methods (contracts), including their components, language and legal ramifications.

CMGT 350000: Materials Testing (Johnson)

8. Analyze methods, materials, and equipment used to construct projects. (supporting course)
    - Conduct standard tests and measurements with steel, aluminum, concrete and wood;
    - Estimate quantities necessary for concrete mix designs;

15. Understand construction quality assurance and control. (assessed and evaluated)
    - Select appropriate construction materials for strength and quality;

19. Understand the basic principles of structural behavior. (supporting course)
    - Utilize measuring methods and hardware that are appropriate for field, laboratory, and office processes related to structural construction.

CMGT 36000: Strength of Materials (Song)

8. Analyze methods, materials, and equipment used to construct projects. (supporting course)
    - Understand what construction materials are used in buildings
    - Distinguish the pros and cons of construction materials
    - Understand construction materials' behavioral response to structural loads.
    - Understand which types of construction material testing are performed.

19. Understand the basic principles of structural behavior. (assessed and evaluated)
    - Perform basic calculations related to structural stress and strain caused by structural loads.
    - Analyze basic structural building elements (e.g. beams, columns, trusses, decks) and their characteristics in terms of structural behavior.

CMGT 37000: Temporary Structures in Construction (Mukherjee)

8. Analyze methods, materials, and equipment used to construct projects. (supporting course)
    - Add here

19. Understand the basic principles of structural behavior. (supporting course)
    - Add here (below are examples)
    - Understand: Construction and Environmental Loads
    - Understand: Temporary Structures and Facilities
    - Understand: Earth / Retaining Structures
    - Understand: Diaphragm / Slurry Walls
    - Understand: Construction Dewatering and Groundwater Control
    - Understand: Underground / Tunneling Support
    - Understand: Underpinning / Cofferdams
    - Understand: Roadway Decking / Construction Ramps, Runways, and Platforms

- Understand: Scaffolding / Falsework / Shoring
- Understand: Concrete Formwork / Bracing and Guying for Stability
- Understand: Falsework / Temporary Structures in Repair and Restoration
- Understand: Leading Edge Vertical Containment Systems
- Understand: Failures of Temporary Structures in Construction

CMGT 38000: Infrastructure Planning, Engineering, and Economics (Kieser)

1. Create Written Communications Appropriate to the Construction Discipline. (supporting course)
   - All students must complete written assignments in this course appropriate to the construction discipline.
   - All students must complete written exams appropriate to course topics.
   - In the course topics students will learn about industry topics in the areas of drinking water, wastewater, stormwater control, transportation systems, and economic analysis.

13. Understand construction risk management. (supporting course)
   - All students will gain an understanding of associated construction risk through embedded exam questions and assignments.
   - All students will understand construction risk management as it relates to various topics covered in this infrastructure management course.
   - This course will discuss construction management risk in the areas of drinking water, wastewater, stormwater control, and transportation systems.

18. Understand the basic principles of sustainable construction. (supporting course)
   - This course will include different aspects of the built environment. Exams and written assignments will be used to assess this aspect of the course.
   - Sustainable construction techniques will be covered in the areas of drinking water, wastewater, stormwater control, and transportation systems.
   - All students will learn about using recyclable and renewable materials in building projects and minimizing energy consumption and waste. This will be assessed through exams and written assignments.

CEMT 39000: Construction Experience III

1. Create Written Communications Appropriate to the Construction Discipline. (assessed and evaluated)
   - Create a "Work Report" that documents your work experience and provides insight into your personal learning.

CMGT 41000: Construction Field Operations (Koo)

4. Create construction project cost estimates. (supporting course)
   - Create Detailed Cost Estimates for heavy equipment
     - Develop the ability to calculate ownership and operating costs.
     - Analyze the advantages and disadvantages of ownership versus renting or leasing machines.

8 . Analyze methods, materials, and equipment used to construct project (assessed and evaluated).
   - Analyze compaction operations
     - Ability to understand which type of compaction is the most effective in different soils and job conditions.
     - Ability to identify a multitude of compaction tools.
     - Ability to calculate estimated compaction production
   - Analyze power requirements
     - Analyze power requirements for a given project in order to select the proper equipment
     - Understand how to determine production
     - Ability to read a performance chart
   - Analyze dozer operation
     - Understand what dozers are used for in construction.

- Identify and distinguish between different types of dozers and blades.
- Calculate dozer productivity for a given set of job specific

- Analyze scraper operation
  - Understand how scrapers are used for construction.
  - Ability to distinguish between different types of scrapers and where each may be used to maximize efficiency.
  - Calculate scraper productivity and balance an equipment spread
- Analyze excavator operation
  - Understand how Excavators are used in construction.
  - Ability to distinguish between different types of excavators and where each may be used to maximize efficiency.
  - Calculate excavator productivity and balance equipment
- Analyze hauling operation
  - Understand the differences between various types of trucks
  - Ability to calculate the number of trucks required to keep excavating equipment working at capacity

11. Apply basic surveying techniques for construction layout and control. (supporting course).
    - Analyze earthwork volume, mass diagram, and hauling distance
      - Calculate earthwork volumes
      - Construct an earthwork volume sheet and mass diagram
      - Identify plan views, profile views, and cross-sections
      - Calculate average haul distances

CMGT 42000: Construction Safety and Inspection (Steinhofer)

2. Create oral presentations appropriate to the construction discipline. (supporting course)
   - Construction Safety and Inspections involves many disciplines. To successfully complete the course each student will have to demonstrate the ability to: assimilate a large quantity of information; synthesize the information collected; evaluate the information; develop solutions and action plans; and organize and compile this information into a **project safety plan.**
3. Create a construction project safety plan. (assessed and evaluated)
   - The student will be able to converse intelligently on current issues and trends in the field of construction safety regulations. Each student will develop and deliver an **oral presentation** that focuses on a relevant issued concerning project safety. The skills learned will enable the student to analyze safety issues, evaluate possible solutions and reach an appropriate decision based upon the correct analysis of complex information.
13. Understand construction risk management. (supporting course)
    The student will develop an understanding of the cost and consequences of risk- based decision making, i.e., **risk management** as it relates to the management of construction activities.

CMGT 43000: Jobsite Management (Song)

4. Create construction project cost estimates. (supporting course)
   - Understand significant factors which cause cost overrun on the jobsite
   - Identify cost control activities from estimates
5. Create a construction project schedules. (supporting course)
   - Understand significant factors which cause time delay on the jobsite
   - Identify time control activities from construction schedules
6. Analyze professional decisions based on ethical principles. (supporting course)
   - Understand significant elements of jobsite environment management
10. Apply construction management skills as an effective member of a multi-disciplinary team. (supporting course)
    - Understand most common and hidden factors that affect labor productivity
12. Understand different methods of project delivery and the roles and responsibilities of constituencies involved in the design and construction process. (supporting course)
    - Understand the pros and cons of different project delivery systems

- Identify the roles and responsibilities of stakeholders within project delivery systems

15. Understand construction quality assurance and control. (assessed and evaluated)
    - Understanding quality management and safety management
16. Understand construction project control processes (supporting course).
    - Understand methods to implement continuous improvement plans in terms of project cost and duration
17. Understand the Legal Implications of Contract, Common, and Regulatory Law to Manage a Construction Project. (supporting course)
    - Understand the type of changes that occur on construction projects.
    - Identify what causes changes to occur.

Understand how changes can be handled, documented, and resolved.

CMGT 44000: Construction Project Management (Johnson)

1. Create written communications appropriate to the construction discipline. (supporting course)
    - Create a written document (project binder) and a formal verbal presentation that will be presented to faculty and the CM IAB.
2. Create oral presentations appropriate to the construction discipline. (assessed & evaluated)
    - Create a written document (project binder) and a formal verbal presentation that will be presented to faculty and the CM IAB.
3. Create a construction project safety plan. (supporting course)
    - Create a project estimate, project schedule, and safety plan directly related to the capstone project.
4. Create construction project cost estimates. (supporting course)
    - Create a project estimate, project schedule, and safety plan directly related to the capstone project.
5. Create construction project schedules. (supporting course)
    - Create a project estimate, project schedule, and safety plan directly related to the capstone project.
7. Analyze construction documents for planning and management of construction processes. (supporting course)
    - Analyze construction documents (contract, specifications, and drawings) for planning and managing the capstone project
9. Apply construction management skills as a member of a multi-disciplinary team. (assessed & evaluated)
    - Apply the various roles and responsibilities of a multi-disciplinary project team to the capstone project.
10. Apply electronic-based technology to manage the construction process. (supporting course)
    - Apply various construction industry software (Stack, Exel, MS Project, NoteVault, Powerpoint, etc.) in the overall management process for the capstone project.
12. Understand different methods of project delivery and the roles and responsibilities of all constituencies involved in the design and construction process. (supporting course)
    - Understand the different types of construction companies and construction project delivery methods, and contracts.
13. Understand construction risk management. (assessed & evaluated)
    - Identify the various risks associated with the construction process and how they can be controlled and/or minimized through risk assessment, allocation of resources, insurance/bonds, and safety management.

CMGT 45000: Structural Systems and Analysis (Mukherjee)

8. Analyze methods, materials, and equipment used to construct projects. (supporting course).
    - Demonstrate an understanding of the availability of concrete, steel and wood as a building and structural material, their origins, manufacturing process, selection and construction
19. Understand the basic principles of structural behavior. (supporting course).

- Define the engineering properties of reinforced concrete, steel, wood and masonry.

CMGT 46000: Soils and Foundations (Koo)

1. Create written communications appropriate to the construction discipline. (supporting course).
   - Conduct a sieve analysis for coarse soils and create a report.
   - Create a report based on the Unified Soil Classification System (USCS).
   - Conduct an Atterberg test for soil consistency and create a report.
   - Conduct a density test and create a Proctor test report.
   - Conduct a sand cone test and create a report.
   - Conduct a water permeability test and create a report.

8. Analyze methods, materials, and equipment used to construct project (supporting course)
   - Analyze engineering properties of soils, soil types, and field exploration.
   - Analyze soil compaction.
   - Analyze permeability of water in soils.
   - Analyze subsurface stress, consolidation, and shear strength of soil.
   - Analyze shallow and deep foundation load, design, and construction.
   - Analyze lateral earth pressure and retaining wall structure.

15: Understand construction quality assurance and control (assessed & evaluated)
   - Understand ASTM testing standards to support QA/QC for soils
     - ASTM D422 Sieve Analysis
     - ASTM D2487 Unified Soil Classification System
     - ASTM D698 Proctor Test
     - ASTM D1556 Sandcone Test

ACCE STUDENT LEARNING OUTCOMES

The American Council for Construction Education (ACCE) has 20 Student Learning Outcomes. The following outcomes are applicable to CEMT 43000.

4. Create construction project cost estimates. (supporting course)
5. Create a construction project schedules. (supporting course)
6. Analyze professional decisions based on ethical principles. (supporting course)
9. Apply construction management skills as an effective member of a multi-disciplinary team. (supporting course)
12. Understand different methods of project delivery and the roles and responsibilities of constituencies involved in the design and construction process. (supporting course)
15. Understand construction quality assurance and control (assessed & evaluated)
16. Understand construction project control processes (supporting course).
17. Understand the Legal Implications of Contract, Common, and Regulatory Law to Manage a Construction Project. (supporting course)