

# Minnesota Articulated College Credit (ACC) Agreement [www.CTEcreditMn.com](http://www.CTEcreditMn.com)

Agreement Name: **Civil Engineering & Architecture (CEA) – PLTW/Siemens**

Agreement Last Reviewed: **Fall 2023**

Next Review Date: **Fall 2025**

College Courses			
Class	Title	School	Credits
ARCH 1000	Residential Construction	Anoka Technical College	2.0 of 2.0
CARP 1810	Residential Blueprint Reading	Hennepin Technical College	1.0 of 1.0
ARCH 1203	Residential Materials & Methods of Construction 1	Hennepin Technical College	3.0 of 3.0
Elective 0	PLTW Civil Engineering and Architecture Elective	Normandale Community College	3.0 of 3.0
ARCH 1101	Studio 1	South Central College	2.0 of 4.0
		AND	
CTLS 2830	Construction Estimating & Strength of Material	South Central College	1.0 of 4.0
		AND	
CTLS 2110	Statics & Strength of Material	South Central College	1.0 of 3.0

## **Curriculum Content Objectives**

To receive credit, students will meet 100% of the following content objectives:

### **1. History of Civil Engineering and Architecture**

- Connect modern structural and architectural designs to historical architectural and civil engineering achievement
- Identify three general categories of structural systems used in historical buildings.
- Explain how historical innovations have contributed to the evolution of civil engineering and architecture.
- Identify and explain the application of principles and elements of design to architectural buildings.
- Determine architectural style through identification of building features, components, and materials.
- Create a mock-up model depicting an architectural style or feature using a variety of materials.

### **2. Careers in Civil Engineering and Architecture**

- Identify the primary duties, and attributes of a civil engineer and an architect along with the traditional path for becoming a civil engineer or architect.
- Identify various specialty disciplines associated with civil engineering.
- Participate in a design charrette and recognize the value of using a charrette to develop innovative solutions to support whole building design.
- Understand the relationship among the stakeholders involved in the design and construction of a building project.

### **3. Residential Design: Building Design and Construction**

- Identify typical components of a residential framing system.
- Recognize conventional residential roof designs.
- Model a common residential roof design and detail advantages and disadvantages of that style.
- Use 3D architectural software to design, model and document a small building.

### **4. Residential Design: Cost and Efficiency Analysis**

- Apply basic math skills to calculate the quantity and cost of concrete needed to pour the pad for a small building.
- Create a cost estimate for a small construction project, including a detailed cost break-down.
- Calculate the heat loss for a building envelope with given conditions appropriate for the project.

## 5. Residential Design

- a. Apply elements of good residential design to the design of a basic house to meet the needs of a client.
- b. Design a home design that complies with applicable codes and requirements.
- c. Incorporate sustainable building principles, energy conservation features, and universal design concepts into a residential design.
- d. Create bubble diagrams and sketch a floor plan.
- e. Identify residential foundation types and choose an appropriate foundation for a residential application.
- f. Calculate the head loss and estimate the water pressure for a given water supply system.
- g. Create sketches to document a preliminary plumbing and a preliminary electrical system layout for a residence that comply with applicable codes.
- h. Design an appropriate sewer lateral for wastewater management for a building that complies with applicable codes
- i. Create a site opportunities map and sketch a project site.
- j. Choose an appropriate building location on a site based on orientation and other site-specific information.
- k. Calculate the storm water runoff from a site before and after development.
- l. Document the design of a home using 3D architectural design software and construction drawings.

## 6. Commercial Applications: Commercial Building Systems

- a. Identify common commercial wall systems and building materials and differentiate between load-bearing and non-load bearing walls.
- b. Identify common commercial building framing systems.
- c. Identify applicable building codes and regulations that apply to a given development.
- d. Classify a building according to its use, occupancy, and construction type using the International Building Code.
- e. Research Land Use regulations to identify zoning designations and allowable uses of property.
- f. Comply with specifications, regulations, and codes during a design process.
- g. Compare a variety of commercial wall systems and select an appropriate system for a given commercial application based on materials, strength, aesthetics, durability, and cost.
- h. Compare a variety of commercial low-slope roof systems and select an appropriate system for a given commercial application based on materials, strength, durability, and cost.
- i. Identify the pros and cons of the use of a green roof in a commercial building design.
- j. Incorporate sustainable building practices, especially a green roof, into the design of a commercial building.
- k. Use 3D architectural design software to incorporate revisions for the redesign of a building.
- l. Use 3D architectural design software to create appropriate documentation to communicate a commercial building design.

## 7. Commercial Applications: Structures

- a. Given a structural form, describe how the structural form resists and transfers applied loads.
- b. Use building codes and other resources to calculate roof loading to a structure and select appropriate roof beams to safely carry the load.
- c. Analyze a simply supported beam subjected to a given loading condition to determine reaction forces, sketch shear and moment diagrams, and determine the maximum moment resulting in the beam.
- d. Use beam formula to calculate end reactions and the maximum moments of a simply supported beam subjected to a given loading condition.
- e. Use structural analysis software to create shear and moment diagrams of simply supported beams subjected to a given loading condition.
- f. Calculate the deflection of a simply supported beam subjected to a given loading condition.
- g. Use building codes and other resources to determine the required floor loading and design a structural steel floor framing system (beams and girders) for a given building occupancy.
- h. Identify and describe the typical usage of foundation systems commonly used in commercial construction.
- i. Determine the loads transferred from a steel framed structure to the ground through a foundation.
- j. Size a spread footing for a given loading condition.
- k. Check structural calculations created by others for correctness.

## 8. Commercial Applications: Services and Utilities

- a. Identify typical utility services for a commercial building, typical transmission/distribution methods for each utility, and methods for measuring usage.
- b. Interpret and apply code requirements and constraints as they pertain to the installation of services and utilities.
- c. Read and understand HVAC construction drawings for a commercial project.

- d. Apply criteria and constraints to size and locate the new utility service connections for a commercial facility.
- e. Modify system designs to incorporate energy conservation techniques.

**9. Commercial Applications: Site Considerations**

- a. Use differential leveling to complete a control survey to establish a point of known elevation for a project.
- b. Design appropriate pedestrian access, vehicular access and a parking lot for a commercial facility.
- c. Analyze a site soil sample to determine the United Soil Classification System designation and predict soil characteristics important to the design and construction of a building on the site.
- d. Explain the impact of site development on storm water runoff.
- e. Estimate the increase in storm water runoff from a commercial site and create a preliminary design for a storm water storage facility.
- f. Identify and explain the purpose of Low Impact Development techniques in site development.
- g. Apply Low Impact Development techniques to a commercial site design reduce the impact of development on storm water runoff quantity and quality.
- h. Follow specifications and codes during a design process.
- i. Given 3D architectural design software, document a commercial site design.

**10. Commercial Applications: Building Design**

- a. Assemble and organize work from a commercial project to showcase the project in an effective and professional manner.
- b. Create visual aids for a presentation that include the appropriate drawings, renderings, models, documentation, and the rationale for choosing the proposal for project development.
- a. Conduct an oral presentation to present a proposal for the design and development of a commercial building project. Identify the boundaries of a property based on its legal description.
- b. Perform research and visit a site to gather information pertinent to the viability of a project on the site.
- c. Identify the criteria and constraints, and gather information to promote viable decisions regarding the development of their solution.
- d. Create an architectural program, a project organization chart, and a Gantt chart and hold project progress meetings to help manage the team project.
- e. Communicate ideas while developing a project using various drawing methods, sketches, graphics, or other media collected and documented.
- f. Identify the criteria for commercial property/project viability.
- g. Investigate the legal, physical, and financial requirements of a project and consider the needs of the community to determine project viability.
- h. Apply current common practices utilized in Civil Engineering and Architecture to develop a viable solution in their project.
- i. Develop an understanding of how software is used as a tool to aid in the solution and then the communication of a project.

**11. Commercial Building Design Presentation**

- a. Assemble and organize work from a commercial project to showcase the project in an effective and professional manner.
- b. Create visual aids for a presentation that include the appropriate drawings, renderings, models, documentation, and the rationale for choosing the proposal for project development.
- c. Conduct an oral presentation to present a proposal for the design and development of a commercial building project.

**Assessments**

Students must achieve no less than 80% or B for a final grade in the high school course to receive ACC.

**ACC Concept**

Through Articulated College Credit (ACC), specific college curriculum content goals and assessments are embedded in participating high school career and technical education (CTE) programs as specified in this agreement. Relevant knowledge, skills, and standards are taught by qualified CTE high school instructor(s) in one or more high school course. ACC is awarded if the student meets the college equivalency standards and later enrolls in the college(s) listed requiring the course in a specific program.