Course Title	Content Area	Grade Level	Credit (if applicable)
PLTW Civil Engineering and Architecture - UNH	CTE: Engineering and Technology	9-12	1 High School Credit 3 College Credits via UNH upon meeting UNH criteria

Course Description

Improving our world through thoughtful building design and development!

Students learn the fundamentals of building design, site design, and development. They apply math, science, and standard engineering practices to design both residential and commercial projects and document their work using 3D architectural design software.

You can change the world, one project at a time.

Civil Engineering and Architecture (CEA) is a high school level specialization course in the PLTW Engineering Program. In CEA students are introduced to important aspects of building and site design and development. They apply math, science, and standard engineering practices to design both residential and commercial projects and document their work using 3D architectural design software. Utilizing the activity-project-problem-based (APB) teaching and learning pedagogy, students will progress from completing structured activities to solving open-ended projects and problems that require them to develop planning, documentation, communication, and other professional skills.

Through both individual and collaborative team activities, projects, and problems, students will solve problems as they practice common design and development protocols such as project management and peer review. Students will develop skill in engineering calculations, technical representation and documentation of design solutions according to accepted technical standards, and use of current 3D architectural design and modeling software to represent and communicate solutions.

Building enthusiasm for and a real understanding of role, impact, and practice of civil engineering and architecture as it relates to building design and development is a primary goal of the course.

(Source: PLTW Civil Engineering Course Resume and Course Outline)

Aligned Core Resources	Connection to the ***BPS Vision of the Graduate***

• My PLTW Online (some elements require PLTW login credentials)
  ○ PLTW Civil Eng & Arch Course Resume
  ○ PLTW Civil Eng & Arch Course Outline
  ○ PLTW Civil Eng & Arch Standards Alignment
• Common Core State Standards for English Language Arts Anchor Standards
• Common Core State Standards for Mathematics
• Next Generation Science Standards
• Standards for Technological and Engineering Literacy
	Meaningfully contribute to a global society
	• Collaboration
	Effectively communicate in a global society
	• Communications and Technology Literacy
	Demonstrate Academic Knowledge and Skills
	• Critical Thinking and Problem Solving
	Professional Skills
	• Team collaboration
	• Project management
	• Problem-solving
	• Communication skills
	• Presentation skills
	• Technical writing

Additional Course Information: *Knowledge/Skill Dependent courses/prerequisites*	**Link to *Completed Equity Audit***
Concurrent enrollment in grade level appropriate math class.	Equity Curriculum Review Audit - Civil Eng & Arch (2025-26)

Standard Matrix

Common Core State Standards for English Language Standards
- Anchor Standards: Research to Build and Present Knowledge
- Writing: Text Types and Purposes
- Reading Informational Text: Key Ideas and Details

Common Core State Standards for Mathematics
- Geometry: Visualization and Spatial Reasoning
- Statistics and Probability: Interpreting Categorical and Quantitative Data

- Statistics and Probability: Making Inferences and Justifying Conclusions
- Number and Quantity: Quantities

Next Generation Science Standards

- Engineering Design: Developing Possible Solutions
- Engineering Design: Evaluating Solutions
- Engineering Design: Analyzing and Interpreting Data
- Engineering Design: Optimizing the Design Solution
- Engineering Design: Developing and Using Models

Standards for Technological and Engineering Literacy

- Creativity and Innovation
- Communication and Collaboration
- Understanding and Applying Engineering Concepts
- Global Awareness in Engineering
- Technology and Engineering in Design
- Collaboration and Teamwork

Unit Links

Unit 1: Overview of Civil Engineering and Architecture

Unit 2: Residential Design

Unit 3: Commercial Applications

Unit 4: Commercial Building Systems

Unit Title

Unit 1: Overview of Civil Engineering and Architecture

Relevant Standards

PLTW Civil Eng & Arch Standards Alignment

- Common Core State Standards for English Language Standards (Page 2)
- Common Core State Standards for Mathematics (Page 6)
- Next Generation Science Standards (Page 13)
- Standards for Technological and Engineering Literacy (Page 19)

Essential Questions

Lesson 1

- How does the quality and type of infrastructure define and sustain a civilization, and what are the consequences when that foundation is neglected?
- What is the inherent duality between the artistic pursuit of beauty and user experience, and the scientific requirement for structural integrity and safety?

Lesson 2

- How is the successful synthesis of Art and Science used by designers to address complex modern global challenges like sustainability, resilience, and urbanization?
- How do the distinct roles of the architect (form/space) and the civil engineer (system/function) collaborate to effectively meet the essential needs of the communities they serve?

Enduring Understandings

- Infrastructure, designed by civil engineers and architects, is the often-unseen foundation upon which all civilizations are built and sustained. The quality and type of this infrastructure (roads, bridges, buildings, water systems) directly determine a society's ability to grow, adapt, and provide quality of life for its citizens.
- Architecture and civil engineering are disciplines of duality, requiring a constant negotiation between two opposing forces: the quantifiable precision of Science (structure, safety, and function) and the qualitative artistry of Art (aesthetics, user experience, and creativity).
- Successful and lasting designs are not created by prioritizing one force over the other (Art vs. Science) but by mastering the synthesis of both. Civil engineers utilize their skills and knowledge to address complex modern challenges (like sustainability and urbanization) by integrating artistic innovation with scientific methodology.
- While the architect focuses primarily on the form and human interaction within spaces, and the civil engineer focuses on the function and safety of the overall system, both professions share the ultimate responsibility of shaping the built environment to serve human needs.

Demonstration of Learning

Written documents, formative and summative assessments, hands on activities demonstrating knowledge of architectural styles.

Pacing for Unit

7 classes

Integration of Technology

Tools and Software

- Building Design Software - Use of a 3D program (Autodesk Revit) to complete architectural design
- Structural Analysis Tool - MDSolids
- Survey equipment - Autolevel
- Budgeting and Project Management

Family Overview and Unit Description

Unit 1 provides an introduction and overview to the past accomplishments within the fields of civil engineering and architecture as well as a brief introduction to the wide variety of careers within the fields of civil engineering and architecture.

Lesson 1.1 History of Civil Engineering and Architecture

The goal of this lesson is to introduce students to the vast history of accomplishments in civil engineering and architecture. The study and improvements on these accomplishments have paved the way for the structures that we use today. In this lesson students will begin to build a common vocabulary related to architectural styles and features, structural systems, and the elements and principles of design.

Lesson 1.2 Careers in Civil Engineering and Architecture

This lesson will provide foundation and perspective for students regarding careers in civil engineering and architecture as they venture through the remainder of the course. The primary duties and responsibilities of civil engineers (and related specialty disciplines) and architects are presented as well as the traditional educational and accreditation requirements that must be met in order to become a professional engineer and architect. Career connections and relationships between these two types of professionals and other stakeholders involved in building design and development are also introduced.

(Source: PLTW Civil Engineering Course Outline)

Unit-Specific Vocabulary		Aligned Unit Materials, Resources, and Technology (beyond core resources)
Civil Engineers Architects Engineering Roman Engineering Vernacular Architecture Arch Dome Aqueducts Design Elements Line	Color Form and Shape Space Texture ValueBalance Rhythm Emphasis Proportion and scale Movement Contrast Unity	N/A

Opportunities for Interdisciplinary Connections	Anticipated Misconceptions
• Math - Measurement and scale are applied in creating accurate models, drawings, and plans. • Art - Architectural aesthetics rely on principles of art and design such as balance, proportion, rhythm, and unity. • Social Studies - Students will learn about vernacular architecture and create a model building for a chosen architectural style. • Social Studies - Students will be involved in a design charrette activity in which they will need to come up with a solution to a real world problem. In order to accomplish this, students will need to research all of the stakeholder's roles as well as become familiar with those occupations current and future outlook	Role of the Architect vs. Engineer Architects and civil engineers do the same job (i.e., that civil engineers only design buildings, or that architects are only concerned with aesthetics). Design Process The design process is a simple, linear path (Idea →Design → Build), rather than an iterative process involving loops for testing, evaluation, and redesign. Problem Formulation The client's initial statement defines the true problem; students fail to see that a major part of design is defining and refining the problem itself. Soft Skills Technical skills (CAD, math) are the only things that matter; they underestimate the importance of communication, collaboration, and ethical decision-making in professional practice.

Connections to Prior Units	Connections to Future Units
N/A	Students will take their understanding of architecture and architectural styles to create their own designs in future units.

Differentiation through *Universal Design for Learning*
Teacher Actions to Provide Differentiated Support

Learning Target 1: I can understand how the work of civil engineers and architects shaped society.
- Connect learning to real-world impacts of engineering and architecture on communities and culture.
- Encourage students to link what they know about society and history to engineering and architecture.
- Promote discussion on shared human needs addressed through design and infrastructure.

Learning Target 2: I can understand the difference between the art of architecture and civil engineering and the science of architecture and civil engineering.
- Use visual models, sketches, and physical examples to show artistic versus scientific aspects.
- Illustrate through multiple media: Support understanding through diagrams, videos, models, and case studies.
- Clarify how artistic and scientific perspectives contribute differently to design and function.

Learning Target 3: I can understand how civil engineers contribute to the solutions of the Grand Challenges for Engineering.
- Connect classroom content to global, real-world challenges.
- Help students see how civil engineering principles apply across global problems.
- Use feedback to emphasize progress toward understanding big, complex systems.

Learning Target 4: I can understand the difference between a Civil Engineer and an Architect.
- Use diagrams, Venn diagrams, and examples to compare roles.
- Define professional terms clearly (e.g., structural integrity, aesthetics, design intent).
- Help students organize differences and overlaps visually.

Supporting Multilingual/English Learners Related CELP standards aligned to Learning Targets			
	Emerging	**Bridging**	**Expanding**
LT1	I can match pictures or words of structures (roads, buildings) to the word society. I can name one thing a civil engineer built that we use.	I can describe with simple phrases how civil engineers and architects have impacted our community (e.g., better roads, tall buildings).	I can explain how the design and construction choices of civil engineers and architects have influenced community development and quality of life.
LT2	I can identify the difference between a design's 'look' (art) and its 'safety/function' (science) using simple terms or visuals.	I can compare the focus of art (aesthetics, human experience) and science (structure, safety) in a design project, using short sentences.	I can analyze and differentiate the interdependent roles of art (creativity, aesthetics) and science (technical precision, stability) in successful architectural and civil engineering projects.
LT3	I can point to or name a problem (e.g., clean water) and say how an engineer helps (e.g., builds a water pipe).	I can summarize the civil engineer's role in solving one Grand Challenge (e.g., sustainable water systems) using key vocabulary.	I can evaluate the diverse contributions of civil engineers to the Grand Challenges, such as designing sustainable infrastructure to address issues like clean water or urbanization.
LT4	I can state one job for a Civil Engineer (e.g., builds bridges) and one job for an Architect (e.g., designs houses).	I can contrast the main responsibilities of a Civil Engineer (focus on structure/systems) and an Architect (focus on design/space) using a few sentences.	I can articulate the distinct professional roles and areas of expertise for Civil Engineers (e.g., infrastructure, structural integrity) and Architects (e.g., spatial design, aesthetic functionality).

Lesson	Learning Target	Success Criteria/ Assessment
Lesson 1 *History of Civil Engineering and Architecture*	LT 1: I can understand how the work of civil engineers and architects shaped society.	• I can describe specific examples of how civil engineers and architects have influenced the development of communities, cities, or civilizations. • I can explain how infrastructure (roads, bridges, buildings, water systems) supports societal growth and daily life.
	LT 2: I can understand the difference between the art of architecture and civil engineering and the science of architecture and civil engineering.	• I can clearly explain what “art” means in architecture and civil engineering (creativity, aesthetics, design, emotion, user experience). • I can clearly explain what “science” means in architecture and civil engineering (structure, function, materials, safety, precision). • I can identify differences between the artistic and scientific sides of each field. • I can describe how art and science work together to create designs that are both beautiful and functional.
	LT 3: I can understand how civil engineers contribute to the solutions of the Grand Challenges for Engineering.	• I can describe how civil engineers use their skills and knowledge to address the challenge. • I can explain specific methods, systems, or technologies civil engineers might use (e.g., water systems, sustainable infrastructure, transportation planning).
Lesson 2 *Careers in Civil Engineering and Architecture*	LT 4: I can understand the difference between a Civil Engineer and an Architect.	• I can describe the main responsibilities of a civil engineer (e.g., designing, constructing, and maintaining infrastructure like bridges, roads, and water systems). • I can describe the main responsibilities of an architect (e.g., designing buildings, planning spaces, focusing on aesthetics and usability).

Unit Title

Unit 2: Residential Design

Relevant Standards

PLTW Civil Eng & Arch Standards Alignment

- Common Core State Standards for English Language Standards (Page 2)
- Common Core State Standards for Mathematics (Page 6)
- Next Generation Science Standards (Page 13)
- Standards for Technological and Engineering Literacy (Page 19)

Essential Questions

Lesson 1

- How do material and system selection (e.g., roofing, plumbing, energy) affect the long-term maintenance costs and environmental impact of a residential structure?
- How has the use of 3D modeling software affected the design and construction industry?

Lesson 2

- How do design choices impact a home's constructability and cost?
- It has been said that, “Having a vision without action is a daydream; Taking action without a vision is a nightmare!” How does this apply to architectural design?

Lesson 3

- How do architects and engineers ethically balance client vision, budget, and the imperative for sustainable design?
- What are the key technical skills, including computational, mathematical, and regulatory knowledge (like building codes), required to successfully design, model, and estimate a residential project?

Enduring Understandings

- The successful design of a residence requires an integrated understanding of its constructability, cost, and functionality. Architectural choices, such as the roof style and material selection, directly influence the initial budget, the required construction methods, and the long-term maintenance needs of the structure.
- Responsible architectural and engineering practice requires balancing client vision and budget with the ethical imperative for sustainability and public safety. Sustainable design is not merely an option but a professional necessity, requiring holistic strategies across energy, water, materials, and waste, even when these choices may affect short-term costs.
- Effective architectural design requires both creative vision and pragmatic, analytical action. Computational and mathematical skills (including geometry, measurement, and cost analysis) are essential for translating creative concepts into safe, accurate, and functional designs that comply with building codes. Modern tools like 3D modeling enhance this process by improving visualization and reducing errors.
- Every design decision, from the smallest fixture to the major structural system, contributes to a home's overall environmental impact and life-cycle cost. Architects and engineers must weigh initial savings against long-term durability and efficiency to ensure the design delivers lasting value and minimizes negative effects on the environment and future generations.

Demonstration of Learning

Written formative and summative assessments.

- Design a small single family residential structure that reflects a set of basic building guidelines
- Create a site opportunities map and site plan for a small residential structure
- Create a simple residential electrical plan
- Document a residential design with construction drawings and a 3D computer model using 3D architectural software

Pacing for Unit

27 Classes

Integration of Technology

Tools and Software

- Building Design Software - Use of a 3D program (Autodesk Revit) to complete architectural design
- Structural Analysis Tool - MDSolids
- Survey equipment - Autolevel
- Budgeting and Project Management

Family Overview & Unit Description

This unit of study introduces students to standard practice in the design of single family homes and provides an opportunity for students to develop a small single family home design that incorporates sustainable design practices as well as universal design features. Students will be introduced to building codes and their impact on design as well as common wood-framed residential construction techniques and practices. Students also will investigate the cost of construction and the significant impact of the choice of construction materials and practices on the ongoing cost of energy for heating and cooling. They will apply this knowledge to the design of a small, affordable home.

Lesson 2.1 Building Design and Construction

In this lesson students will learn typical wood-framed residential construction techniques and practices. They will build a common vocabulary related to building components and materials and become familiar with a variety of residential framing

methods and roof styles. In addition, students will be introduced to technical documentation of residential structures and will use 3D architectural modeling software to model and document the design of a small outdoor storage structure.

Lesson 2.2 Cost and Efficiency Analysis

In this lesson students investigate the cost of construction and the recurring energy costs associated with design decisions and construction techniques. Students will have the opportunity to perform quantity take-offs and cost estimates related to parts of small construction projects. In addition students will learn about and compare the energy efficiency of a variety of construction materials and calculate the rate of heat loss or gain through a building envelope which can be used to estimate energy demands for heating and cooling a building.

Lesson 2.3 Residential Design

In this lesson students apply elements of good residential building and site design to design a small affordable home for a client based on information gathered during a client interview and meetings. Students will perform code research and develop a design that meets applicable building codes and requirements as well as universal design principles. Students will also learn about sustainable building practices which they will apply to their home design in an effort to reduce the environmental impact of the building. Basic site design and orientation considerations are presented to guide students in appropriately locating the home on the building site to improve usability and reduce environmental impact. During the design process, students will also be introduced to a variety of residential foundation systems, basic residential electrical system components, plumbing systems and water supply calculations, and wastewater disposal and treatment systems. They will include consideration of these systems in their design development.

(Source: PLTW Civil Engineering Course Outline)

Unit-Specific Vocabulary		**Aligned Unit Materials, Resources, and Technology (beyond core resources)**
Wood Frame Construction Studs Insulation Floor Joists Subfloor	Top plate Roof Truss Sheathing Siding	N/A

Opportunities for Interdisciplinary Connections	**Anticipated Misconceptions**
• Students will use their English language skills in the development of presentations. • Math - Measurement and scale are applied in creating accurate models, drawings, and plans. • Math - Students will rearrange formulas to perform calculations for stormwater management and wastewater management. • Social Studies - Students will research and complete an activity on Land Use Development and Ordinances. • Art - Architectural aesthetics rely on principles of art and design such as balance, proportion, rhythm, and unity.	Building Codes Building codes are only restrictions that stifle creativity, rather than a necessary baseline for safety, health, and minimum performance. Cost Estimation The materials cost is the main or only factor in a construction budget, neglecting labor, permits, contingencies, and long-term maintenance/utility costs. 3D Modeling & CAD The 3D model (CAD) is the final deliverable, rather than a tool for analysis, communication, and generating construction documentation (2D drawings, schedules). Sustainability (Residential) Sustainability is only about adding solar panels or green roofs; students may fail to consider passive design strategies like building orientation and insulation as fundamental to energy efficiency. Load Paths Loads (weight) travel straight down through walls; students may not grasp the concept of load distribution through roofs, beams, headers, and foundations.

Connections to Prior Units	**Connections to Future Units**
Students will be able to use their knowledge of architectural styles to help design their residential dwelling.	Students will use the knowledge they gain from the residential unit and be able to apply the math and Autodesk Revit knowledge to future projects.

Differentiation through *Universal Design for Learning*

Teacher Actions to Provide Differentiated Support

Learning Target 1: I can understand why it is important for an architect to know the details of how residential buildings are constructed in order to design a house.

- Connect design concepts to what students already know about construction.
- Show how knowing building details makes architectural designs realistic and functional.
- Use models, drawings, and 3D visuals to show how design connects to construction.

Learning Target 2: I can understand how the use of 3D modeling software has affected the design and construction industry.

- Encourage students to explore 3D models, renderings, and simulations.
- Allow different ways to show understanding (e.g., modeling, screenshots, or presentations).
- Connect to real-world software and industry practices students may use in careers.

Learning Target 3: I can understand that if a cost estimate indicates that a residential design is significantly over budget, appropriate actions will need to be taken to reduce the cost.

- Help students recognize how budget impacts design choices.
- Support analyzing budgets, materials, and trade-offs.
- Encourage reflection and problem-solving when budgets must be adjusted.

Learning Target 4: I can understand what Green Architecture is and why it is important.

- Connect sustainability to global and local environmental challenges.
- Link to students' existing understanding of environmental responsibility.
- Encourage students to see how they can make a positive impact through design.

Supporting Multilingual/English Learners
Related *CELP standards* aligned to Learning Targets

	Emerging	Bridging	Expanding
LT1	I can match the architect's drawing to the building process (e.g., foundation, walls). I can say why a design must be possible to build.	I can explain simply that an architect needs to know construction details to make sure the house design is safe and possible to build (e.g., walls must hold the roof).	I can analyze and justify the importance of an architect's construction knowledge in creating a safe, functional, and structurally sound residential design.
LT2	I can identify a 3D model (picture) and say that it helps designers see the design better or find problems.	I can describe with some detail how 3D modeling software helps the industry by making designs easier to visualize and allowing teams to find errors early.	I can evaluate the transformative impact of 3D modeling software on design precision, error reduction, collaboration, and overall efficiency within the construction industry.
LT3	I can identify the design as "too expensive" and suggest one action like making the house smaller or using cheaper materials.	I can list and explain two or three actions a designer could take to bring a residential project that is over budget back into the spending limit (e.g., simplifying the roofline, reducing square footage).	I can propose and prioritize appropriate design and material adjustments necessary to effectively mitigate a significant budget overrun while maintaining the client's core requirements.
LT4	I can name one thing that makes a building "green" (e.g., solar panels, recycled materials) and say it is better for the Earth.	I can describe what Green Architecture is (sustainable design) and give a few reasons why it is important (saves energy, reduces waste).	I can articulate the principles of Green Architecture (sustainability, energy efficiency, site integration) and justify its importance in minimizing environmental impact and promoting long-term resource conservation.

Lesson	Learning Target	Success Criteria/ Assessment
Lesson 1 *Building Design and Construction*	LT 1: I can understand why it is important for an architect to know the details of how residential buildings are constructed in order to design a house.	• I can explain how design decisions affect construction (e.g., materials, methods, cost, and structure). • I understand that architects must design structures that can actually be built safely and efficiently. • I can identify basic construction methods used in residential buildings (e.g., framing, foundation, roofing, insulation). • I can explain how knowing these methods helps architects create accurate and realistic designs.
	LT 2: I can understand how the use of 3D modeling software has affected the design and construction industry.	• I can explain what 3D modeling software is and how it is used in architecture and engineering. • I can explain how 3D modeling software helps designers

		visualize and communicate ideas more clearly to clients, engineers, and builders. • I can describe how 3D modeling improves accuracy in measurements, material estimation, and design details.
Lesson 2.2 *Cost and Efficiency Analysis*	LT 3: I can understand that If a cost estimate indicates that a residential design is significantly over budget, then appropriate actions will need to be taken to reduce the cost.	• I can explain what a cost estimate is and why it is important in the design and construction process. • I understand that a cost estimate helps determine whether a design is financially realistic before construction begins. • I understand the impact of being over budget on the client, materials, and construction timeline.
Lesson 2.3 *Residential Design*	LT 4: I can understand what Green Architecture is and why it is important.	• I can define Green Architecture as designing buildings that are environmentally responsible, energy-efficient, and sustainable. • I can identify the main goals of Green Architecture, such as reducing energy use, conserving water, and minimizing waste. • I can explain how buildings impact the environment through energy consumption, water use, and materials.

Unit Title
Unit 3: Commercial Applications
Relevant Standards
PLTW Civil Eng & Arch Standards Alignment • Common Core State Standards for English Language Standards (Page 2) • Common Core State Standards for Mathematics (Page 6) • Next Generation Science Standards (Page 13) • Standards for Technological and Engineering Literacy (Page 19)

Essential Questions	Enduring Understandings
Lesson 1 • How do the distinct legal and regulatory frameworks (including land use regulations, building codes, and energy conservation codes) and the increased scale of construction fundamentally differentiate the design and development process for a commercial project from a residential one? Lesson 2 • What core engineering principles and specialized mathematical competencies are required to design, analyze, and select materials for a complex commercial structure, ensuring structural integrity while adhering to the principle that "Form Follows Function"? Lesson 3 • How must a commercial designer integrate and optimize a building's utility systems (e.g., plumbing, HVAC, electrical) to comply with codes like the International Energy Conservation Code (IECC) and achieve holistic building efficiency and sustainable performance? Lesson 4 • How do design professionals utilize advanced site analysis (like differential surveying) and employ the philosophy of minimal environmental impact ("touch the earth lightly") to ensure a commercial building project is successfully and ethically integrated into its community and environment?	• Commercial design is fundamentally governed by a complex framework of land use regulations (zoning and community planning) and strict building code requirements (safety, accessibility, and structural integrity). The increased scale and technical complexity of commercial projects—as compared to residential—require designers to navigate these constraints, balancing community needs, public safety standards, and project development goals. • Structural integrity and safety are guaranteed through the application of precise mathematical and engineering principles (e.g., algebra, geometry, physics-based calculations). Successful structural design, which often follows the principle that "Form Follows Function," relies on analyzing load forces and selecting efficient material shapes, such as the I-beam, to prevent failures and optimize the strength-to-weight ratio of the structure. • A successful commercial building is a cohesive system where the design of utility systems (HVAC, plumbing, electrical) is fully integrated into the overall architectural plan. Compliance with performance standards, such as the International Energy Conservation Code (IECC), is mandatory, ensuring that the building is not only functional and safe but also highly efficient, thus supporting broader goals of green building and sustainability. • Responsible design and development demand a commitment to environmental stewardship, embodying the philosophy to "touch the earth lightly." Designers and engineers must utilize accurate site analysis (like differential surveying) and employ current sustainable construction practices to minimize environmental impact, manage resources responsibly, and ensure that new commercial structures contribute positively to their surrounding community.

Demonstration of Learning	Pacing for Unit
Written formative and summative assessments. • Collaborate effectively with peers to design renovation to an existing commercial facility according to applicable building codes and regulations • Collaborate effectively with peers to design a viable small commercial building that meets identified code and ordinance requirements • Use Low Impact Development principals to design a site that support a commercial facility • Document the design or renovation of a commercial facility with construction drawings and a 3D computer model, using 3D architectural software • Design a sewer lateral	29 Classes **Integration of Technology** Tools and Software • Building Design Software - Use of a 3D program (Autodesk Revit) to complete architectural design • Structural Analysis Tool - MDSolids • Survey equipment - Autolevel • Budgeting and Project Management

Family Overview and Unit Description
This unit will provide students with an opportunity to discover the diversity and complexity of commercial building

design as they design a renovation to a commercial facility. The design of commercial facilities includes multiple building systems and involves a wide range of engineering and architectural considerations. In this unit students will learn about site considerations important to the function of the building. Students will learn about common built-up systems that provide the building envelope such as wall and roofs. They will learn about the utilities and services that supply power, water, and communication services to the building. In addition students will learn about common structural systems employed to support all of the building components. Applying the knowledge they gain from this unit of study, students will design a renovation to a commercial facility and document that design using 3D architectural software.

Lesson 3.1 Commercial Building Systems

In this lesson students will be exposed to the design and development of commercial facilities and the building codes and land development regulations that impact commercial construction. Students are presented with a commercial renovation design project on which they will work throughout this unit. They will research building codes and land development regulations and learn about a variety of commercial wall, roof, and floor framing systems as they further develop a common vocabulary related to building design and development. Students continue to build expertise in the use of a 3D architectural design software package as they model and document their commercial design project ideas.

Lesson 3.2 Structures

This lesson is designed to introduce students to the concepts and principles of structural engineering and structural efficiency. The activities related to this lesson are designed to aid students in learning about the variety of forces that impact the design and performance of a building and how to quantify those loads using building codes and the physical characteristics of the structure. Students are also introduced to the physical laws and mathematics involved in determining the internal resistive forces generated by the imposed loads as the loads are transferred through the structural elements of the building into the ground. A variety of structural systems and common commercial foundation systems are presented, and the lesson focuses on the analysis and design of beams and spread footings.

Lesson 3.3 Services and Utilities

This lesson will introduce students to the multiple modern utilities and services required in order for a building to function effectively and lawfully in today's society. These utilities and services include a reliable supply of energy and water, a system to dispose of wastes, and capacity for communication via multiple modes. Students will identify typical utilities and services for commercial buildings and common methods for distribution and measuring of those services. They will interpret and apply building code requirements and consider other physical constraints in the design and location of new utility service connections for their commercial project. In addition students will interpret and apply energy code requirements in the design of their commercial project building envelope and internal utility distribution systems in an effort to conserve natural resources, reduce operating costs, and protect the environment from the negative impact of development.

Lesson 3.4 Site Considerations

In this lesson students will learn about the important factors to be considered in commercial site design. They will perform a land survey, conduct a soil analysis, and conduct a physical investigation of the site in order to gather information relevant to their commercial project design. Students will use the information they have collected to design and document appropriate site improvements to provide adequate parking based on facility use and building code requirements and provide safe vehicular and pedestrian traffic access and flow. The site must also provide handicap access and provide access for emergency vehicles and the movement of goods and waste. Students will also become familiar with the requirements related to storm water runoff and management and learn the calculations necessary to comply with building codes. Based on the information they acquire during this lesson, students will design and document a site design for their commercial project. Their design will utilize low impact development techniques in order to incur minimal impact on people and the environment.

(Source: PLTW Civil Engineering Course Outline)

Unit-Specific Vocabulary		**Aligned Unit Materials, Resources, and Technology (beyond core resources)**
Brownfields Constraints Ethical Municipality Compliance Ordinances Regulations Occupant load Zoning	Curtain Wall Structural Engineer Structural Efficiency Tension Compression Shear force Moment Free Body Diagram	N/A

Opportunities for Interdisciplinary Connections	Anticipated Misconceptions
• Students will use their English language skills in the development of presentations. • Math - Measurement and scale are applied in creating accurate models, drawings, and plans. • Math - Students will rearrange beam deflection formulas as well as use beam deflection short cuts. • Social Studies - Students will utilize green design in their model home thus comparing and contrasting buildings. By doing such, students can compare and contrast modern roofs to roof designs from other time periods • Art - Architectural aesthetics rely on principles of art and design such as balance, proportion, rhythm, and unity. • Physics - Civil engineers and architects take the theoretical physics concept of thermal resistance and standardize it into the practical, additive R-value metric for use in real-world infrastructure designs.	Scale & Complexity Commercial construction is just a larger version of residential; they underestimate the massive differences in fire suppression systems, structural steel/concrete design, and commercial HVAC/plumbing systems. Regulations (Zoning vs. Code) Zoning/Land Use regulations are the same as Building Codes. Students may confuse what the land can be used for (zoning) with how the building on that land must be built (code). Structural Design Structural stability is achieved simply by making components thicker or bigger, neglecting the concept of structural efficiency and the importance of beam shape (e.g., I-beams) and material properties. "Form Follows Function" This principle means a building should be boring or strictly utilitarian. They miss that it means the building's aesthetic and form must be justified by its purpose and not decorative alone.
Connections to Prior Units	**Connections to Future Units**
This unit builds on the students prior knowledge of Autodesk Revit as well as adds new components such as beam deflection and structural engineering.	Students will continue to use many of the techniques and information they have gained for Unit 4.

Differentiation through *Universal Design for Learning*
Teacher Actions to Provide Differentiated Support

Learning Target 1: I can understand the difference between land use regulations and building code requirements.
- Activate or supply background knowledge: Build on what students already know about community rules and safety.
- Clarify vocabulary and symbols: Clarify complex terminology like “zoning,” “setback,” and “code.”
- Optimize relevance, value, and authenticity: Connect codes and regulations to real-life construction and neighborhood planning.

Learning Target 2: I can compare and contrast the influence of land use regulations and building codes on the design and construction process.
- Highlight patterns, critical features, big ideas, and relationships: Use a Venn Diagram or a two-column chart to visually separate the scope of Land Use Regulations (e.g., where you can build, how big the lot coverage is) from Building Codes (e.g., how you must build for safety, such as stair height and fire rating).
- Clarify vocabulary and symbols: Clearly define and contrast terms such as "Zoning" (Land Use) versus "Structural Integrity" (Building Code) to establish distinct conceptual boundaries for students.
- Guide information processing, visualization, and manipulation: Provide before-and-after scenarios of a building design, illustrating how a change in a setback requirement (Land Use) affects the building footprint versus how a change in insulation R-value (Building Code) affects the wall assembly.

Learning Target 3: I can understand the difference between residential construction and commercial construction.
- Highlight patterns, critical features, big ideas, and relationships: Compare size, materials, and design purpose of different construction types.
- Illustrate through multiple media: Use visuals, diagrams, or real-world examples to highlight differences.
- Optimize relevance, value, and authenticity: Relate learning to real projects and career roles in construction.

Learning Target 4: I can understand building codes and why they are important in construction of properties.
- Activate or supply background knowledge: Connect to safety and community standards students already know.
- Optimize relevance, value, and authenticity: Show how codes protect people and ensure safe, functional buildings.
- Highlight patterns, critical features, big ideas, and relationships: Explain how codes influence every part of a design.

Learning Target 5: I can describe what cross-sectional shape provides the strongest beam.
- Illustrate through multiple media: Use visual models or 3D simulations to show beam strength.
- Guide information processing, visualization, and manipulation: Help students interpret structural diagrams and analyze forces.
- Use multiple tools for construction and composition: Let students test and model beams physically or digitally.

Learning Target 6: I can explain how the design of the utility systems for a building affect the overall design of the building.

- Highlight big ideas and relationships: Show how plumbing, HVAC, and electrical systems connect to structure and layout.
- Illustrate through multiple media: Use diagrams, schematics, or modeling tools.
- Foster collaboration and community: Encourage teamwork to plan integrated systems.

Learning Target 7: I can describe three differences in how residential building project design differs from commercial building project design.

- Highlight patterns, critical features, big ideas, and relationships: Use comparison charts or visuals to emphasize key differences.
- Illustrate through multiple media: Support understanding with photos, blueprints, or video tours.
- Optimize relevance, value, and authenticity: Relate designs to real-world construction and careers

Learning Target 8: I can explain how differential surveying is used by a typical homeowner to provide better results for home improvement projects.

- Optimize relevance, value, and authenticity: Connect surveying to real homeowner tasks and real-world applications.
- Activate or supply background knowledge: Link to familiar tasks like leveling or measuring slopes.
- Build fluencies with graduated levels of support for practice and performance: Scaffold learning through guided practice and hands-on activities.

Supporting Multilingual/English Learners
Related *CELP standards* aligned to Learning Targets

	Emerging	Bridging	Expanding
LT1	I can tell if a rule is about where a building goes (land use) or how a building is made (building code).	I can describe that land use rules are about location and purpose and building codes are about safety and construction.	I can differentiate between land use regulations (zoning, density, aesthetics) and building code requirements (safety, structural, fire) and their respective jurisdictions.
LT2	I can identify that rules (codes/regulations) change what a designer can do and how a builder works.	I can explain how both land use rules and building codes limit or guide the design, from the size of the lot to the strength of the walls.	I can compare and contrast the specific ways that land use regulations (site placement, form) and building codes (material choice, structural design) influence the entire design and construction process.
LT3	I can match a house design to residential and a store design to commercial.	I can state that residential is for living and commercial is for business, and they use different materials or rules.	I can distinguish the core differences between residential construction (e.g., scale, complexity of systems, ownership structure) and commercial construction (e.g., specialized use, high occupancy codes).
LT4	I can name one thing a building code makes sure is safe (e.g., fire safety, strong walls).	I can explain why building codes are important—they ensure properties are safe for people and strong against damage.	I can analyze the essential role of building codes in protecting public health, ensuring structural integrity, and establishing minimum acceptable standards for property construction.
LT5	I can point to the shape that makes the strongest beam (I-beam).	I can describe the I-beam shape and explain that its design puts material where it is needed most to resist bending forces.	I can articulate why the I-beam cross-sectional shape provides superior strength and efficiency for structural beams compared to other shapes due to its ability to maximize the moment of inertia.
LT6	I can identify the pipe/wire locations and say that the utility systems (water, electric) change where walls or bathrooms must be.	I can explain how the need for space, pipes, and vents for utility systems (HVAC, plumbing) limits or guides where the designer can place rooms and structural elements.	I can evaluate the interdependent relationship between a building's utility system design (HVAC, electrical, plumbing) and the overall architectural design, including space allocation, vertical chases, and system access.
LT7	I can state three simple ways a house design is different from a store design (e.g., cost, number of bathrooms, building height).	I can describe three specific ways that residential design differs from commercial design (e.g., regulatory focus, budget scale, complexity of mechanical systems).	I can compare and contrast at least three significant differences between the design processes for residential and commercial projects, such as code compliance focus, program complexity,

			or budget constraints.
LT8	I can identify that surveying measures land height and that the information helps a homeowner plan (e.g., where water will flow).	I can explain that a homeowner uses differential surveying to find the precise height differences on their property to better plan projects like drainage or grading.	I can describe and justify how a typical homeowner can utilize the precise elevation data provided by differential surveying to optimize planning and execution for effective home improvement projects (e.g., proper slope for drainage).

Lesson	Learning Target	Success Criteria/ Assessment
Lesson 1 *Commercial Building Systems*	LT 1: I can understand the difference between land use regulations and building code requirements.	• I can define land use regulations as rules that control how land can be used (for example, zoning laws that separate residential, commercial, and industrial areas). • I can explain that land use regulations focus on planning and development of land within a community.
	LT 2: I can compare and contrast the influence of land use regulations and building codes on the design and construction process.	• I can define the purpose of land use regulations and provide examples of how they impact a building project. • I can define the purpose of building codes and provide examples of how they impact a building project. • I can explain how land use regulations primarily affect the "where" and "what type" of structure is built. • I can explain how building codes primarily affect the "how" a structure is built safely and effectively. • I can accurately compare and contrast the distinct roles of both land use regulations and building codes in the overall design and construction process.
	LT 3: I can understand the difference between residential construction and commercial construction	• I can define residential construction as building structures meant for people to live in, such as houses, apartments, and townhomes. • I can define commercial construction as building structures meant for businesses or public use, such as offices, schools, hospitals, and stores. • I can explain how budget, timeline, and materials differ between residential and commercial projects.

	LT 4: I can understand building codes and why they are important in construction of properties.	• I can define building codes as official regulations that set minimum standards for design, construction, and safety of buildings.
		• I understand that building codes are created and enforced by local, state, and national authorities to protect people and property.
		• I can explain that building codes exist to:
		  ○ Ensure safety for occupants (e.g., fire protection, structural strength, electrical safety).
		  ○ Promote accessibility for all users, including those with disabilities.
		  ○ Support public health and welfare through sanitation, ventilation, and energy standards.
		  ○ Provide consistency in construction practices.

Lesson 3.2 *Structures*	LT 5: I can describe what cross-sectional shape provides the strongest beam.	• I can define what a beam is — a structural element that supports loads by resisting bending. • I can explain what cross-sectional shape means — the shape of a beam's cut surface when viewed from the end. • I can identify that the I-beam (or H-beam) is one of the strongest cross-sectional shapes used in construction. • I can describe that this shape is strong because it places material farthest from the center (neutral axis), where it resists bending the most.
Lesson 3.3 *Services and Utilities*	LT 6: I can explain how the design of the utility systems for a building affect the overall design of the building.	• I can define utility systems as the essential building systems that provide water, electricity, heating, cooling, and waste removal.

		• I can identify the main utility systems in a building:
		  ○ Plumbing (water supply and waste)
		  ○ Electrical (power and lighting)
		  ○ HVAC (heating, ventilation, air conditioning)
		  ○ Communication and fire protection systems
		• I can explain that utility systems influence the layout and structure of a building.
		• I understand that utilities must be planned early in the design process to avoid conflicts with walls, ceilings, and structural supports.

Lesson 3.4
Site Considerations
	LT 7: I can describe three differences on how residential building project design differs from commercial building project design.	• I can define what residential building design means (homes, apartments, places where people live).
		• I can define what commercial building design means (offices, schools, stores, factories, or other buildings used for business or public use).
		• I can identify at least three clear differences between residential and commercial design, such as:
		  ○ Purpose and Function: Residential designs focus on comfort and livability, while commercial designs focus on efficiency and capacity for work or service.
		  ○ Building Codes and Safety: Commercial buildings follow stricter fire, accessibility, and structural codes due to higher occupancy.
		  ○ Materials and Structure: Commercial buildings often use steel and concrete for strength and height; residential projects use wood framing.
		  ○ Utility Systems: Commercial designs require larger-scale HVAC, electrical, and plumbing systems to serve more people.
		  ○ Aesthetics and Layout: Residential designs emphasize personal style and privacy; commercial designs prioritize public spaces and accessibility.

	LT 8: I can explain how differential surveying is used by a typical homeowner to provide better results for home improvement projects.	• I can define differential surveying as a method used to measure differences in elevation between points to determine accurate height and slope information.
		• I can explain the purpose of differential surveying — to ensure level, accurate, and properly graded surfaces for construction or landscaping projects.
		• I can identify at least two home improvement projects where differential surveying is useful, such as:
		  ○ Installing a patio, deck, or driveway that must be level or properly sloped for drainage.
		  ○ Landscaping or yard grading to prevent water pooling near the house.
		  ○ Adding an addition or building a shed that needs a level foundation.

Unit Title

Unit 4: Commercial Building Design Problem

Relevant Standards

PLTW Civil Eng & Arch Standards Alignment

- Common Core State Standards for English Language Standards (Page 2)
- Common Core State Standards for Mathematics (Page 6)
- Next Generation Science Standards (Page 13)
- Standards for Technological and Engineering Literacy (Page 19)

Essential Questions

Lesson 1

- If you had to describe one strategy that would most help an architect/engineer to be a good and effective building project designer, what would it be?
- Stephen Covey includes "Begin with the End in Mind" as one of the seven habits listed in his book, The 7 Habits of Highly Effective People. How can this habit make an engineer/architect more effective?

Lesson 2

- How important is it to an architect's or civil engineer's success that s/he possesses "people skills"?

Enduring Understandings

- Effective architects and engineers integrate technical knowledge, creativity, communication, and problem-solving strategies to design safe, functional, and aesthetically pleasing structures. A successful designer continuously refines their process to balance client needs, environmental constraints, and construction feasibility.
- Clear vision and purposeful planning are essential to the design process. Architects and engineers who "begin with the end in mind" are more effective because they anticipate project goals, user needs, and long-term impacts — allowing them to make intentional design decisions that align with the desired outcome.
- Strong interpersonal and communication skills are critical for architects and engineers, as collaboration, negotiation, and teamwork are vital to the design and construction process. Technical expertise alone is not enough; understanding and managing relationships with clients, contractors, and team members ensures project success and professional growth.

Demonstration of Learning

Written formative and summative assessments.

- Analyze a given building/site design and make recommendations to identify errors and/or omissions improve energy efficiency reduce the quantity and/or improve the quality of storm water runoff

Pacing for Unit

24 Classes

Integration of Technology

Tools and Software

- Building Design Software - Use of a 3D program (Autodesk Revit) to complete architectural design
- Structural Analysis Tool - MDSolids
- Survey equipment - Autolevel
- Budgeting and Project Management

Family Overview and Unit Description

This unit will allow students to collaborate on the design and documentation of a small commercial facility within a project design team. They will identify a need within their community, investigate a potential site, develop a preliminary design, and document the design of the facility as a team. They will also present their design concept to a panel that will critique their design and offer feedback to the team related to their design and presentation.

Lesson 4.1 Commercial Design Problem

In this lesson students will work within design teams to develop a preliminary design for a small commercial facility. As part of the design process, they will investigate a potential site for development of their commercial project; research codes, zoning ordinance, and regulations that impact the site; and determine the legal description of the property. Students will develop an architectural program to describe the desired outcome of the project and help guide development. They will become familiar with legal, physical, and financial conditions that should be considered in order to determine the viability of project development and help determine whether a project solution should be undertaken. As the team project progresses, students will apply the skills and knowledge they have gained throughout the course to the team commercial project. They will learn new skills related to team design work, including creating a project organization chart, developing and using a Gantt chart to plan and monitor project progress, and holding regular team meetings. Students will document their design according to accepted practice using 3D architectural modeling software.

Lesson 4.2 Commercial Design Presentation

In this lesson students will create and deliver a formal presentation (both oral and written) of their final team

commercial design project to include a description of both the design process (and justifications of design decisions) as well as the resulting design. The project presentation will be reviewed and critiqued by a panel who will offer feedback to the team related to their design process, decision making, and the resulting design and documentation.

(Source: PLTW Civil Engineering Course Outline)

Unit-Specific Vocabulary		**Aligned Unit Materials, Resources, and Technology (beyond core resources)**
Sustainability Legal Description Site Discovery Building Codes Zoning Codes ADA Requirements Occupancy Load Egress Rendering	Principal Meridian Metes and Bounds Plat Municipal Ordinances Municode Frontage Feasibility Gantt Chart	N/A

Opportunities for Interdisciplinary Connections	**Anticipated Misconceptions**
• Students will use their English language skills in the development of presentations. • Math - Measurement and scale are applied in creating accurate models, drawings, and plans. • Math - Students will rearrange beam deflection formulas as well as use beam deflection short cuts. • Social Studies - Students will utilize green design in their model home thus comparing and contrasting buildings. By doing such, students can compare and contrast modern roofs to roof designs from other time periods. • Art - Architectural aesthetics rely on principles of art and design such as balance, proportion, rhythm, and unity.	Site Analysis/Surveying Differential surveying is unnecessary if an area looks flat, or that fences or visible property markers accurately define legal property lines. Stormwater Management Drainage is a simple problem solved by putting in a single drain or French drain. They overlook the need for holistic stormwater plans, managing runoff volume, and using techniques like permeable pavement or rain gardens. Ethics and Environment "Touching the earth lightly" only applies to visible landscaping, missing the impact of foundation work, utility trenching, and construction waste on the site ecology. Project Management A project is finished once the design drawings are done. They fail to account for the crucial role of the engineer/architect during construction administration, bidding, and addressing site problems.

Connections to Prior Units	**Connections to Future Units**
Builds upon the use of Autodesk Revit for building design	N/A

Differentiation through *Universal Design for Learning*
Teacher Actions to Provide Differentiated Support

Learning Target 1: I can analyze a potential site for a commercial project and explain how building codes and regulations affect what can be built.
- Provide visual aids, diagrams, or maps of building codes and zoning.
- Allow students to present findings in writing, verbally, or visually.
- Offer real-world examples to increase relevance and engagement.

Learning Target 2: I can design a commercial building and create a complete project portfolio that communicates my design clearly.
- Use modeling software, drawings, or physical models.
- Allow portfolios in multiple formats: digital, printed, or video.
- Provide choice in design topics or building types to enhance engagement.

Learning Target 3: I can evaluate how a commercial building project affects people and the environment, and explain how design choices can make it more sustainable and ethical.
- Provide case studies, videos, or infographics on sustainability.
- Encourage reflection through discussion, journals, or presentations.
- Offer collaborative group work to increase engagement and relevance.

Learning Target 4: I can research and interpret legal descriptions of property using online resources and historical documents.
- Offer tutorials for online databases and historical document access.
- Provide graphic organizers to map out legal descriptions.
- Allow verbal explanations or annotated diagrams to demonstrate understanding.

Learning Target 5: I can sketch a plat based on legal descriptions using the rectangular survey system and metes and bounds.
- Provide step-by-step instructions and sample sketches.
- Allow use of digital drawing tools or physical paper.
- Scaffold the task with guided examples to build confidence.

Learning Target 6: I can understand the significance of recording complete legal descriptions with local courts and the methods used.
- Use diagrams, flowcharts, or videos to illustrate recording processes.
- Allow written, verbal, or visual explanations of the process.
- Connect tasks to real-life relevance to enhance engagement.

Learning Target 7: I can identify the key site characteristics that influence the suitability for a proposed development.
- Provide photos, maps, or 3D site models.
- Encourage students to create checklists or charts to organize data.
- Allow students to choose a site of interest for analysis.

Learning Target 8: I can research and document various site conditions using a Site Discovery Checklist.
- Provide digital or printable checklists with guiding prompts.
- Allow documentation through photos, diagrams, or written notes.
- Scaffold the process by demonstrating examples of completed checklists.

Learning Target 9: I can evaluate the impact of environmental, zoning, and adjacent property considerations on site development.
- Provide visual case studies or GIS maps.
- Allow students to present their evaluation verbally, in writing, or through diagrams.
- Encourage peer discussion to enhance engagement.

Learning Target 10: I can compare several commercial development options to determine the most viable project for a site.
- Use charts or tables to organize comparisons.
- Allow students to present options visually, verbally, or digitally.
- Scaffold criteria for comparison to support decision-making.

Learning Target 11: I can evaluate the legal, physical, and financial feasibility of proposed development options.
- Provide checklists or templates for feasibility analysis.
- Allow flexible expression: reports, presentations, or interactive models.
- Incorporate real-world scenarios to motivate learning.

Learning Target 12: I can use a decision matrix to make comparisons based on gathered data.
- Provide sample decision matrices and guided steps.
- Allow digital, paper, or visual representations of the matrix.
- Encourage collaborative completion for engagement and feedback.

Learning Target 13: I can collaborate on the purpose, materials, and techniques for creating a model of a commercial design solution.
- Offer multiple materials (digital, physical) for modeling.
- Encourage peer discussion and shared planning.
- Provide visual or written guides for construction techniques.

Learning Target 14: I can construct a scaled model that accurately represents key aspects of a commercial design solution.
- Provide scaffolding with templates or measurement guides.
- Allow students to use physical or digital models.
- Offer opportunities for iterative feedback to support mastery.

Learning Target 15: I can prepare visual aids and a presentation to effectively communicate the final commercial design solution.
- Provide multiple formats for visual aids (slides, posters, 3D models).
- Allow oral, video, or written presentations.
- Scaffold presentation structure and provide rubrics for guidance.

Supporting Multilingual/English Learners
Related *CELP standards* aligned to Learning Targets

	Emerging	Bridging	Expanding
LT1	I can identify one rule (code or regulation) that changes what kind of store can be built on a map.	I can describe with simple phrases how site rules (zoning) and construction rules (codes) affect the size or type of building a company can make there.	I can analyze a potential site, referencing specific building codes and zoning regulations, to explain their complex influence on the feasibility and parameters of a commercial project.
LT2	I can draw a simple floor plan of a commercial building and label the rooms.	I can create a simple folder with my commercial design sketch and list the main materials and purpose.	I can design a commercial building and compile a comprehensive, well-organized project portfolio that clearly and professionally communicates all facets of the design solution.
LT3	I can name one way the building affects people (e.g., job) and one way it's good for the Earth (e.g., less trash).	I can explain with detail how commercial design choices (e.g., green roof, local materials) can make a project more sustainable and better for the community and environment.	I can evaluate the full socio-economic and environmental impact of a commercial project and propose/justify advanced, ethical design strategies to enhance its sustainability and community benefit.
LT4	I can find the name of the owner of a property using an online map or document.	I can use online resources to locate a property's legal document and identify key facts like the lot number or property lines.	I can research and accurately interpret complex legal descriptions of property (e.g., lot and block, metes and bounds) using specialized online resources and historical public documents.
LT5	I can draw a simple square or rectangle to show a piece of land from a simple description.	I can sketch a basic plat map (drawing of land) using given rectangular survey information (e.g., section, township) or simple directions (metes and bounds).	I can accurately sketch and label a plat map based on both the Rectangular Survey System and metes and bounds descriptions, demonstrating comprehension of surveying terminology.
LT6	I can say that property maps must be kept at the local office so everyone knows who owns what.	I can explain that recording legal descriptions is important because it creates a public record of ownership, which prevents future disputes.	I can evaluate the legal and financial significance of recording complete legal descriptions with local courts and describe the specific methods and documentation required for this process.
LT7	I can name three things about the land that change what we can build (e.g., water/river, road access, slope).	I can identify the key site characteristics (e.g., topography, utility access, soil type) and explain why each influences the feasibility of building a new project.	I can systematically identify and prioritize the key physical and logistical site characteristics (e.g., geotechnical conditions, infrastructure availability, legal easements) that critically influence development suitability.
LT8	I can look at a picture of a site and check off if it has a road, trees, or water on a list.	I can use a checklist to document basic observations about the current site conditions, like nearby roads, zoning use, and environmental features.	I can research and thoroughly document various site conditions using a structured Site Discovery Checklist, synthesizing data from multiple sources (maps, surveys, site visits).
LT9	I can say that building near a house (adjacent property) or a park (environmental) can cause problems.	I can explain how nearby homes (adjacent property), environmental rules, and zoning all affect where we can build and how big the building can be.	I can evaluate and articulate the complex impact of environmental constraints, zoning ordinances, and adjacent property considerations on design decisions and the overall viability of site development.
LT10	I can choose the best project (e.g., hotel, store) for a piece of land from two simple options.	I can compare a few commercial project options for a site by listing the pros and cons for each one.	I can compare and critically analyze several commercial development options (e.g., office park vs. retail center) against site data to determine the most financially and environmentally viable project.

LT11	I can say if a project is possible (physical) and if we have enough money (financial).	I can evaluate a proposed project's feasibility by describing its legal compliance, physical ability to be built, and if it is affordable (financial).	I can comprehensively evaluate the legal, physical, and financial feasibility of proposed development options, integrating data on zoning, site constraints, and projected return on investment.
LT12	I can put check marks on a simple table (matrix) to show which option is better based on a few facts.	I can use a decision matrix by assigning scores to criteria (e.g., cost, size, traffic impact) to compare development options and identify the best choice.	I can effectively utilize a weighted decision matrix to systematically make data-driven comparisons between complex options based on gathered site and feasibility data.
LT13	I can say what the model will show and point to the materials we will use to build it.	I can work with my group to decide what the model's main focus is and select appropriate materials and simple building techniques.	I can collaboratively determine and articulate the precise purpose, material selection, and sophisticated construction techniques necessary for accurately representing a commercial design solution in a scaled model.
LT14	I can cut and glue simple shapes to help build a part of the scaled model.	I can construct a scaled model following a plan, making sure the main elements (e.g., building, parking lot) are accurate in size and location.	I can independently construct a meticulously scaled model that accurately represents the structural, spatial, and aesthetic aspects of the final commercial design solution.
LT15	I can hold up a drawing and read one short sentence about my building during the presentation.	I can create simple visual aids (e.g., poster, slide with pictures) and present the main ideas of my final design solution to the class.	I can prepare and utilize professional-quality visual aids and deliver a compelling, well-structured presentation to effectively communicate the final commercial design solution and its rationale.

Lesson	Learning Target	Success Criteria/ Assessment
Lesson 4.1 *Commercial Building Design Problem*	LT 1: I can analyze a potential site for a commercial project and explain how building codes and regulations affect what can be built.	• I can identify zoning laws, land use restrictions, and other site-specific regulations. • I can explain how building codes (structural, safety, accessibility, fire) impact the design possibilities. • I can evaluate site features (topography, utilities, access) in relation to regulations. • I can justify whether the site is suitable for the proposed commercial project.
	LT 2: I can design a commercial building and create a complete project portfolio that communicates my design clearly.	• I can produce accurate site plans, floor plans, elevations, and sections. • I can include materials, construction methods, and specifications in the portfolio. • I can organize the portfolio in a logical, professional way. • I can clearly communicate design ideas through drawings, diagrams, and written explanations.
	LT 3: I can evaluate how a commercial building project affects people and the environment, and explain how design choices can make it more sustainable and ethical.	• I can identify environmental impacts such as energy use, waste, and ecological effects. I can suggest sustainable design choices (energy efficiency, renewable resources, green materials). • I can assess social and ethical considerations (safety, accessibility, community impact). • I can explain how specific design choices improve sustainability and ethical outcomes.
	LT 4: I can research and interpret legal descriptions of property using online resources and historical documents.	• I can locate property records from reliable online databases or archives. • I can read and interpret legal descriptions, including lot, block, and subdivision information. • I can explain key terms used in legal property descriptions (e.g., metes and bounds, township, range).

		• I can summarize property boundaries and features accurately from the documents.
	LT 5: I can sketch a plat based on legal descriptions using the rectangular survey system and metes and bounds.	• I can identify and apply the rectangular survey system (township, range, section) to map property. • I can interpret metes and bounds descriptions to determine boundary lines. • I can draw an accurate plat that represents property dimensions and relationships. • I can label key features, boundaries, and reference points clearly on the plat.
	LT 6: I can understand the significance of recording complete legal descriptions with local courts and the methods used.	• I can explain why accurate legal descriptions are required for property ownership and transactions. • I can describe the process for recording property with local courts or registries. • I can identify consequences of incomplete or incorrect legal descriptions. • I can provide examples of proper recording methods and documentation.
	LT 7: I can identify the key site characteristics that influence the suitability for a proposed development.	• I can recognize physical characteristics such as topography, soil type, and drainage. • I can identify access points, utilities, and existing infrastructure on the site. • I can explain how these characteristics affect potential development options.
	LT 8: I can research and document various site conditions using a Site Discovery Checklist.	• I can gather information about the site from maps, surveys, and online resources. • I can complete a Site Discovery Checklist accurately, noting important details about the site. • I can organize and present the collected data clearly for analysis.
	LT 9: I can evaluate the impact of environmental, zoning, and adjacent property considerations on site development.	• I can identify zoning regulations and land-use restrictions affecting the site. • I can assess environmental factors such as wetlands, flood zones, or protected habitats. I can analyze how neighboring properties or land uses might influence the project. • I can provide reasoned conclusions on whether the site is suitable for the proposed development.
	LT 10: I can compare several commercial development options to determine the most viable project for a site.	• I can identify multiple possible development options for a given site. • I can describe the strengths and weaknesses of each option. • I can justify which option is most viable based on site conditions and project goals.
	LT 11: I can evaluate the legal, physical, and financial feasibility of proposed development options.	• I can assess zoning, building codes, and other legal requirements for each option. • I can evaluate physical site characteristics (topography, access, utilities) for feasibility. • I can analyze financial factors such as construction costs, potential revenue, and return on investment. • I can explain whether each option is feasible or not, and why.
	LT 12: I can use a decision matrix to make comparisons based on gathered data.	• I can identify relevant criteria (legal, physical, financial, environmental, etc.) for comparison. • I can assign weights and scores to each criterion in a decision matrix. • I can calculate total scores and rank options objectively. • I can explain my choice of the best development option using the decision matrix results.

Lesson 4.2 *Commercial Building Design Presentation*	LT 13: I can collaborate on the purpose, materials, and techniques for creating a model of a commercial design solution.	• I can explain the purpose of the model and what it is intended to communicate. • I can identify appropriate materials and tools for constructing the model. • I can discuss and select building techniques with team members to achieve accurate representation. • I can contribute ideas and listen to others' suggestions during the planning process.
	LT 14: I can construct a scaled model that accurately represents key aspects of a commercial design solution.	• I can follow scale measurements to ensure accuracy in the model. • I can build the model using appropriate materials and techniques. • I can include key design features (floor plan, elevations, major structural elements) • I can check and refine the model to ensure it accurately reflects the original design.
	LT 15: I can prepare visual aids and a presentation to effectively communicate the final commercial design solution.	• I can create clear and organized visual aids (drawings, renderings, diagrams) that highlight key design features. • I can develop a structured presentation that communicates design ideas logically. • I can explain the design solution clearly and respond to questions during the presentation. • I can use visuals to support and enhance my oral explanation.