

Civil Engineering and Architecture - PLTW Curriculum

This curricula and accompanying instructional materials have been developed to align with the NJSLs and in accordance with the NJ Department of Education's guidelines to include: Curriculum designed to meet grade level expectations, integrated accommodations and modifications for students with IEPs, 504s, ELLs, and gifted and talented students, assessments including benchmarks, formative, summative, and alternative assessments, a list of core instructional and supplemental materials, pacing guide, interdisciplinary connections, integration of 21st century skills, integration of technology, and integration of 21st Century Life and Career standards.

About the Standards

In 1996, the New Jersey State Board of Education adopted the state's first set of academic standards called the Core Curriculum Content Standards. The standards described what students should know and be able to do upon completion of a thirteen-year public school education. Over the last twenty years, New Jersey's academic standards have laid the foundation for local district curricula that is used by teachers in their daily lesson plans.

Revised every five years, the standards provide local school districts with clear and specific benchmarks for student achievement in nine content areas. Developed and reviewed by panels of teachers, administrators, parents, students, and representatives from higher education, business, and the community, the standards are influenced by national standards, research-based practice, and student needs. The standards define a "Thorough and Efficient Education" as guaranteed in 1875 by the New Jersey Constitution. Currently the standards are designed to prepare our students for college and careers by emphasizing high-level skills needed for tomorrow's world.

The New Jersey Student Learning Standards include Preschool Teaching and Learning Standards, as well as nine K-12 standards for the following content areas: **21st Century Life and Careers, Comprehensive Health and Physical Education, English Language Arts, Mathematics, Science, Social Studies, Technology, Visual and Performing Arts, World Languages**

The most recent review and revision of the standards occurred in 2014. However, the standards in language arts and math underwent an additional review in 2015 with adoption by the New Jersey State Board of Education in May 2016.

Lower Cape May Regional School District Career and Technical Education - Engineering Curriculum	
Content Area: Career and Technical Education - Engineering	
Course Title: Civil Engineering and Architecture	Grade level: 11-12
Unit 1: Overview of Civil and Architecture	Dates for Units: Weeks 1-5
Unit 2: Residential Design	Dates for Units : Weeks 5-15
Unit 3: Commercial Applications	Dates for Units :Weeks 16-26
Unit 4: Commercial Building Design	Dates for Units: Weeks 27-40
Date Created: 9/12/2022	Board Approved On:

Lower Cape May Regional School District (Insert Subject/Content Area) Curriculum Unit 1 Overview
Content Area: Career and Technical Education - Engineering
Unit Title: Overview of Civil and Architecture
Target Course/Grade Level: Civil Engineering and Architecture – PLTW Grades 11-12
<p>Unit Summary: Historical examples of amazing construction projects often lead to the realization that the ancient people’s construction methods were not so different from modern methods and</p>

sometimes were much more clever.

- In Lesson 1.1 History of Civil Engineering and Architecture, you learn about the history of the fields of civil engineering and architecture. You build a vocabulary related to civil engineering and architecture, including the principles and elements of design and architectural styles.
- In Lesson 1.2 Careers in Civil Engineering and Architecture, you explore career opportunities. While architecture and civil engineering disciplines have many overlapping roles, the training for each is different and they offer a rich variety of specialties.

Interdisciplinary Connections: [Link to NJSLS](#)

- In addition to Technology standards, connections are linked to the New Jersey Student Learning Standards in Social Studies.
- **NJSLS Social Studies 6.2.12.C.3.d - Determine how, and the extent to which, scientific and technological changes, transportation, and new forms of energy brought about massive social, economic, and cultural changes.** Students will learn about vernacular architecture and create a model building for a chosen architectural style.
- **NJSLS Social Studies 6.1.12.C.16.b - Predict the impact of technology on the global workforce and on entrepreneurship.** 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.

Resources: [Effective Strategies for Interdisciplinary Teaching](#)

21st Century Themes, Skills, and Standards:

- **CRP1**-Students will act as responsible and contributing citizens*
- **CRP2**-Students will apply applicable academic skills*
- **CRP3**-Students will attend to personal health and financial well-being
- **CRP4**-Students will communicate effectively, clearly and with reason*
- **CRP5**-Students will consider the environmental, social, and economic impacts of decisions*
- **CRP6**-Students will demonstrate creativity and innovation*
- **CRP7**-Students will employ valid and reliable research strategies*
- **CRP8**-Students will utilize critical thinking to make sense of problems and persevere in solving* them
- **CRP9**-Students will model leadership, integrity, and effective management*
- **CRP10**-Students will plan education and career paths aligned to personal goals*
- **CRP11**-Students will utilize technology to enhance productivity*

- **CRP12-Students** will work productively in teams while using cultural, global competence*

For more information regarding 21st Century Skills and for classroom resources [click here.](#)

Integration of Technology Standards

- **8.1 Educational Technology:** All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge.
- **8.2 Technology Education, Engineering, Design and Computational Thinking - Programming:** All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.*

For more information regarding Technology Standards [click here.](#)

Integration of 21st Century Life and Career Standards

- **9.1 Personal Financial Literacy:** Students will understand the important fiscal knowledge, habits, and skills that must be mastered in order to make informed decisions about personal finance. Financial literacy is an integral component of a student's college and career readiness, enabling students to achieve fulfilling, financially-secure, and successful careers.
- **9.2 Career Awareness, Exploration, and Preparation:** Students will understand the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.*
- **9.3 Career and Technical Education:** Students will know and understand the expectations aligned with the completion of a CTE Program of Study.*
- **9.4 Career Readiness, Life Literacies, and Key Skills:** Students will understand key literacies and technical skills such as critical thinking, global and cultural awareness, and technology literacy that are critical for students to develop to live and work in an interconnected global economy.

For more information regarding 21st Century Life and Career Standards [click here.](#)

Learning Targets

CPI #	Cumulative Progress Indicators (CPI) for Unit
8.2.12.ED.1	Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.

LOWER CAPE MAY REGIONAL SCHOOL DISTRICT

8.2.12.ED.2	Create scaled engineering drawings for a new product or system and make modification to increase optimization based on feedback
8.2.12.ED.6	Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor).
8.2.12.ITH.1	Analyze a product to determine the impact that economic, political, social, and/or cultural factors have had on its design, including its design constraints.
8.2.12.ITH.3	Analyze the impact that globalization, social media, and access to open source technologies has had on innovation and on a society's economy, politics, and culture
8.2.12.ETW.4	Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints
9.1.8.CDM.3:	Compare and contrast loan management strategies, including interest charges and total principal repayment costs.
9.1.8.EG.5:	Interpret how changing economic and societal needs influence employment trends and future education.
9.1.2.CAP.1:	Make a list of different types of jobs and describe the skills associated with each job.
9.2.5.CAP.1:	Evaluate personal likes and dislikes and identify careers that might be suited to personal likes.
9.2.8.CAP.5:	Develop a personal plan with the assistance of an adult mentor that includes information about career areas of interest, goals and an educational plan.
9.2.8.CAP.8:	Compare education and training requirements, income potential, and primary duties of at least two jobs of interest.
9.3.12.AC.1	Use vocabulary, symbols and formulas common to architecture and construction.
9.3.12.AC.4	Evaluate the nature and scope of the Architecture & Construction Career Cluster and the role of architecture and construction in society and the economy.
9.3.12.AC.5	Describe the roles, responsibilities, and relationships found in the architecture and construction trades and professions, including labor/management relationships.
9.3.12.AC.6	Read, interpret and use technical drawings, documents and specifications to plan a project.
9.3.12.AC-DES.4	Apply building codes, laws and rules in the project design.

<p>• 9.4.12.CI.2:</p>	<p>Identify career pathways that highlight personal talents, skills and abilities.</p>
<p>9.4.12.CT.2:</p>	<p>Explain the potential benefits of collaborating to enhance critical thinking and problem solving.</p>
<p>9.4.12.TL.1:</p>	<p>Assess digital tools based on features such as accessibility options, capacities and utility for accomplishing a specified task</p>
<p>9.4.12.IML.2:</p>	<p>Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.</p>
<p>8.2.12.ED.2</p>	<p>Create scaled engineering drawings for a new product or system and make modification to increase optimization based on feedback</p>
<p>Unit Enduring Questions:</p> <ul style="list-style-type: none"> ● How has the work of civil engineers and architects shaped society? How is the work of civil engineers and architects shaped by society? ● What is the difference between the art of architecture and civil engineering and the science of architecture and civil engineering? ● How will civil engineers contribute to the solutions of the Grand Challenges for Engineering? Choose one challenge and describe how civil engineers will most likely contribute to a solution. 	<p>Unit Enduring Understandings:</p> <ul style="list-style-type: none"> ● Strategic and systematic design and inquiry processes guide the development of an effective solution to the problem. ● Successful engineers exhibit specific personal and professional characteristics that lend themselves to the creative, collaborative, and solution-driven nature of the profession. ● An engineering design process is an iterative systematic approach to problem solving ● The practice of engineering requires the application of mathematical principles and common engineering tools, techniques, and technologies. ● Every career field requires technical literacy and career-specific knowledge and skills to support professional practice. ● Professional practice is guided by professional ethics and standards and requires effective communication and collaboration. ● Engineers use professional skills and knowledge to pursue opportunities and create sustainable solutions to improve and enhance the quality of life of individuals and society. ● Engineering practice requires effective

	<p>communication with a variety of audiences using multiple modalities.</p>
<p>Unit Objectives: <i>Students will know....</i></p> <ul style="list-style-type: none"> ● history of civil engineering and architecture. ● the principles and elements of design and architectural styles. 	<p>Unit Objectives: <i>Students will be able to.....</i></p> <ul style="list-style-type: none"> ● create a model of an architectural feature. ● create a career video portraying a chosen career path. ● participate in a design charrett for a hypothetical design project in which each student acts as a different design professional.

<p>Lower Cape May Regional School District (Insert Subject/Content Area) Curriculum Unit 2 Overview</p>
<p>Content Area: Career and Technical Education -Engineering</p>
<p>Unit Title: Residential Design</p>
<p>Target Course/Grade Level: Civil Engineering and Architecture – PLTW Grades 11-12</p>
<p>Unit Summary: Over the last 3000 years, structures have provided people shelter from elements such as wind, rain, sun, cold, and dust. We have learned from experience. Structures today provide</p>

much better protection from harsh temperatures, wind, rain, and snow than structures in primitive times. With the exception of minor stylistic details and additional bathrooms, the basic design of houses has changed very little over many years—living areas, sleeping areas, foundations, floors, walls, roofs, doors, and windows. Most of the creativity and engineering in residential design involves changes to make homes more comfortable, usable, efficient, and environmentally responsible.

- In Lesson 2.1 Building Design and Construction, you learn common residential building practices and terminology. You apply your learning as you model the design of a basic shed using 3D architectural software.
- In Lesson 2.2 Cost and Efficiency Analysis, you consider common costs of design and construction and cost estimating. Cost and quality are always building-design considerations. Creating smart designs requires careful considerations and trade-offs between quality, comfort, and cost over time.
- In Lesson 2.3 Residential Design, you design an affordable home for a client using sustainable practices to select building components and carefully integrate utilities and services that reduce the building's energy consumption and maximize efficiency. You model your design using 3D architectural design software and present your work in the form of a written report and professional construction documents.

Interdisciplinary Connections: [Link to NJSLS](#)

- In addition to Technology standards, connections are linked to the New Jersey Student Learning in Mathematics and Social Studies.
- **NJSLS Math A-CED.4 - Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.** Students will rearrange formulas to perform calculations for stormwater management and wastewater management.
- **NJSLS Social Studies 6.1.12.B.13.b - Evaluate the effectiveness of environmental movements and their influence on public attitudes and environmental protection laws.** Students will

research and complete an activity on Land Use Development and Ordinances.

Resources: [Effective Strategies for Interdisciplinary Teaching](#)

21st Century Themes, Skills, and Standards:

Integration of 21st Century Skills

- **CRP1**-Students will act as responsible and contributing citizens*
- **CRP2**-Students will apply applicable academic skills*
- **CRP3**-Students will attend to personal health and financial well-being
- **CRP4**-Students will communicate effectively, clearly and with reason*
- **CRP5**-Students will consider the environmental, social, and economic impacts of decisions*
- **CRP6**-Students will demonstrate creativity and innovation*
- **CRP7**-Students will employ valid and reliable research strategies*
- **CRP8**-Students will utilize critical thinking to make sense of problems and persevere in solving them*
- **CRP9**-Students will model leadership, integrity, and effective management*
- **CRP10**-Students will plan education and career paths aligned to personal goals
- **CRP11**-Students will utilize technology to enhance productivity*
- **CRP12**-Students will work productively in teams while using cultural, global competence*

For more information regarding 21st Century Skills and for classroom resources [click here](#).

Integration of Technology Standards

- **8.1 Educational Technology:** All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge.
- **8.2 Technology Education, Engineering, Design and Computational Thinking - Programming:** All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.*

For more information regarding Technology Standards [click here](#).

Integration of 21st Century Life and Career Standards

- **9.1 Personal Financial Literacy:** Students will understand the important fiscal knowledge, habits, and skills that must be mastered in order to make informed decisions about personal finance. Financial literacy is an integral component of a student's college and career readiness, enabling students to achieve fulfilling, financially-secure, and successful careers.
- **9.2 Career Awareness, Exploration, and Preparation:** Students will understand the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.
- **9.3 Career and Technical Education:** Students will know and understand the expectations

aligned with the completion of a CTE Program of Study.

- **9.4 Career Readiness, Life Literacies, and Key Skills:** Students will understand key literacies and technical skills such as critical thinking, global and cultural awareness, and technology literacy that are critical for students to develop to live and work in an interconnected global economy.

For more information regarding 21st Century Life and Career Standards [click here.](#)

Learning Targets

CPI #	Cumulative Progress Indicators (CPI) for Unit
8.2.12.ED.1	Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
8.2.12.ED.2	Create scaled engineering drawings for a new product or system and make modification to increase optimization based on feedback.
8.2.12.NT.1	Explain how different groups can contribute to the overall design of a product.
8.2.12.NT.2	Redesign an existing product to improve form or function.
8.2.12.ITH.3	Analyze the impact that globalization, social media, and access to open source technologies has had on innovation and on a society's economy, politics, and culture.
9.1.8.CDM.3:	Compare and contrast loan management strategies, including interest charges and total principal repayment costs.
9.1.8.EG.5:	Interpret how changing economic and societal needs influence employment trends and future education.
9.1.2.CAP.1:	Make a list of different types of jobs and describe the skills associated with each job.
9.2.5.CAP.1:	Evaluate personal likes and dislikes and identify careers that might be suited to personal likes.
9.2.8.CAP.5:	Develop a personal plan with the assistance of an adult mentor that includes information about career areas of interest, goals and an educational plan.
9.2.8.CAP.8:	Compare education and training requirements, income potential, and primary duties of at least two jobs of interest.

9.3.12.AC.1	Use vocabulary, symbols and formulas common to architecture and construction.
9.3.12.AC.4	Evaluate the nature and scope of the Architecture & Construction Career Cluster and the role of architecture and construction in society and the economy.
9.3.12.AC.5	Describe the roles, responsibilities, and relationships found in the architecture and construction trades and professions, including labor/management relationships.
9.3.12.AC.6	Read, interpret and use technical drawings, documents and specifications to plan a project.
9.3.12.AC-DES.4	Apply building codes, laws and rules in the project design.
• 9.4.12.CI.2:	Identify career pathways that highlight personal talents, skills and abilities.
9.4.12.CT.2:	Explain the potential benefits of collaborating to enhance critical thinking and problem solving.
9.4.12.TL.1:	Assess digital tools based on features such as accessibility options, capacities and utility for accomplishing a specified task
9.4.12.IML.2:	Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.
9.3.12.AC-CST.5	Apply practices and procedures required to maintain jobsite safety.
9.3.12.AC-DES.5	Identify the diversity of needs, values and social patterns in project design, including accessibility standards.
9.3.12.AC-DES.6	Apply the techniques and skills of modern drafting, design, engineering and construction to projects.
<p>Unit Enduring Questions:</p> <ul style="list-style-type: none"> ● How would you decide the style of roof to use when designing a house? List at least three considerations. ● Is it important for an architect to know the details of how residential buildings are constructed in order to design a house? Explain. ● How has the use of 3D modeling software affected the design and construction industry? ● If a cost estimate indicates that a 	<p>Unit Enduring Understandings:</p> <ul style="list-style-type: none"> ● Engineers use professional skills and knowledge to pursue opportunities and create sustainable solutions to improve and enhance the quality of life of individuals and society. ● Describe and distinguish among the sub-disciplines of civil engineering and architecture. ● . Engineering practice requires effective communication with a variety of audiences using multiple modalities. ● . Successful engineering professionals exhibit

<p>residential design is significantly over budget, what changes would you consider to reduce the cost of the project? List at least three changes. Would these changes result in higher or lower long-term or maintenance cost of the project? List at least three changes. Would these changes result in higher or lower long-term or maintenance costs?</p> <ul style="list-style-type: none"> ● 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? ● 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/engineering design? ● How would you describe the computational thinking and mathematical skills necessary to properly design a home and perform a cost estimate? Are different computational/mathematical skills necessary to design and analyze the water supply and plumbing system ● Is it an ethical responsibility of architects/engineers to create sustainable designs regardless of project cost? Justify your position. ● What green or sustainable technique could you incorporate at home (or could have been incorporated during the design and construction phases) to reduce the negative environmental impact of your home and its operation in each of the major sustainability focus areas: water, energy, building materials, and solid waste? Give one example in each area of focus and explain. ● Do building codes make the practice of architecture and engineering easier or more difficult? Explain. 	<p>personal and professional characteristics and behaviors that involve considerations of the impact of their work on individuals, society, and the natural world.</p> <ul style="list-style-type: none"> ● Contribute individually to overall collaborative efforts. ● Exhibit an engineering mindset by demonstrating independent thinking and self-direction in pursuit of accomplishing a goal. ● Explain and justify an engineering design process. ● Architects apply art and science to plan, design, and analyze buildings and built environments to meet human needs that reflect functional, technical, social, environmental, and aesthetic considerations.
<p>Unit Objectives:</p>	<p>Unit Objectives:</p>

<p><i>Students will know....</i></p> <ul style="list-style-type: none"> ● the primary parts of a traditional wood frame structure and then describe the purpose of each. ● How to calculate the R and U values of a home and how to increase or decrease respectively. ● How to estimate project costs. 	<p><i>Students will be able to.....</i></p> <ul style="list-style-type: none"> ● Design and build their own scale wood shed from their own paper design ● Design a shed using the Revit Software ● Calculate how much it would cost for a concrete slab under their shed. ● Calculate how much it would cost to build a 10'x12' shed. ● Calculate the R and U Values of a shed wall from their Revit Shed.
--	---

<p>Lower Cape May Regional School District (Insert Subject/Content Area) Curriculum Unit 3 Overview</p>
<p>Content Area: Career and Technical Education -Engineering</p>
<p>Unit Title: Commercial Applications</p>
<p>Target Course/Grade Level: Civil Engineering and Architecture – PLTW Grades 11-12</p>
<p>Unit Summary: A commercial building is defined as a building that is designed, built, and operated for any use other than residential, manufacturing, or agriculture. Commercial buildings serve a wide range of uses and include facilities built for schools, hospitals, churches, hotels, offices, malls, gas stations, and restaurants, to name a few. Often municipalities control development of commercial facilities through land use and zoning regulations.</p> <p>Each commercial building must meet the requirements established in building codes and state and local regulations. These requirements should be identified and researched prior</p>

to designing the structure to ensure compliance.

Commercial building systems often differ significantly from residential building systems. Depending on the usage, low-rise (three stories or less) commercial building design and construction can sometimes be similar to residential design and construction. However, because the typical commercial facility suffers much more intense usage, is exposed to greater loads, and must meet more stringent building code requirements, commercial building materials and construction methods are often chosen based on the need for higher strength and more durability than typical residential construction.

Interdisciplinary Connections: [Link to NJSLS](#)

- In addition to Technology standards, connections are linked to the New Jersey Student Learning Standards in Mathematics and Social Studies.
- **NJSLS Math A-CED.4 - Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.** Students will rearrange beam deflection formulas as well as use beam deflection short cuts.
- **NJSLS Social Studies 6.2.8.B.4.e - Analyze the motivations for civilizations to modify the environment, determine the positive and negative consequences of environmental changes made during this time period, and relate these changes to current environmental challenges.** Students will utilize green design in their model home thus comparing and contrasting building. By doing such, students can compare and contrast modern roofs to roof designs from other time periods.

Resources: [Effective Strategies for Interdisciplinary Teaching](#)

Integration of 21st Century Skills

- **CRP1**-Students will act as a responsible and contributing citizens*
- **CRP2**-Students will apply applicable academic skills*
- **CRP3**-Students will attend to personal health and financial well-being

- **CRP4**-Students will communicate effectively, clearly and with reason*
- **CRP5**-Students will consider the environmental, social, and economic impacts of decisions*
- **CRP6**-Students will demonstrate creativity and innovation*
- **CRP7**-Students will employ valid and reliable research strategies*
- **CRP8**-Students will utilize critical thinking to make sense of problems and persevere in solving them*
- **CRP9**-Students will model leadership, integrity, and effective management*
- **CRP10**-Students will plan education and career paths aligned to personal goals*
- **CRP11**-Students will utilize technology to enhance productivity*
- **CRP12**-Students will work productively in teams while using cultural, global competence*

For more information regarding 21st Century Skills and for classroom resources [click here.](#)

Integration of Technology Standards

- **Standard 8.1 Computer Science:** This outlines a comprehensive set of concepts and skills, such as data and analysis, algorithms and programming, and computing systems.
- **Standard 8.2 Design Thinking:** This outlines the technological design concepts and skills essential for technological and engineering literacy. The framework design includes Engineering Design, Ethics and Culture, and the Effects of Technology on the Natural world among the disciplinary concepts.

For more information regarding Technology Standards [click here.](#)

Integration of 21st Century Life and Career Standards

- **9.1 Personal Financial Literacy:** Students will understand the important fiscal knowledge, habits, and skills that must be mastered in order to make informed decisions about personal finance. Financial literacy is an integral component of a student's college and career readiness, enabling students to achieve fulfilling, financially-secure, and successful careers.
- **9.2 Career Awareness, Exploration, and Preparation:** Students will understand the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements. *
- **9.3 Career and Technical Education:** Students will know and understand the expectations aligned with the completion of a CTE Program of Study.
9.3.ST-4, 9.3.ST-6, 9.3.ST-ET.3
- **9.4 Career Readiness, Life Literacies, and Key Skills:** Students will understand key literacies and technical skills such as critical thinking, global and cultural awareness, and technology literacy that are critical for students to develop to live and work in an interconnected global economy.

For more information regarding 21st Century Life and Career Standards [click here.](#)

Learning Targets

CPI #	Cumulative Progress Indicators (CPI) for Unit
8.2.12.ED.1	Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
8.2.12.ED.2	Create scaled engineering drawings for a new product or system and make modification to increase optimization based on feedback
8.2.12.ED.5	Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).
8.2.12.NT.1	Explain how different groups can contribute to the overall design of a product.
8.2.12.NT.2	Redesign an existing product to improve form or function.
9.1.8.CDM.3:	Compare and contrast loan management strategies, including interest charges and total principal repayment costs.
9.1.8.EG.5:	Interpret how changing economic and societal needs influence employment trends and future education.
9.1.2.CAP.1:	Make a list of different types of jobs and describe the skills associated with each job.
9.2.5.CAP.1:	Evaluate personal likes and dislikes and identify careers that might be suited to personal likes.
9.2.8.CAP.5:	Develop a personal plan with the assistance of an adult mentor that includes information about career areas of interest, goals and an educational plan.
9.2.8.CAP.8:	Compare education and training requirements, income potential, and primary duties of at least two jobs of interest.
9.3.12.AC.1	Use vocabulary, symbols and formulas common to architecture and construction.
9.3.12.AC.4	Evaluate the nature and scope of the Architecture & Construction Career Cluster and the role of architecture and construction in society and the economy.
9.3.12.AC.5	Describe the roles, responsibilities, and relationships found in the architecture and construction trades and professions, including labor/management relationships.

9.3.12.AC.6	Read, interpret and use technical drawings, documents and specifications to plan a project.
9.3.12.AC-DES.4	Apply building codes, laws and rules in the project design.
• 9.4.12.CI.2:	Identify career pathways that highlight personal talents, skills and abilities.
9.4.12.CT.2:	Explain the potential benefits of collaborating to enhance critical thinking and problem solving.
9.4.12.TL.1:	Assess digital tools based on features such as accessibility options, capacities and utility for accomplishing a specified task
9.4.12.IML.2:	Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.
9.3.12.AC-CST.5	Apply practices and procedures required to maintain jobsite safety.
9.3.12.AC-DES.5	Identify the diversity of needs, values and social patterns in project design, including accessibility standards.
9.3.12.AC-DES.6	Apply the techniques and skills of modern drafting, design, engineering and construction to projects.
9.3.12.AC-CST.9	Safely use and maintain appropriate tools, machinery, equipment and resources to accomplish construction project goals.
<p>Unit Enduring Questions:</p> <ul style="list-style-type: none"> ● What is the difference between land use regulations and building code requirements? ● How do land development regulations help or hinder development in a community? ● Use an analogy to compare residential construction and commercial construction, and fill in the blanks: _____ versus _____. Support your answer with specific examples of construction practices. ● Are building code requirements too strict to allow creativity and unconventional design solutions? ● How would you describe the mathematical skills and knowledge necessary to analyze and design a structure to a student who is thinking 	<p>Unit Enduring Understandings:</p> <ul style="list-style-type: none"> ● Engineers use professional skills and knowledge to pursue opportunities and create sustainable solutions to improve and enhance the quality of life of individuals and society. ● Engineering practice requires effective communication with a variety of audiences using multiple modalities. ● Demonstrate an ability to function on multidisciplinary teams. ● The skills necessary for students to generate ideas and solutions to problems ● Develop models to represent design alternatives and generate data to inform decision making, test alternatives, and demonstrate solutions. ● Architects and engineers use 3D modeling software to aid in the design and documentation of building projects..

<p>about taking CEA?</p> <ul style="list-style-type: none"> ● What cross-sectional shape provides the strongest beam? Justify your answer. ● Why do buildings fall down? How can we prevent future structural failures? ● What does the expression, “Form follows Function” mean? How does it relate to structural engineering? ● How does the design of the utility systems for a building affect the overall design of the building? ● How does the International Energy Conservation Code (IECC) support the goal of green building and sustainable architecture? ● How does residential building project design differ from commercial building project design? Describe at least three differences and three similarities. ● How could differential surveying be used by a typical homeowner to provide better results for home improvement projects? Explain using at least two home improvement project examples. ● What does the aboriginal proverb “touch the earth lightly” mean with respect to building project design and development? What current design and construction practice best represents this philosophy? Explain your answer. 	
<p>Unit Objectives: <i>Students will know....</i></p> <ul style="list-style-type: none"> ● How to calculate the percentage of soil to sand in their backyard. ● The land use and development regulations or where to find them. ● What types of commercial wall and roof systems exist. ● How to calculate live load and dead load. 	<p>Unit Objectives: <i>Students will be able to.....</i></p> <ul style="list-style-type: none"> ● Identify components of various commercial framing system ● Perform a basic plumbing, electrical, and mechanical system design for a commercial building ● Complete a basic survey of a plot of land, evaluate a site’s storm water runoff, and classify soils

--	--

**Lower Cape May Regional School District (Insert Subject/Content Area) Curriculum
Unit 4 Overview**

Content Area: Career and Technical Education -Engineering

Unit Title: Commercial Building Design

Target Course/Grade Level: Civil Engineering and Architecture – PLTW Grades 11-12

Unit Summary:

The design of a commercial facility involves a wide range of professionals working together to accomplish a multitude of tasks. Productive teamwork and effective project management is essential so that the efforts are coordinated and efficient.

One of the initial tasks associated with commercial project development is thoroughly researching the site on which the facility will be situated. This research must include document research as well as a physical investigation of the site conditions to identify factors that can affect the success of the project. Before a commercial facility is designed, an architectural program should be created with input from all stakeholders to specify the project criteria and constraints.

Once the design team has an understanding of the project requirements, the design effort should be carefully managed to provide the most effective use of the available resources (time, materials, and people). The design process should be monitored throughout the project and adjusted as necessary to provide a smooth and efficient design effort. The final product of the design effort is project documentation (drawing and specification) that will provide enough information to the building contractor to successfully construct the facility to perform the intended functions.

During this unit student design teams will design a commercial facility for a given site. During the design process, students will review applicable codes and regulations, research

the site, and perform a site visit to identify factors that will affect development of the site. Based on the information and data collected, the teams will assess the viability of several commercial projects and select the most appropriate development option for the site. An architectural program will be created to document the criteria and constraints of the project. Additionally, a project management plan will be created. The project will be modeled using 3D architectural software. Students will produce project documentation to include a project report, engineering calculations, and construction drawings.

Interdisciplinary Connections: [Link to NJSLs](#)

- In addition to Technology standards, connections are linked to the New Jersey Student Learning Standards in Mathematics and Social Studies.
- **NJSLS Math A-CED.4 - Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.** Students will rearrange beam deflection formulas as well as use beam deflection short cuts.
- **NJSLS Social Studies 6.2.8.B.4.e - Analyze the motivations for civilizations to modify the environment, determine the positive and negative consequences of environmental changes made during this time period, and relate these changes to current environmental challenges.** Students will utilize green design in their model home thus comparing and contrasting building. By doing such, students can compare and contrast modern roofs to roof designs from other time periods.

Resources: [Effective Strategies for Interdisciplinary Teaching](#)

21st Century Themes, Skills, and Standards:

Integration of 21st Century Skills

- **CRP1**-Students will act as responsible and contributing citizens*
- **CRP2**-Students will apply applicable academic skills*
- **CRP3**-Students will attend to personal health and financial well-being
- **CRP4**-Students will communicate effectively, clearly and with reason*
- **CRP5**-Students will consider the environmental, social, and economic impacts of decisions*
- **CRP6**-Students will demonstrate creativity and innovation*
- **CRP7**-Students will employ valid and reliable research strategies*
- **CRP8**-Students will utilize critical thinking to make sense of problems and persevere in solving them*
- **CRP9**-Students will model leadership, integrity, and effective management*
- **CRP10**-Students will plan education and career paths aligned to personal goals

- **CRP11**-Students will utilize technology to enhance productivity*
- **CRP12**-Students will work productively in teams while using cultural, global competence*

For more information regarding 21st Century Skills and for classroom resources [click here.](#)

Integration of Technology Standards

- **8.1 Educational Technology:** All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge.
- **8.2 Technology Education, Engineering, Design and Computational Thinking - Programming:** All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.*

For more information regarding Technology Standards [click here.](#)

Integration of 21st Century Life and Career Standards

- **9.1 Personal Financial Literacy:** Students will understand the important fiscal knowledge, habits, and skills that must be mastered in order to make informed decisions about personal finance. Financial literacy is an integral component of a student's college and career readiness, enabling students to achieve fulfilling, financially-secure, and successful careers.
- **9.2 Career Awareness, Exploration, and Preparation:** Students will understand the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.
- **9.3 Career and Technical Education:** Students will know and understand the expectations aligned with the completion of a CTE Program of Study.
- **9.4 Career Readiness, Life Literacies, and Key Skills:** Students will understand key literacies and technical skills such as critical thinking, global and cultural awareness, and technology literacy that are critical for students to develop to live and work in an interconnected global economy.

For more information regarding 21st Century Life and Career Standards [click here.](#)

Learning Targets

CPI #	Cumulative Progress Indicators (CPI) for Unit
8.2.12.ED.1	Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.

LOWER CAPE MAY REGIONAL SCHOOL DISTRICT

8.2.12.ED.2	Create scaled engineering drawings for a new product or system and make modifications to increase optimization based on feedback.
8.2.12.ED.3	Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.
8.2.12.ED.5	Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).
8.2.12.NT.2	Redesign an existing product to improve form or function.
8.2.12.NT.1	Explain how different groups can contribute to the overall design of a product.
8.2.12.ETW.1:	Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product.
9.1.8.CDM.3:	Compare and contrast loan management strategies, including interest charges and total principal repayment costs.
9.1.8.EG.5:	Interpret how changing economic and societal needs influence employment trends and future education.
9.1.2.CAP.1:	Make a list of different types of jobs and describe the skills associated with each job.
9.2.5.CAP.1:	Evaluate personal likes and dislikes and identify careers that might be suited to personal likes.
9.2.8.CAP.5:	Develop a personal plan with the assistance of an adult mentor that includes information about career areas of interest, goals and an educational plan.
9.2.8.CAP.8:	Compare education and training requirements, income potential, and primary duties of at least two jobs of interest.
9.3.12.AC.1	Use vocabulary, symbols and formulas common to architecture and construction.
9.3.12.AC.4	Evaluate the nature and scope of the Architecture & Construction Career Cluster and the role of architecture and construction in society and the economy.
9.3.12.AC.5	Describe the roles, responsibilities, and relationships found in the architecture and construction trades and professions, including labor/management relationships.
9.3.12.AC.6	Read, interpret and use technical drawings, documents and specifications to

	plan a project.
9.3.12.AC-DES.4	Apply building codes, laws and rules in the project design.
• 9.4.12.CI.2:	Identify career pathways that highlight personal talents, skills and abilities.
9.4.12.CT.2:	Explain the potential benefits of collaborating to enhance critical thinking and problem solving.
9.4.12.TL.1:	Assess digital tools based on features such as accessibility options, capacities and utility for accomplishing a specified task
9.4.12.IML.2:	Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.
9.3.12.AC-CST.5	Apply practices and procedures required to maintain jobsite safety.
9.3.12.AC-DES.5	Identify the diversity of needs, values and social patterns in project design, including accessibility standards.
9.3.12.AC-DES.6	Apply the techniques and skills of modern drafting, design, engineering and construction to projects.
9.3.12.AC-CST.9	Safely use and maintain appropriate tools, machinery, equipment and resources to accomplish construction project goals.
<p>Unit Enduring Questions:</p> <ul style="list-style-type: none"> ● 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? ● How important is it to an architect’s or civil engineer’s success that s/he possess “people skills”? Justify your answer. 	<p>Unit Enduring Understandings:</p> <ul style="list-style-type: none"> ● Engineers use professional skills and knowledge to pursue opportunities and create sustainable solutions to improve and enhance the quality of life of individuals and society. ● Engineering practice requires effective communication with a variety of audiences using multiple modalities.
<p>Unit Objectives: <i>Students will know....</i></p>	<p>Unit Objectives: <i>Students will be able to.....</i></p>

<ul style="list-style-type: none"> ● How to better work in a team and be a team player from team building exercises. ● More of the Revit software 	<ul style="list-style-type: none"> ● Plan and design a commercial building's structure, utilities, and site ● Prepare and present a set of construction documents and design work for a commercial project
---	--

Lower Cape May Regional School District (Insert Subject/Content Area) Curriculum Evidence of Learning

Specific Formative Assessments Utilized in Daily Lessons:

- Design Process
- Engineering Notebook Documentation
- Unit Conversion and Dimensional Analysis
- Problem-solving Scenarios
- Technical Drawings
- Precision and Accuracy
- Unit Test
- Drawing Sheets from Revit Software
- Presentations:
 - Students will formally present all design challenge work through their engineering notebook documentation.
 - Students will orally present their solution to their projects and problem-solving scenarios as if they were pitching their idea to their client.

Summative Assessment Utilized throughout Units:

- Unit Tests
- Creative Projects

Modifications for ELL's, Special Education, 504, and Gifted and Talented Students:

- Teacher tutoring
- Peer tutoring
- Cooperative Learning Groups
- Modified Assignments
- Differentiated Instruction
- Response to Intervention (www.help4teachers.com)
- Follow all IEP and 504 modifications
- **ADD TO LIST AS YOU SEE NECESSARY**

Teacher Notes:

- As required by the NJ Department of Education, teachers in all content areas will integrate the 21st Century Life and Careers Standards. As the NJDOE indicates, “Providing New Jersey students with the life and career skills needed to function optimally within this dynamic context is a critical focus and organizing principle of K-12 public education. New Jersey has both an obligation to prepare its young people to thrive in this environment, and a vested economic interest in grooming an engaged citizenry made up of productive members of a global workforce that rewards innovation, creativity, and adaptation to change.” The links below indicate the CPIs for grade ranges and need to be addressed throughout the units of study:

Life and Career Standards

- As indicated in the NJSLS, standards and interdisciplinary connections will be integrated throughout content area curriculum. Links to relevant content standards can be found below:

[LINK APPROPRIATE INTERDISCIPLINARY CONNECTIONS & RELEVANT NJSLS HERE](#)

Project-based Learning Tasks:

- Creation of a model to depict a distinct architectural style or feature.
- Design Charrette
- Creation of a Utility Shed using Revit software.
- Design of an affordable home using Revit software and applicable building practices
- Structural Efficiency tower
- Creation of a commercial library using Revit Software

Vocabulary:

- In-text vocabulary should be incorporated into every unit. Word journals, vocabulary walls, and/or various other activities should be utilized by the instructor to teach vocabulary.

The Research Process:

- The research process must be integrated within each course curriculum. Student will be provided with opportunities to investigate issues from thematic units of study. As the NJSLS indicate, students will develop proficiency with MLA or APA format as applicable.
- [Link Research resources here.](#)

Technology:

Students must engage in technology applications integrated throughout the curriculum. [Applicable technology utilized in this curricula are included below:](#)

- Autodesk Revit
- Google Classroom
- Web Soil Surveys
- Soil Testing

Resources:

Ancillary resources and materials used to deliver instruction **are included below:**

- PowerPoints
- Google Classroom
- Document Camera
- Autodesk Revit

Differentiation Strategies

Differentiation strategies can require varied amounts of preparation time. High-prep strategies often require a teacher to both create multiple pathways to process information/demonstrate learning and to assign students to those pathways. Hence, more ongoing monitoring and assessment is often required. In contrast, low-prep strategies might require a teacher to strategically create process and product choices for students, but students are allowed to choose which option to pursue given their learning profile or readiness level. Also, a low-prep strategy might be focused on a discrete skill (such as vocabulary words), so there are fewer details to consider. Most teachers find that integration of one to two new low-prep strategies and one high-prep strategy each quarter is a reasonable goal.

Low Prep Strategies (add to list as needed)

Varied journal prompts, spelling or vocabulary lists	Students are given a choice of different journal prompts, spelling lists or vocabulary lists depending on level of proficiency/assessment results.
Anchor activities	Anchor activities provide meaningful options for students when they are not actively engaged in classroom activities (e.g., when they finish early, are waiting for further directions, are stumped, first enter class, or when the teacher is working with other students). Anchors should be directly related to the current learning goals.
Choices of books	Different textbooks or novels (often at different levels) that students are allowed to choose from for content study or for literature circles.
Choices of review activities	Different review or extension activities are made available to students during a specific section of the class (such as at the beginning or end of the period).

Homework options	Students are provided with choices about the assignments they complete as homework. Or, students are directed to specific homework based on student needs.
Student-teacher goal setting	The teacher and student work together to develop individual learning goals for the student.
Flexible grouping	Students might be instructed as a whole group, in small groups of various permutations (homogeneous or heterogeneous by skill or interest), in pairs or individual. Any small groups or pairs change over time based on assessment data.
Varied computer programs	The computer is used as an additional center in the classroom, and students are directed to specific websites or software that allows them to work on skills at their level.
Multiple Intelligence or Learning Style options	Students select activities or are assigned an activity that is designed for learning a specific area of content through their strong intelligence (verbal-linguistic, interpersonal, musical, etc.)
Varying scaffolding of same organizer	Provide graphic organizers that require students to complete various amounts of information. Some will be more filled out (by the teacher) than others.
Think-Pair-Share by readiness, interest, and/or learning profile	Students are placed in predetermined pairs, asked to think about a question for a specific amount of time, then are asked to share their answers first with their partner and then with the whole group.
Mini workshops to re-teach or extend skills	A short, specific lesson with a student or group of students that focuses on one area of interest or reinforcement of a specific skill.
Orbitals	Students conduct independent investigations generally lasting 3-6 weeks. The investigations “orbit” or revolve around some facet of the curriculum.
Games to practice mastery of information and skill	Use games as a way to review and reinforce concepts. Include questions and tasks that are on a variety of cognitive levels.
Multiple levels of questions	Teachers vary the sorts of questions posed to different students based on their ability to handle them. Varying questions is an excellent way to build the confidence (and motivation) of students who are reluctant to contribute to class discourse. Note: Most teachers would probably admit that without even thinking about it they tend to address particular types of questions to particular students. In some cases, such tendencies may need to be corrected. (For

	example, a teacher may be unknowingly addressing all of the more challenging questions to one student, thereby inhibiting other students' learning and fostering class resentment of that student.)
High Prep Strategies (add to list as needed)	
Cubing	Designed to help students think about a topic or idea from many different angles or perspectives. The tasks are placed on the six sides of a cube and use commands that help support thinking (justify, describe, evaluate, connect, etc.). The students complete the task on the side that ends face up, either independently or in homogenous groups.
Tiered assignment/ product	The content and objective are the same, but the process and/or the products that students must create to demonstrate mastery are varied according to the students' readiness level.
Independent studies	Students choose a topic of interest that they are curious about and wants to discover new information on. Research is done from questions developed by the student and/or teacher. The researcher produces a product to share learning with classmates.
4MAT	Teachers plan instruction for each of four learning preferences over the course of several days on a given topic. Some lessons focus on mastery, some on understanding, some on personal involvement, and some on synthesis. Each learner has a chance to approach the topic through preferred modes and to strengthen weaker areas
Jigsaw	Students are grouped based on their reading proficiency and each group is given an appropriate text on a specific aspect of a topic (the economic, political and social impact of the Civil War, for example). Students later get into heterogeneous groups to share their findings with their peers, who have read about different areas of study from source texts on their own reading levels. The jigsaw technique allows you to tackle the same subject with all of your students while discreetly providing them the different tools they need to get there.
Multiple texts	The teacher obtains or creates a variety of texts at different reading levels to assign strategically to students.
Alternative assessments	After completing a learning experience via the same content or process, the student may have a choice of products to show what has been learned. This differentiation creates possibilities for students who excel in different modalities over others (verbal versus visual).

<p>Modified Assessments</p>	<p>Assessments can be modified in a variety of ways – for example by formatting the document differently (e.g. more space between questions) or by using different types of questions (matching vs. open ended) or by asking only the truly essential questions.</p>
<p>Learning contracts or Personal Agendas</p>	<p>A contract is a negotiated agreement between teacher and student that may have a mix of requirements and choice based on skills and understandings considered important by the teacher. A personal agenda could be quite similar, as it would list the tasks the teacher wants each student to accomplish in a given day/lesson/unit. Both Learning contracts and personal agendas will likely vary between students within a classroom.</p>
<p>Compacting</p>	<p>This strategy begins with a student assessment to determine level of knowledge or skill already attained (i.e. pretest). Students who demonstrate proficiency before the unit even begins are given the opportunity to work at a higher level (either independently or in a group).</p>
<p>Literature circles</p>	<p>Flexible grouping of students who engage in different studies of a piece of literature. Groups can be heterogeneous and homogeneous.</p>
<p>Learning Centers</p>	<p>A station (or simply a collection of materials) that students might use independently to explore topics or practice skills. Centers allow individual or groups of students to work at their own pace. Students are constantly reassessed to determine which centers are appropriate for students at a particular time, and to plan activities at those centers to build the most pressing skills.</p>
<p>Tic-Tac-Toe Choice Board (sometimes called “Think-Tac-Toe”</p>	<p>The tic-tac-toe choice board is a strategy that enables students to choose multiple tasks to practice a skill, or demonstrate and extend understanding of a process or concept. From the board, students choose (or teacher assigns) three adjacent or diagonal. To design a tic-tac-toe board: - Identify the outcomes and instructional focus - Design 9 different tasks - Use assessment data to determine student levels - Arrange the tasks on a tic-tac-toe board either randomly, in rows according to level of difficulty, or you may want to select one critical task to place in the center of the board for all students to complete.</p>
<p>Curriculum development Resources/Instructional Materials:</p>	
<p>List or Link Ancillary Resources and Curriculum Materials Here:</p> <ul style="list-style-type: none"> • • 	



Board of Education Approved Text(s)

- List BOE Approved text here