Civil Engineering and Architecture

Grades 11-12

Unit 1

Subject	Grade	Unit	Suggested Timeline
Civil Engineering and Architecture	11-12	1 – Overview of Civil Engineering and Architecture	5 weeks

Grade Level Summary

This unit provides some historical and career perspective for students as a reference as they travel through the course. Engineering and architecture are professions that build on historical practice so a look at their history will help students appreciate existing solutions as an inspiration for future ones. The career exploration will also help students who may be interested in these professions find more specifically where their interests may lie.

Grade Level Units

Unit 1 – Overview of Civil Engineering and Architecture
Unit 2 – Residential Design
Unit 3 – Commercial Applications
Unit 4 – Commercial Building Design

Unit Title

Overview of Civil Engineering and Architecture

Unit Overview

Roads have not always been paved with eight lanes and sporting venues have not always been enormous enclosed volumes of conditioned air. Students will study the history of civil engineering and look at what some of the major innovations were along the way that have lead us to current engineering practice. The history of architecture and the elements of design will also be explored. Both professions – civil engineering and architecture – lend themselves to varying degrees and areas of specialization. By studying some of the career options within the professions, students can give some of the areas we'll study throughout the course some additional perspective beyond the classroom.

Unit Essential Questions	Key Understandings
1-1. How did the art and science of architecture and civil engineering evolve over time?	1-1. Many features of ancient structures are seen in modern buildings.
1-2. What are three structural systems used by architects in historical construction projects?	1-2. Architectural style is often an important key to understanding how a community or neighborhood has developed and the aesthetic customs that have formed over time.
1-3. How have historical innovations contributed to modern civil engineering and architecture?	1-3. The multiple architectural styles that have been developed throughout history are an indication of changing needs of people and society and uses for space.
1-4. How are visual design elements and principles manifested in architecture?	1-4. Visual design principles and elements constitute an aesthetic vocabulary that can be used to describe buildings and may contribute to their function, location, or time period.
2-1. What abilities and interests do you possess that could translate to a career field related to civil engineering or architecture?	2-1. Civil engineers and architects apply math, science, and discipline-specific skills to design and implement solutions.
2-2. What advantages are there to bringing together a group of people with varying backgrounds and skills for brainstorming a solution to a design problem?	2-2. Civil engineering and architecture careers are comprised of several specialties and offer creative job opportunities for individuals with a wide variety of backgrounds and goals.
	2-3. Civil engineers are problem solvers involved in the design and construction of a diverse array of projects in a wide range of disciplines including structural, environmental, geotechnical, water resources, transportation, construction and urban planning.

	2-4. Architects primarily focus on designing the interior and exterior "look and feel" of commercial and residential structures meant for human habitation. 2-5. An effective method for brainstorming possible solutions involves a collaboration of many stakeholders with a variety of skills coming together in an organized meeting called a charrette. 2-6. The atomic structure of a material determines whether it is a conductor, an insulator, or a semiconductor.

Focus Standards Addressed in the Unit	
3.4.12.C3	Apply the concept that many technological problems require a multi-disciplinary approach.
CC.1.3.11-12.J	Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.
CC.1.4.11-12.S	Draw evidence from literary or informational texts to support analysis, reflection, and research, applying grade level reading standards for literature and literary non-fiction.
CC.1.4.11-12.U	Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments and information.
CC.1.4.11-12.V	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Important Standards Addressed in the Unit	
CC.1.4.11-12.R	Demonstrate a grade appropriate command of the conventions of standard English grammar and spelling.

Misconceptions	**Proper Conceptions**
1. All civil engineers and architects do the same type of work as others.	1. There are many areas of specialization within each of these professions. While a general knowledge of all of the aspects of each discipline is necessary, engineers and architects often choose certain types of work in which they specialize.
2. Modern construction types and methods are superior to historical methods so there is no need to study anything but current trends.	2. There is no doubt that today's construction industry advanced in technology and efficiency over time. However, an understanding of historical construction methods and materials, is important – especially when working on repairs or renovations of existing structures.

Concepts	**Competencies**	**Vocabulary**	
• History • Careers	• Provide examples of classical architectural and engineering features in modern construction • Describe the various career opportunities within civil engineering and architecture	Aesthetics Arch Architect Balance Bearing Walls Civil Engineer Color Contrast Design Principles Dome Element of Design Emphasis	ABET AIA ASCE Building Code Charrette Construction Documents Municipality NAAB NCARB Stakeholder Zoning Ordinance

		Façade Form Keystone Line Lintel Movement Pattern Post-and-Lintel Construction Repetition Rhythm Shape Space Texture Unity Value Vernacular Architecture Voussoir	

Assessments

Homework – Occasional homework assignments will be given to reinforce classroom concepts. Homework will be graded for completeness (including level of documentation of work) and will be used to formatively assess if additional instruction is needed.

Engineering Notebook Checks – Students will maintain a formal engineering notebook to document their work throughout the course. Periodic checks will assess proper notebook format and content. Certain projects will be completely contained within the engineering notebook and will be assessed according to the rubric provided for that project.

Vocabulary Quizzes – Understanding and using technical language is an important component of this course. Students will be expected to acquire and use new terms. Periodic quizzes within each unit will assess their ability to identify new vocabulary.

Oral Presentations – Students will report project solutions via oral presentations to the class. Content and presentation style will be assessed according to a standard rubric for each project.

Unit Tests / Unit Projects – Each unit will include a summative written test or project. Projects may be assessed through a presentation, engineering notebook review, electronic submission, or a combination of one or more of these. Rubrics and design briefs will be provided with each project to clearly communicate the content and performance expectations for that project.

Suggested Strategies to Support Design of Coherent Instruction

Charlotte Danielson's Framework for Teaching: Domain 3 Instruction

Lesson 1.1 – Overview of Civil Engineering and Architecure
Lesson 1.2 – Careers in Civil Engineering and Architecture

The importance of both of these lessons truly reveals itself as the course continues on. Get a feel for the interests of students within each of the professions and actively encourage each student to find specific applications for those areas in each activity.

Differentiation:

- Provide graphic organizers
- Provide multiple concrete examples
- Break extended projects into smaller identifiable milestones with checkpoints along the way
- Pair stronger students with struggling students for peer assistance

Interdisciplinary Connections:

- Research process – English / Social Studies
- Writing skills – English

Additional Resources:

- ***www.iste.org/docs/pdfs/20-14_ISTE_Standards-T_PDF.pdf*** International Society for Technology in Education standards.
- ***www.asce.org/*** American Society of Civil Engineers – additional resources specific to the practice of civil engineering
- ***www.aia.org/*** American Institute of Architects – additional resources specific to the practice of architecture

Created By:
Rick Geesaman

Civil Engineering and Architecture

Grades 11-12

Unit 2

Subject	Grade	Unit	Suggested Timeline
Civil Engineering and Architecture	11-12	2 – Residential Design	11 weeks

Grade Level Summary

Residential construction has requirements unique to itself. As an introduction to building design and construction, residential design will be considered. This unit provides a foundation for the study of more complex building design and construction topics later in the course.

Grade Level Units

Unit 1 – Overview of Civil Engineering and Architecture
Unit 2 – Residential Design
Unit 3 – Commercial Applications
Unit 4 – Commercial Building Design

Unit Title

Residential Design

Unit Overview

While residential construction can be complex, the design and construction of typical single-family residence is a good introduction for a building design course. Students will study common residential wall, floor and roof framing systems, doors and windows, residential utility distribution systems, and residential site development. The unit begins with the design of a basic utility shed using 3d architectural design software. By completing the design of a simple structure, students will be able to become familiar with some common construction details and vocabulary while using the design software that will be used throughout the course. After completing the shed design, the unit continues with an exploration of construction and building operation costs. Students will look at the cost impacts of using different construction types, and will also consider the long-term cost effects of energy efficient construction. The unit concludes with a design project in which students will design a house for a client using specific guidelines.

Unit Essential Questions

1-1. Why is wood so often used for residential buildings?
1-2. What alternatives to wood frame construction are available and what are the advantages and disadvantages of each?
1-3. How are trusses able to span large distances?
1-4. What framing systems are used to support residential roofs?
1-5. How are different roof styles and pitches related to different architectural styles?

2-1. What is the difference between R-value and U-value? When are they used?
2-2. What are some leading causes of solar gain?
2-3. What key areas of a building can minimize heat loss?
2-4. Why is a cost estimate important to create before starting a project?

Key Understandings

1-1. Many residential structures are constructed with wood framing systems and are built using standard practices.
1-2. A variety of roof shapes and materials are available for residential structures to address aesthetic preferences, carry design loads, and meet environmental challenges.
1-3. Designers design, modify, and plan structures using 3D architectural software.
1-4. Architects and engineers use a variety of views to document and detail a building project on construction drawings.

2-1. The combination of concrete and rebar, called reinforced concrete, is an important component of residential foundations.
2-2. Accurately determining the cost and quantities for a construction project can ensure a successful building project providing a high quality structure with less material and financial waste.
2-3. An effective residential structure should include methods for adequate heating and cooling.
2-4. R-value and U-factor measurements are used to select materials that with ensure a structure is properly insulated.

3-1. Responsible designers maximize the potential of the property, minimize impact on the environment, and

3-1. How do you achieve a balance between cost-saving measures, important features, and environmental responsibility when designing a residential structure? 3-2. What are the advantages and disadvantages of using 3D architectural software rather than creating hand-produced plans? 3-3. Why are organizations such as LEED important? 3-4. When planning a project, how does the availability of public utilities impact the design? 3-5. What options are available for the management of wastewater from a building? 3-6. What are the important considerations when design a plumbing system? 3-7. Why should a designer know about the different types of lighting and their applications? 3-8. What are the important considerations when designing an electrical system? 3-9. What information is important when documenting the design of a building?	incorporate universal design concepts in order to create an attractive and functional space. 3-2. Responsible designers anticipate the needs and requirements of the users. 3-3. Codes are created to protect the health and safety of the public, dictate the minimum requirements that must be met in a building project, and constrain the location of structures, utilities, building construction, and landscape components placed on a site. 3-4. Appropriate flow rate, pressure, and water quality are necessary for effective water supply and use. 3-5. When utilities are not available within a reasonable distance to be economically brought on site, substitutions must be designed and constructed. 3-6. Utilities and systems must be properly sized to minimize cost and appropriately serve the project and the structure occupants. 3-7. The design of electrical and plumbing systems must be carefully integrated into the architectural and structural design of a building. 3-8. Careful landscape design that takes into consideration local environmental conditions can improve energy efficiency, reduce noise, reduce water usage, reduce storm water runoff, and improve the visual impact of a building project. 3-9. Storm water runoff from a site often increases when the site is developed and is frequently regulated by local jurisdictions. 3-10. Universal Design involves the design of products and environments to be usable by all people and includes barrier free accessibility to projects that may be required by federal regulations. 3-11. Green or sustainable design reduces the negative impact of a project on the environment and human health and improves the performance of the project during its life-cycle.

Focus Standards Addressed in the Unit

CC.1.2.11-12.G	Integrate and evaluate multiple sources of information presented in different media or formats (e.g. visually, quantitatively) as well as in words in order to address a question or solve a problem.
CC.1.3.11-12.J	Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.
CC.1.4.11-12.A	Write informative/ explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately.
CC.1.4.11-12.B	Write with a sharp distinct focus identifying topic, task, and audience.
CC.1.4.11-12.S	Draw evidence from literary or informational texts to support analysis, reflection, and research, applying grade level reading standards for literature and literary non-fiction.
CC.1.4.11-12.V	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
CC.1.4.11-12.W	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the task,

	purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
CC.2.1.HS.F.3	Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs and data displays.
CC.2.3.HS.A.14	Apply geometric concepts to model and solve real world problems.

Important Standards Addressed in the Unit	
CC.1.2.11-12.B	Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences and conclusions based on and related to an author's implicit and explicit assumptions and beliefs
CC.1.2.11-12.F	Evaluate how words and phrases shape meaning and tone in texts.
CC.1.3.11-12.I	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 11-12 reading and content, choosing flexibly from a range of strategies and tools.
CC.1.4.11-12.F	Demonstrate a grade-appropriate command of the conventions of standard English grammar, usage, capitalization, punctuation, and spelling.
CC.1.4.11-12.R	Demonstrate a grade appropriate command of the conventions of standard English grammar and spelling.
CC.1.4.11-12.X	Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes and audiences.

Misconceptions	**Proper Conceptions**
1. Wood is wood; all pieces of lumber with the same size are interchangeable.	1. Different species of lumber have different strength and performance characteristics. Even within the same species, different grades of wood will perform differently.
2. Cheaper construction costs are always better.	2. Sometimes additional cost during construction can lead to operating savings over time. Examples include additional expenses to purchase more efficient heating and cooling equipment and lighting fixtures that will reduce energy use and expense during the home's lifetime.

Concepts	**Competencies**	**Vocabulary**	
• Building framing • Construction Cost • Residential Design	• Identify components of a typical residential house framing system • Use material unit costs to complete a construction cost estimate using a given design • Design a residential structure given a specific set of requirements	Felt Floor Joists Header House Wrap Insulation Sheathing Siding Sill Solar Orientation Source Reduction Stud Subfloor Sustainability Top Plate Truss Compression Strength Concrete Design Temperature Differential	Berm Building Code Building Envelope Circuit Circuit Breaker Cleanout Coniferous Construction Type Deciduous Distribution Panel Drain Drainage Drainage Fixture Unit Drainage System Ducts Easement Egress Electric Meter Exit Discharge Grading

		Fascia Footing Foundation Heat Loss Radiant Heat Rafter Rebar R-Value Sole Plate Square Tensile Strength Thermal Conduction Thermal Convection Transmission Load U-Factor	Ground Hot Water Individual Sewage Disposal System Ingress Invert Elevation Lavatory Main Nonpotable Water Outlet Potable Water Plumbing Fixture Pressure Head Prevailing Winds Rainfall Intensity Return Period Riser Sanitary Sewer Setback Sewage Sewer Soil Pipe Stack Static Head Storm Duration Switch Leg Time of Concentration Trap Universal Design Valve Variance Vent Pipe Water Closet Water Distributing Pipe Water Heater Water Meter Water Service Watt

Assessments

Homework – Occasional homework assignments will be given to reinforce classroom concepts. Homework will be graded for completeness (including level of documentation of work) and will be used to formatively assess if additional instruction is needed.

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Suggested Strategies to Support Design of Coherent Instruction

Charlotte Danielson's Framework for Teaching: Domain 3 Instruction

Lesson 2.1 – Building Design and Construction

A solid foundation of construction basics is important for success in this course. Provide ample examples of typical construction details and framing schemes for the residential structures and utility systems. Having a deep resource of typical details will help students as they encounter new problems along the way.

Lesson 2.2 – Cost and Efficiency Analysis

It is important for students to understand that we are not able to go into the depth required to compile complete construction estimates in this course. What is important is that students are able to identify the variables within construction that impact cost beyond mere material costs. Intentionally talk about labor costs, installation equipment costs, and design costs throughout this lesson and other lessons as appropriate. This will help students gain an appreciation of the effects of all design decisions on construction cost.

Differentiation:

- Provide graphic organizers
- Provide multiple concrete examples
- Break extended projects into smaller identifiable milestones with checkpoints along the way
- Pair stronger students with struggling students for peer assistance

Interdisciplinary Connections:

- Design process – Scientific method
- Research process – English / Social Studies
- Writing skills – English
- Sketching - Art

Additional Resources:

- ***www.iste.org/docs/pdfs/20-14_ISTE_Standards-T_PDF.pdf*** International Society for Technology in Education standards.
- ***www.asce.org*** American Society of Civil Engineers – additional resources specific to the practice of civil engineering
- ***www.aia.org*** American Institute of Architects – additional resources specific to the practice of architecture
- ***www.nhab.org*** National Association of Home Builders – additional resources for home construction

Created By:

Rick Geesaman

Civil Engineering and Architecture

Grades 11-12

Unit 3

Subject	Grade	Unit	Suggested Timeline
Civil Engineering and Architecture	11-12	3 – Commercial Applications	11 weeks

Grade Level Summary

Students will take their knowledge of residential construction and expand into commercial construction. Structural, architectural, mechanical system, and site design for commercial projects will be explored. The use of 3d architectural design software will be expanded throughout the unit.

Grade Level Units

Unit 1 – Overview of Civil Engineering and Architecture
Unit 2 – Residential Design
Unit 3 – Commercial Applications
Unit 4 – Commercial Building Design

Unit Title

Commercial Applications

Unit Overview

This unit will build on the prior unit's study of residential construction. Students will begin by comparing and contrasting residential and commercial building systems while investigating the additional code requirements for commercial construction. Students will then begin to use mathematical models to find required structural member sizes for different applied loading. Beam and foundation sizes will be calculated and students will review others' work for completeness and correctness. There are many more utility and service considerations when dealing with commercial construction so students will explore their use and distribution in a commercial context. Students will use building data to size service connections to the building. Integrating a commercial building with the surrounding land is an important part of building design, so students will conduct a land survey, analyze soil conditions, and manipulate site grades to learn how engineers adapt a building's site for development.

Unit Essential Questions	Key Understandings
1-1. How do Land Use and Development regulations help or hinder development in a community?	1-1. Commercial building systems differ from residential building systems in many significant ways.
1-2. Why are building codes important in the construction of buildings?	1-2. Codes and building regulations define and constrain all aspects of building design and construction including the structure, site design, utilities, and building usage.
1-3. How does commercial building design and construction differ from residential building design and construction?	1-3. Zoning regulations are used to control land use and development.
1-4. What factors influence the choice of commercial construction materials?	1-4. Wall, roof, floor, and framing systems for commercial facilities are chosen based on many factors.
1-5. How do sustainable design alternatives, such as a green roof, impact the environment and quality of life?	
2-1. What is structural engineering?	2-1. The purpose of a structure is to withstand all applied loads and forces and to transfer these forces to the Earth.
2-2. What is the function of a structure?	2-2. Structural engineering involves the critical analysis of forces and loads, the anticipated effect of these loads on a structure, and the design of structural elements to safely and efficiently resist the anticipated forces and loads.
2-3. How do you determine the loads that must be used to design a structure?	2-3. Design loads are often dictated by building codes.
2-4. In what ways are wind, snow, seismic, dead, and live loads similar to or different from each other?	2-4. Structural design includes the determination of how structures disperse the applied loads.
2-5. How does the design of a structure impact how loads are dispersed?	2-5. The application of loads to a building results in resisting forces from the structure which can be predicted through the use of mathematics and physical science principles.
2-6. How does the use of mathematics help in understanding and quantifying the forces and loads on a structure?	
2-7. How does the structure of a building affect the form and function of that building?	

3-1. What limitations affect electricity production using solar cells? 3-2. What limitations affect electricity production using hydrogen fuel cells? 3-3. How can system configuration affect voltage and current? 3-4. How does thermodynamics relate to energy and power?	3-1. When utilities are not available within a reasonable distance to be economically brought on site, substitutions must be designed and constructed. 3-2. Utilities and systems must be properly sized to minimize cost and appropriately serve the project. 3-3. Responsible designers anticipate the needs and requirements of the users. 3-4. The design of mechanical systems impact the architectural and structural design of a building. 3-5. Energy codes are designed to conserve natural resources, reduce operating costs, protect the environment and create healthier living and working spaces. They dictate the minimum requirements for the building envelope, lighting, mechanical systems, and service water heating for commercial facilities. 3-6. The design of internal systems is documented with construction drawings specific to each system.
4-1. How is land surveying used in the development of a building project? 4-2. What information is important to consider when planning the placement of driveways, parking spaces, and pedestrian access? 4-3. How are the needs of a site user and the circulation patterns for the site interrelated? 4-4. Why is it important to know the soil characteristics of a site when planning a building project? 4-5. How does development change the characteristics of a site? 4-6. What steps must be taken to ensure that the improvements made on a property will not adversely affect users or neighboring properties?	4-1. Land surveying is used for many purposes during the design and construction of a project including establishing the topography of a site, setting control points, and establishing the location of project features. 4-2. Engineers must consider parking requirements, pedestrian access, ingress and egress, landscaping, storm water management, and site grading when creating a site design. 4-3. Ingress and egress, parking, pedestrian, and handicapped access must be planned to efficiently and safely move traffic, goods, and people. 4-4. The characteristics of soils present on a site impact the design and construction of improvements to a property. 4-5. Codes determine the type, sizing, and placement of site features such as parking lots, entrance and exit roads, pedestrian and handicapped access, and storm water facilities. 4-6. The surface conditions and topography of a site affect the quantity and quality of storm water runoff and the design of the storm water management system. 4-7. A soil can be classified according to its grain size and plasticity which impact the characteristics the soil will exhibit.

Focus Standards Addressed in the Unit

3.4.12.C3	Apply the concept that many technological problems require a multi-disciplinary approach.
CC.1.2.11-12.B	Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences and conclusions based on and related to an author's implicit and explicit assumptions and beliefs.
CC.1.2.11-12.G	Integrate and evaluate multiple sources of information presented in different media or formats (e.g. visually, quantitatively) as well as in words in order to address a question or solve a problem.
CC.1.3.11-12.J	Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.
CC.1.4.11-12.A	Write informative/ explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately.
CC.1.4.11-12.B	Write with a sharp distinct focus identifying topic, task, and audience.

CC.1.4.11-12.S	Draw evidence from literary or informational texts to support analysis, reflection, and research, applying grade level reading standards for literature and literary non-fiction.
CC.1.4.11-12.U	Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments and information.
CC.1.5.11-12.A	Initiate and participate effectively in a range of collaborative discussions on grades level topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
CC.1.5.11-12.D	Present information, findings, and supporting evidence, conveying a clear and distinct perspective; organization, development, substance, and style are appropriate to purpose, audience, and task.
CC.1.5.11-12.E	Make strategic use of digital media in presentations to add interest and enhance understanding of findings, reasoning, and evidence.
CC.2.1.HS.F.3	Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs and data displays.
CC.2.2.HS.D.1	Interpret the structure of expressions to represent a quantity in terms of its context.
CC.2.2.HS.D.7	Create and graph equations or inequalities to describe numbers or relationships.
CC.2.2.HS.D.10	Represent, solve and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.
CC.2.3.HS.A.14	Apply geometric concepts to model and solve real world problems.

Important Standards Addressed in the Unit	
CC.1.2.11-12.F	Evaluate how words and phrases shape meaning and tone in texts.
CC.1.3.11-12.I	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 11-12 reading and content, choosing flexibly from a range of strategies and tools.
CC.1.4.11-12.F	Demonstrate a grade-appropriate command of the conventions of standard English grammar, usage, capitalization, punctuation, and spelling.
CC.1.4.11-12.R	Demonstrate a grade appropriate command of the conventions of standard English grammar and spelling.
CC.1.4.11-12.T	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
CC.1.4.11-12.V	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
CC.1.4.11-12.W	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
CC.1.4.11-12.X	Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes and audiences.
CC.1.5.11-12.B	Evaluate how the speaker's perspective, reasoning, and use of evidence and rhetoric affect the credibility of an argument through the author's stance, premises, links among ideas, word choice, points of emphasis, and tone.

Misconceptions	**Proper Conceptions**
1. Commercial and residential construction are unrelated to each other.	1. The two types of construction are definitely different but conceptually the two are related. Students should understand that code requirements are quite different

2. A structural member's orientation isn't important; it just needs to be big enough to carry the applied loads.	for the two types of construction and this – along with the difference in scale -- drives much of the differences between the two. 2. Except for sections that are symmetrical about both axes, the orientation of a structural member can significantly affect its strength. Mathematical models allow us to calculate the section properties in each direction so that we can predict how the member will react to applied loads.

Concepts

- Commercial Building Systems
- Commercial Utilities
- Site Design

Competencies

- 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

Vocabulary

Ballast
Beam
Brownfield
Building Code
Built-up Roof (BUR)
Cast-in-place Concrete Column
Concrete Masonry Unit (CMU)
Construction Type
Curtain Wall
Decking
Egress
Elevated Floor
EPDM (Ethylene Propylene Diene Monomer)
Exit
Exit Access
Exit Discharge
Fenestration
Hybrid
Ingress
Light Gauge Steel
Load
Load Bearing Wall
Low Slope Roof
Masonry
Municipality
Non-Load Bearing Wall
Occupancy Load
Open Web Steel Joist

Allowable Strength
ASD
Axial Force
Beam
Beam Analysis
Caisson
Column
Continuous Beam
Dead Load
Deep Foundation
Deflection
Deformation
Design Load
Equilibrium
Fixed Support
Footing
Force

Air Handling Unit (AHU)
Circuit
Circuit Breaker
Cleanout
Distribution Panel
Drain
Drainage Fixture Unit
Drainage System
Ducts
Electric Meter
Fenestration
Ground
Heat Pump
Hot Water
Individual Sewage Disposal System
Lavatory
Main
Nonpotable Water
Outlet
Plumbing Fixture
Potable Water
Riser
Sanitary Sewer
Sewage
Sewer
Soil Pipe
Stack
Storm Sewer
Switch Leg
Trap
Valve
Vent Pipe
Water Closet
Water Distributing Pipe
Water Heater
Water Meter
Water Service
Watt

Angle of Repose
Backsight
Bench Mark (BM)
Closure Error
Coarse Grained Soil
Construction Survey
Control Survey
Datum
Design Storm

		Foundation Free body Diagram Girder Grade Beam Internal Force Kip Lateral Load Live Load Load Load Path Mat (Raft) Foundation Moment About a Point P Moment Arm Moment Diagram Nominal Strength Occupancy Category Pile Pin Support Roller Support Safety Factor Seismic Load Serviceability Shallow Foundation Shear Diagram Shear Force Simple Beam Span Spread Footing Stability Statically Determinate Beam Strain Stress Structural Engineer Tributary Area Tributary Width Truss Weight Wind Load Yield Stress	Detention Pond (Dry Pond) Differential Leveling Duration Egress Elevation Field Notes Fine Grained Soil Finish Grade Foresight Geodetic Survey Grading Impervious Ingress Initial Point Land Surveying Liquid Limit Low Impact Development Plane Survey Plastic Limit Plasticity Index Poorly Graded Property Survey Rainfall Intensity Retention Pond (Wet Pond) Return Period Rod Intercept Runoff Coefficient Stadia Storm Water Wetlands Topographic Survey Well Graded

Assessments

Homework – Occasional homework assignments will be given to reinforce classroom concepts. Homework will be graded for completeness (including level of documentation of work) and will be used to formatively assess if additional instruction is needed.

Engineering Notebook Checks – Students will maintain a formal engineering notebook to document their work throughout the course. Periodic checks will assess proper notebook format and content. Certain projects will be completely contained within the engineering notebook and will be assessed according to the rubric provided for that project.

Vocabulary Quizzes – Understanding and using technical language is an important component of this course. Students will be expected to acquire and use new terms. Periodic quizzes within each unit will assess their ability to identify new vocabulary.

Oral Presentations – Students will report project solutions via oral presentations to the class. Content and presentation style will be assessed according to a standard rubric for each project.

Unit Tests / Unit Projects – Each unit will include a summative written test or project. Projects may be assessed through a presentation, engineering notebook review, electronic submission, or a combination of one or more of these. Rubrics and design briefs will be provided with each project to clearly communicate the content and performance expectations for that project.

Suggested Strategies to Support Design of Coherent Instruction

Charlotte Danielson's Framework for Teaching: Domain 3 Instruction

Lesson 3.1 – Commercial Building Systems
Lesson 3.3 – Services and Utilities

Conceptually, commercial building systems and utilities are quite similar to their residential equivalents. Applications, sizes, materials, usage demands, and code requirements vary between residential and commercial construction but the foundational knowledge built in the previous unit should be used to smooth the transition. Like with residential construction, provide ample examples of commercial construction details so that students have a pool of existing solutions to use as a reference as they encounter new problems.

Lesson 3.2 – Structures

Visual examples of deflected members will go a long way in starting the discussion of structural member design. Use wood studs with varying spans to illustrate the effect of span length and loading conditions on deflection so that students can visualize beam mechanics. For students in calculus class, discuss the beam integration that takes the loading function to shear to moment to rotation to deflection for a mathematical perspective on the relationship between all of those values.

Differentiation:

- Provide graphic organizers
- Provide multiple concrete examples
- Break extended projects into smaller identifiable milestones with checkpoints along the way
- Pair stronger students with struggling students for peer assistance

Interdisciplinary Connections:

- Design process – Scientific method
- Research process – English / Social Studies
- Writing skills – English
- Sketching - Art

Additional Resources:

- ***www.iste.org/docs/pdfs/20-14_ISTE_Standards-T_PDF.pdf*** International Society for Technology in Education standards.
- ***www.asce.org*** American Society of Civil Engineers – additional resources specific to the practice of civil engineering
- ***www.aia.org*** American Institute of Architects – additional resources specific to the practice of architecture
- ***www.aisc.org*** American Institute of Steel Construction – additional resources specific to steel construction
- ***www.concrete.org*** American Concrete Institute – additional resources specific to concrete construction
- ***www.sdi.com*** Steel Deck Institute – additional resources specific to corrugated steel roof and floor deck
- ***www.iccsafe.org*** International Code Council – additional resources specific to national model building construction codes

Created By:

Rick Geesaman

Civil Engineering and Architecture

Grades 11-12

Unit 4

Subject	Grade	Unit	Suggested Timeline
Civil Engineering and Architecture	11-12	4 – Commercial Building Design	7 weeks

Grade Level Summary

All of the building design skills that the students have acquired throughout the course will be applied to a final design project. Students will complete the design of a commercial building and present their solution to peers and instructors.

Grade Level Units

Unit 1 – Overview of Civil Engineering and Architecture
Unit 2 – Residential Design
Unit 3 – Commercial Applications
Unit 4 – Commercial Building Design

Unit Title

Commercial Building Design

Unit Overview

Student design teams will be presented with commercial design problems. The teams will analyze building sites and project types to choose their facility. Code research will be conducted to find what regulations apply to their design. Architectural design programs will be developed with design criteria and constraints being applied to the design throughout the process. Teams will prepare construction documents for their solution using 3d architectural design software, as well as design calculations to support their solution. A project report will also be completed and all of the design work and the final solution will be presented for evaluation and comment.

Unit Essential Questions

1-1. Why is it important for every team member to understand and carry out the appropriate team role when working together on a project?
1-2. As the developer of a piece of property, what factors must you consider for cost effectiveness and success of your development?
1-3. What types of information should you gather about a site before making a decision on site selection?
1-4. What is meant by "viability analysis"? What kinds of questions should a viability analysis answer?
1-5. What regulatory agencies should you know? Why is it important to work with them in preparing to develop property?
1-6. As an owner of the property, what issues are of concern to you and may affect the development of the property?
2-1. How can self-assessment, critiques, and peer reviews help improve our project and presentation skills?
2-2. How do drawings, renderings, and other documentation relate to and support the goals and criteria of a presentation?

Key Understandings

1-1. Detailed planning, documentation and management of a project is essential to its success.
1-2. People work in teams to produce solutions to complex problems.
1-3. A legal description of property is used to identify real estate in a legal transaction and can be found in a deed, mortgage, plat or other purchase documents.
1-4. The selection of a site and the project being planned are interrelated. A site should be thoroughly research to determine whether it is compatible with the project to be built.
1-5. Legal, physical, and financial conditions as well as the needs of the surrounding community should be taken into consideration when determining the viability of a project.
2-1. Critiques and reviews are used to inform and provide suggestions for improvement.
2-2. Presentations and displays of work provide the means to effectively promote the implementation of a project.
2-3. A well-done presentation will enhance the quality of a team's project.

Focus Standards Addressed in the Unit	
CC.1.2.11-12.G	Integrate and evaluate multiple sources of information presented in different media or formats (e.g. visually, quantitatively) as well as in words in order to address a question or solve a problem.
CC.1.3.11-12.J	Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.
CC.1.4.11-12.A	Write informative/ explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately.
CC.1.4.11-12.B	Write with a sharp distinct focus identifying topic, task, and audience.
CC.1.4.11-12.U	Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments and information.
CC.1.4.11-12.V	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
CC.1.4.11-12.W	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
CC.1.5.11-12.A	Initiate and participate effectively in a range of collaborative discussions on grades level topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
CC.1.5.11-12.D	Present information, findings, and supporting evidence, conveying a clear and distinct perspective; organization, development, substance, and style are appropriate to purpose, audience, and task.
CC.1.5.11-12.E	Make strategic use of digital media in presentations to add interest and enhance understanding of findings, reasoning, and evidence.
CC.2.3.HS.A.14	Apply geometric concepts to model and solve real world problems.

Important Standards Addressed in the Unit	
CC.1.2.11-12.B	Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences and conclusions based on and related to an author's implicit and explicit assumptions and beliefs.
CC.1.3.11-12.E	Evaluate the structure of texts including how specific sentences, paragraphs and larger portions of the texts relate to each other and the whole.
CC.1.3.11-12.I	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 11-12 reading and content, choosing flexibly from a range of strategies and tools.
CC.1.4.11-12.F	Demonstrate a grade-appropriate command of the conventions of standard English grammar, usage, capitalization, punctuation, and spelling.
CC.1.4.11-12.R	Demonstrate a grade appropriate command of the conventions of standard English grammar and spelling.
CC.1.4.11-12.S	Draw evidence from literary or informational texts to support analysis, reflection, and research, applying grade level reading standards for literature and literary non-fiction.
CC.1.4.11-12.T	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
CC.1.4.11-12.X	Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes and audiences.

CC.1.5.11-12.B	Evaluate how the speaker's perspective, reasoning, and use of evidence and rhetoric affect the credibility of an argument through the author's stance, premises, links among ideas, word choice, points of emphasis, and tone.
CC.1.5.11-12.G	Demonstrate command of the conventions of standard English when speaking based on grade 11-12 level and content.

Misconceptions

1. I work better on my own so I don't need to learn how to work in groups.
2. It's OK to let the stronger group members bear the weight of the work. I'll just step in if needed.

Proper Conceptions

1. Even in a one-person firm, engineers and architects always work as part of a group so learning to work as a group member is critical.
2. All team members must carry their own weight. One of the most critical aspects of group work is scheduling and planning what members will do what tasks. Continually monitoring progress against the schedule and shifting resources as necessary is a vital part of successfully completing a project as a team.

Concepts

- Commercial Building Design
- Design Presentation

Competencies

- 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

Vocabulary

Architectural Programming
Architectural Program
Baseline
Bearing
Bench Mark (BM)
Floor Plan
Gantt Chart
Land Patent
Metes and Bounds
Plat
Principal Meridian
Project Management
Public Land Survey System
Range
Rectangular Survey System
Section
Setback
Specifications
Township
Viability Analysis

Assessments

Homework – Occasional homework assignments will be given to reinforce classroom concepts. Homework will be graded for completeness (including level of documentation of work) and will be used to formatively assess if additional instruction is needed.

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Suggested Strategies to Support Design of Coherent Instruction

Charlotte Danielson's Framework for Teaching: Domain 3 Instruction

Lesson 4.1 – Commercial Building Design Problem

Students will be required to integrate and apply all of the skills they have acquired throughout the course to successfully complete the final project. Regularly reference back to prior activities as a reference for students as they tackle new situations within their commercial design. Closely monitor group progress so that teams do not go off track or fall behind to a point where completion is not possible. Structure is important for success in a long-term open ended problem.

Differentiation:

- Provide graphic organizers
- Provide multiple concrete examples
- Break extended projects into smaller identifiable milestones with checkpoints along the way
- Pair stronger students with struggling students for peer assistance

Interdisciplinary Connections:

- Design process – Scientific method
- Research process – English / Social Studies
- Writing / presentation skills – English
- Sketching / drawing - Art

Additional Resources:

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Created By:

Rick Geesaman

NORTHERN YORK COUNTY SCHOOL DISTRICT

Civil Engineering and Architecture

June 2015

I. Philosophy

Civil Engineering and Architecture (CEA) is a specialization course in Project Lead The Way's (PLTW) high school engineering pathway. In Northern High School's engineering course sequence, CEA is appropriate for students who have completed Principles of Engineering (POE). Civil Engineering is a broad engineering discipline and that breadth makes it impossible to effectively study all of those areas in a single year high school course. To offer some depth of study within the course, the primary areas of focus within civil engineering will be those that exist within building design and construction. Because the work of engineers in this area is closely related to and directly shaped by the work of an architect, architectural concepts will also be studied throughout the course.

II. Core Concepts

Civil Engineering is one of the four primary engineering disciplines covering the construction and maintenance of physical structures, as well as the management of the environment. Our study of building design and construction will include:

- Architectural design including an investigation of the history of architecture, visual elements of building design, building codes, accessibility, energy efficiency, and the development of construction documents.
- Structural engineering including load determination, beam design, common structural materials, framing systems, and foundations.
- Building site engineering including utilities, storm water management, traffic flow, surveying, and soil classification.

Course of Study

Marking Periods 1 and 2

- **Unit 1: Overview of Civil Engineering and Architecture** – Students will begin with an historical study of civil engineering and architecture as well as an exploration of careers in those fields. This foundation will give students a reference to which they can return throughout the course, and some context through which they can better understand where discrete concepts fit and relate with each other within the professions.
- **Unit 2: Residential Design** – The design and construction of residential structures is explored. Students will complete residential design activities, estimate required quantities and the cost of construction materials, evaluate building site and utility requirements, and explore sustainable construction methods. Construction documents will be prepared using 3d architectural design software.

Marking Period 3

- **Unit 3: Commercial Applications** – Students will build on their building design skills by applying them to a commercial building project. Codes and regulations will be studied to appreciate the legal criteria and constraints that building designers must consider in various types of projects. Commercial construction will be compared and

contrasted with residential construction methods. The increased demand on utilities and larger scale of commercial electrical and mechanical systems will be considered. In addition to the design of the building itself, students will also investigate the design of the surrounding building site including utility hookups, traffic, parking, and topography. Students will also perform a site survey and classify physical soil samples.

Marking Period 4

- **Unit 4: Commercial Building Design** – Students will work in groups to complete the site development and building design for a commercial project. Construction documents will be developed using 3d architectural design software. Teams will present their design process and solutions for review by classmates and instructors.

B. Texts and Resources

- PowerPoint presentations
- PLTW activities
- PLTW projects
- Autodesk Revit 3d architectural design computer software

C. Expected Levels of Achievement

Students are expected to maintain a minimum grade of 70%. Assessments – as outlined below – will measure the students' ability to apply an engineering design process to solve problems throughout the course. An end of course standardized PLTW assessment will evaluate the students' mastery of the course concepts.

Grading System:

93-100	=	A	(excellent progress)
85-92	=	B	(above average progress)
77-84	=	C	(average progress)
70-76	=	D	(below average progress)
Below 70	=	F	(failing)
Unfinished	=	I	(some incomplete work)

D. Procedures for Evaluation

1. **Written assessments** may include but will not necessarily be limited to:
   - Quizzes within each unit
   - Unit tests
   - Maintaining a formal engineering notebook

- Reports summarizing problem solutions
- Homework assignments
- Course portfolio

2. **Project assessments** may include but will not necessarily be limited to:
    - Revit architectural presentations and drawing documents
    - Oral presentations
    - Computer generated presentations

3. Missed work must be made up in accordance with current NHS policy. For extended absences of more than three days, special consideration for extended time may be arranged as necessary. Assignments will be provided online when possible to help students keep up with missed work.

4. All students are expected to produce their own original work in satisfying the requirements of this course, and to cite the use of others' work included in their own as necessary. Violations of this expectation will result in a score of "zero" for the assignment on which the violation occurred along with an administrative referral.

Northern York County School District Curriculum

Course Name	Civil Engineering and Architecture
Grade Level	11-12
Credits	1.10 Credits (Weighted GPA)
Instructional Procedures	**Refer to individual Unit Curriculum Unit Framework documents**

Unit 1	**Overview of Civil Engineering and Architecture**		
Time Frame	**5 Weeks**		
1.1	**History of Civil Engineering and Architecture**		
Key Concepts	**Essential Questions**	**PA Academic Standards**	**Terminology**
1. Many features of ancient structures are seen in modern buildings.	How did the art and science of architecture and civil engineering evolve over time?	**CC.1.3.11-12.J** Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.	Aesthetics Arch Architect Balance Bearing Walls Civil Engineer Color Contrast Design Principles Dome Element of Design

2. Architectural style is often an important key to understanding how a community or neighborhood has developed and the aesthetic customs that have formed over time.	What are three structural systems used by architects in historical construction projects?	**CC.1.4.11-12.R** Demonstrate a grade appropriate command of the conventions of standard English grammar and spelling.	Emphasis Façade Form Keystone Line Lintel Movement Pattern Post-and-Lintel Construction Repetition Rhythm Shape Space Texture Unity Value Vernacular Architecture Voussoir
3. The multiple architectural styles that have been developed throughout history are an indication of changing needs of people and society and uses for space.	How have historical innovations contributed to modern civil engineering and architecture?	**CC.1.4.11-12.S** Draw evidence from literary or informational texts to support analysis, reflection, and research, applying grade level reading standards for literature and literary non-fiction.	
4. Visual design principles and elements constitute an aesthetic vocabulary that can be used to describe buildings and may contribute to their function, location, or time period.	How are visual design elements and principles manifested in architecture?	**CC.1.4.11-12.U** Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments and information.	
		CC.1.4.11-12.V Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.	

1.2	Careers in Civil Engineering and Architecture		
Key Concepts	**Essential Questions**	**PA Academic Standards**	**Terminology**
1. Civil engineers and architects apply math, science, and discipline-specific skills to design and implement solutions.	What abilities and interests do you possess that could translate to a career field related to civil engineering or architecture?	**3.4.12.C3** Apply the concept that many technological problems require a multi-disciplinary approach.	ABET AIA ASCE Building Code Charrette Construction Documents Municipality NAAB NCARB Stakeholder Zoning Ordinance
2. Civil engineering and architecture careers are comprised of several specialties and offer creative job opportunities for individuals with a wide variety of backgrounds and goals.	What advantages are there to bringing together a group of people with varying backgrounds and skills for brainstorming a solution to a design problem?		
3. Civil engineers are problem solvers involved in the design and construction of a diverse array of projects in a wide range of disciplines including structural, environmental, geotechnical, water resources, transportation, construction and urban planning.			
4. Architects primarily focus on designing the interior and exterior "look and feel" of commercial and residential structures meant for human habitation.			
5. An effective method for brainstorming possible solutions involves a collaboration of many stakeholders with a variety of skills coming together in an organized meeting called a charrette.			

Unit 2	Residential Design		
Time Frame	**11 Weeks**		
2.1	**Building Design and Construction**		
Key Concepts	**Essential Questions**	**PA Academic Standards**	**Terminology**
1. Many residential structures are constructed with wood framing systems and are built using standard practices	Why is wood so often used for residential buildings?	**CC.1.2.11-12.B** Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences and conclusions based on and related to an author's implicit and explicit assumptions and beliefs	Felt Floor Joists Header House Wrap Insulation Sheathing Siding Sill Solar Orientation Source Reduction Stud Subfloor Sustainability Top Plate Truss
2. A variety of roof shapes and materials are available for residential structures to address aesthetic preferences, carry design loads, and meet environmental challenges.	What alternatives to wood frame construction are available and what are the advantages and disadvantages of each?	**CC.1.2.11-12.F** Evaluate how words and phrases shape meaning and tone in texts.	
3. Designers design, modify, and plan structures using 3D architectural software.	How are trusses able to span large distances?	**CC.1.2.11-12.G** Integrate and evaluate multiple sources of information presented in different media or formats (e.g. visually, quantitatively) as well as in words in order to address a question or solve a problem.	
4. Architects and engineers use a variety of views to document and detail a building project on construction drawings.	What framing systems are used to support residential roofs?	**CC.1.3.11-12.J** Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase	

		important to comprehension or expression.	
	How are different roof styles and pitches related to different architectural styles?	**CC.1.3.11-12.K** Read and comprehend literary fiction on grade level, reading independently and proficiently.	
		CC.1.4.11-12.S Draw evidence from literary or informational texts to support analysis, reflection, and research, applying grade level reading standards for literature and literary non-fiction.	
		CC.1.4.11-12.V Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.	
2.2	**Cost and Efficiency Analysis**		
Key Concepts	**Essential Questions**	**PA Academic Standards**	**Terminology**
1. The combination of concrete and rebar, called reinforced concrete, is an important component of residential foundations.	What is the difference between R-value and U-value? When are they used?	**CC.1.2.11-12.G** Integrate and evaluate multiple sources of information presented in different media or formats (e.g. visually, quantitatively) as well as in words in order to address a question or solve a problem.	Compression Strength Concrete Design Temperature Differential Fascia Footing Foundation Heat Loss Radiant Heat Rafter Rebar R-Value
2. Accurately determining the cost and quantities for a construction project can ensure a successful building project providing a high quality structure with less material and financial waste.	What are some leading causes of solar gain?	**CC.1.3.11-12.I** Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 11-12 reading and content, choosing	

		flexibly from a range of strategies and tools.	Sole Plate Square Tensile Strength Thermal Conduction Thermal Convection Transmission Load U-Factor
3. An effective residential structure should include methods for adequate heating and cooling.	What key areas of a building can minimize heat loss?	**CC.2.1.HS.F.3** Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs and data displays.	
4. R-value and U-factor measurements are used to select materials that with ensure a structure is properly insulated.	Why is a cost estimate important to create before starting a project?	**CC.2.3.HS.A.14** Apply geometric concepts to model and solve real world problems.	
2.3	**Residential Design**		
Key Concepts	**Essential Questions**	**PA Academic Standards**	**Terminology**
1. Responsible designers maximize the potential of the property, minimize impact on the environment, and incorporate universal design concepts in order to create an attractive and functional space.	How do you achieve a balance between cost-saving measures, important features, and environmental responsibility when designing a residential structure?	**CC.1.2.11-12.B** Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences and conclusions based on and related to an author's implicit and explicit assumptions and beliefs	Berm Building Code Building Envelope Circuit Circuit Breaker Cleanout Coniferous Construction Type Deciduous Distribution Panel Drain Drainage Drainage Fixture Unit Drainage System Ducts Easement Egress Electric Meter Exit Discharge Grading Ground Hot Water Individual Sewage Disposal System Ingress
2. Responsible designers anticipate the needs and requirements of the users.	What are the advantages and disadvantages of using 3D architectural software rather than creating hand-produced plans?	**CC.1.2.11-12.F** Evaluate how words and phrases shape meaning and tone in texts.	
3. Codes are created to protect the health and safety of the public, dictate the minimum requirements that must be met in a building project, and constrain the location of structures, utilities, building construction, and landscape components placed on a site.	Why are organizations such as LEED important?	**CC.1.2.11-12.G** Integrate and evaluate multiple sources of information presented in different media or formats (e.g. visually, quantitatively) as well as in words in order to address a question or solve a problem.	
4. Appropriate flow rate, pressure, and water quality are necessary for effective water supply and use.	When planning a project, how does the	**CC.1.3.11-12.J** Acquire and use accurately general academic and	

	availability of public utilities impact the design?	domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.	Invert Elevation Lavatory Main Nonpotable Water Outlet Potable Water Plumbing Fixture Pressure Head Prevailing Winds Rainfall Intensity Return Period Riser Sanitary Sewer Setback Sewage Sewer Soil Pipe Stack Static Head Storm Duration Switch Leg Time of Concentration Trap Universal Design Valve Variance Vent Pipe Water Closet Water Distributing Pipe Water Heater Water Meter Water Service Watt
5. When utilities are not available within a reasonable distance to be economically brought on site, substitutions must be designed and constructed.	What options are available for the management of wastewater from a building?	**CC.1.3.11-12.K** Read and comprehend literary fiction on grade level, reading independently and proficiently.	
6. Utilities and systems must be properly sized to minimize cost and appropriately serve the project and the structure occupants.	What are the important considerations when design a plumbing system?	**CC.1.4.11-12.A** Write informative/ explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately.	
7. The design of electrical and plumbing systems must be carefully integrated into the architectural and structural design of a building.	Why should a designer know about the different types of lighting and their applications?	**CC.1.4.11-12.B** Write with a sharp distinct focus identifying topic, task, and audience.	
8. Careful landscape design that takes into consideration local environmental conditions can improve energy efficiency, reduce noise, reduce water usage, reduce storm water runoff, and improve the visual impact of a building project.	What are the important considerations when designing an electrical system?	**CC.1.4.11-12.F** Demonstrate a grade-appropriate command of the conventions of standard English grammar, usage, capitalization, punctuation, and spelling.	
9. Storm water runoff from a site often increases when the site is developed and is frequently regulated by local jurisdictions	What information is important when documenting the design of a building?	**CC.1.4.11-12.R** Demonstrate a grade appropriate command of the conventions of standard English grammar and spelling.	
10. Universal Design involves the design of products and environments to be usable by all people and includes barrier free accessibility to projects that may be required by federal regulations.		**CC.1.4.11-12.S** Draw evidence from literary or informational texts to support analysis, reflection, and research, applying grade level	

		reading standards for literature and literary non-fiction.	
11. Green or sustainable design reduces the negative impact of a project on the environment and human health and improves the performance of the project during its life-cycle.		**CC.1.4.11-12.W** Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.	
		CC.1.4.11-12.X Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes and audiences.	

Unit 3	**Commercial Applications**		
Time Frame	**11 Weeks**		
3.1	**Commercial Building Systems**		
Key Concepts	**Essential Questions**	**PA Academic Standards**	**Terminology**
1. Commercial building systems differ from residential building systems in many significant ways.	How do Land Use and Development regulations help or hinder development in a community?	**CC.1.2.11-12.B** Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences and conclusions based on and related to an author's implicit and explicit assumptions and beliefs.	Ballast Beam Brownfield Building Code Built-up Roof (BUR) Cast-in-place Concrete Column

2. Codes and building regulations define and constrain all aspects of building design and construction including the structure, site design, utilities, and building usage.	Why are building codes important in the construction of buildings?	**CC.1.2.11-12.F** Evaluate how words and phrases shape meaning and tone in texts.	Concrete Masonry Unit (CMU) Construction Type Curtain Wall Decking Egress Elevated Floor EPDM (Ethylene Propylene Diene Monomer) Exit Exit Access Exit Discharge Fenestration Hybrid Ingress Light Gauge Steel Load Load Bearing Wall Low Slope Roof Masonry Municipality Non-Load Bearing Wall Occupancy Load Open Web Steel Joist
3. Zoning regulations are used to control land use and development.	How does commercial building design and construction differ from residential building design and construction?	**CC.1.2.11-12.G** Integrate and evaluate multiple sources of information presented in different media or formats (e.g. visually, quantitatively) as well as in words in order to address a question or solve a problem.	
4. Wall, roof, floor, and framing systems for commercial facilities are chosen based on many factors.	What factors influence the choice of commercial construction materials?	**CC.1.3.11-12.I** Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 11-12 reading and content, choosing flexibly from a range of strategies and tools.	
	How do sustainable design alternatives, such as a green roof, impact the environment and quality of life?	**CC.1.3.11-12.J** Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.	
		CC.1.4.11-12.A Write informative/ explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately.	

		CC.1.4.11-12.F Demonstrate a grade-appropriate command of the conventions of standard English grammar, usage, capitalization, punctuation, and spelling.	
		CC.1.4.11-12.R Demonstrate a grade appropriate command of the conventions of standard English grammar and spelling.	
		CC.2.1.HS.F.3 Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs and data displays.	
		CC.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems.	
3.2	**Structures**		
Key Concepts	**Essential Questions**	**PA Academic Standards**	**Terminology**
1. The purpose of a structure is to withstand all applied loads and forces and to transfer these forces to the Earth.	What is structural engineering?	**CC.1.2.11-12.G** Integrate and evaluate multiple sources of information presented in different media or formats (e.g. visually, quantitatively) as well as in words in order to address a question or solve a problem.	Allowable Strength ASD Axial Force Beam Beam Analysis Caisson Column Continuous Beam Dead Load Deep Foundation Deflection Deformation Design Load Equilibrium Fixed Support Footing Force Foundation
2. Structural engineering involves the critical analysis of forces and loads, the anticipated effect of these loads on a structure, and the design of structural elements to safely and efficiently resist the anticipated forces and loads.	What is the function of a structure?	**CC.1.3.11-12.J** Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.	

3. Design loads are often dictated by building codes.	How do you determine the loads that must be used to design a structure?	**CC.2.2.HS.D.1** Interpret the structure of expressions to represent a quantity in terms of its context.	Free body Diagram Girder Grade Beam Internal Force Kip Lateral Load Live Load Load Load Path Mat (Raft) Foundation Moment About a Point P Moment Arm Moment Diagram Nominal Strength Occupancy Category Pile Pin Support Roller Support Safety Factor Seismic Load Serviceability Shallow Foundation Shear Diagram Shear Force Simple Beam Span Spread Footing Stability Statically Determinate Beam Strain Stress Structural Engineer Tributary Area Tributary Width Truss Weight Wind Load Yield Stress
4. Structural design includes the determination of how structures disperse the applied loads.	In what ways is wind, snow, seismic, dead, and live loads similar to or different from each other?	**CC.2.2.HS.D.7** Create and graph equations or inequalities to describe numbers or relationships.	
5. The application of loads to a building results in resisting forces from the structure which can be predicted through the use of mathematics and physical science principles.	How does the design of a structure impact how loads are dispersed?	**CC.2.2.HS.D.10** Represent, solve and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.	
	How does the use of mathematics help in understanding and quantifying the forces and loads on a structure?	**CC.2.3.HS.A.14** Apply geometric concepts to model and solve real world problems.	
	How does the structure of a building affect the form and function of that building?		

3.3	Services and Utilities		
Key Concepts	**Essential Questions**	**PA Academic Standards**	**Terminology**
1. When utilities are not available within a reasonable distance to be economically brought on site, substitutions must be designed and constructed.	When planning a project how does the availability of public utilities impact the design?	**CC.1.2.11-12.B** Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences and conclusions based on and related to an author's implicit and explicit assumptions and beliefs.	Air Handling Unit (AHU) Circuit Circuit Breaker Cleanout Distribution Panel Drain Drainage Fixture Unit Drainage System Ducts Electric Meter Fenestration Ground Heat Pump Hot Water Individual Sewage Disposal System Lavatory Main Nonpotable Water Outlet Plumbing Fixture Potable Water Riser Sanitary Sewer Sewage Sewer Soil Pipe Stack Storm Sewer Switch Leg Trap Valve Vent Pipe Water Closet Water Distributing Pipe Water Heater Water Meter
2. Utilities and systems must be properly sized to minimize cost and appropriately serve the project.	What options are available for the management of wastewater from a building?	**CC.1.2.11-12.F** Evaluate how words and phrases shape meaning and tone in texts.	
3. Responsible designers anticipate the needs and requirements of the users.	What are the important considerations when designing an HVAC system?	**CC.1.2.11-12.G** Integrate and evaluate multiple sources of information presented in different media or formats (e.g. visually, quantitatively) as well as in words in order to address a question or solve a problem.	
4. The design of mechanical systems impact the architectural and structural design of a building.	Why is it important for an architect to understand how electrical, plumbing, and HVAC systems are designed and constructed?	**CC.1.3.11-12.I** Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 11-12 reading and content, choosing flexibly from a range of strategies and tools.	
5. Energy codes are designed to conserve natural resources, reduce operating costs, protect the environment and create healthier living and working spaces. They dictate the minimum requirements for the building envelope, lighting, mechanical systems, and service water heating for commercial facilities.		**CC.1.3.11-12.J** Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge	

		when considering a word or phrase important to comprehension or expression.	Water Service Watt
6. The design of internal systems is documented with construction drawings specific to each system.		**CC.1.3.11-12.K** Read and comprehend literary fiction on grade level, reading independently and proficiently.	
		CC.1.4.11-12.A Write informative/ explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately.	
		CC.1.4.11-12.B Write with a sharp distinct focus identifying topic, task, and audience.	
		CC.1.4.11-12.F Demonstrate a grade-appropriate command of the conventions of standard English grammar, usage, capitalization, punctuation, and spelling.	
		CC.1.4.11-12.R Demonstrate a grade appropriate command of the conventions of standard English grammar and spelling.	
		CC.1.4.11-12.S Draw evidence from literary or informational texts to support analysis, reflection, and research, applying grade level reading standards for literature and literary non-fiction.	
		CC.1.4.11-12.T Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.	

		CC.1.4.11-12.U Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments and information.	
		CC.1.4.11-12.V Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.	
		CC.1.4.11-12.W Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.	
		CC.1.4.11-12.X Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes and audiences.	
		CC.1.5.11-12.A Initiate and participate effectively in a range of collaborative discussions on grades	

		level topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.	
		CC.1.5.11-12.B Evaluate how the speaker's perspective, reasoning, and use of evidence and rhetoric affect the credibility of an argument through the author's stance, premises, links among ideas, word choice, points of emphasis, and tone.	
		CC.1.5.11-12.D Present information, findings, and supporting evidence, conveying a clear and distinct perspective; organization, development, substance, and style are appropriate to purpose, audience, and task.	
		CC.1.5.11-12.E Make strategic use of digital media in presentations to add interest and enhance understanding of findings, reasoning, and evidence.	
		CC.2.2.HS.D.7 Create and graph equations or inequalities to describe numbers or relationships.	
		CC.2.2.HS.D.10 Represent, solve and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.	

3.4	Site Considerations		
Key Concepts	**Essential Questions**	**PA Academic Standards**	**Terminology**
1. Land surveying is used for many purposes during the design and construction of a project including establishing the topography of a site, setting control points, and establishing the location of project features.	How is land surveying used in the development of a building project?	**3.4.12.C3** Apply the concept that many technological problems require a multi-disciplinary approach.	Angle of Repose Backsight Bench Mark (BM) Closure Error Coarse Grained Soil Construction Survey Control Survey Datum Design Storm Detention Pond (Dry Pond) Differential Leveling Duration Egress Elevation Field Notes Fine Grained Soil Finish Grade Foresight Geodetic Survey Grading Impervious Ingress Initial Point Land Surveying Liquid Limit Low Impact Development Plane Survey Plastic Limit Plasticity Index Poorly Graded Property Survey Rainfall Intensity Retention Pond (Wet Pond) Return Period Rod Intercept
2. Engineers must consider parking requirements, pedestrian access, ingress and egress, landscaping, storm water management, and site grading when creating a site design.	What information is important to consider when planning the placement of driveways, parking spaces, and pedestrian access?		
3. Ingress and egress, parking, pedestrian, and handicapped access must be planned to efficiently and safely move traffic, goods, and people.	How are the needs of a site user and the circulation patterns for the site interrelated?		
4. The characteristics of soils present on a site impact the design and construction of improvements to a property.	Why is it important to know the soil characteristics of a site when planning a building project?		
5. Codes determine the type, sizing, and placement of site features such as parking lots, entrance and exit roads, pedestrian and handicapped access, and storm water facilities.	How does development change the characteristics of a site?		
6. The surface conditions and topography of a site affect the quantity and quality of storm water runoff and the design of the storm water management system.	What steps must be taken to ensure that the improvements made on a property will not adversely affect users or		

	neighboring properties?		Runoff Coefficient Stadia Storm Water Wetlands Topographic Survey Well Graded
7. A soil can be classified according to its grain size and plasticity which impact the characteristics the soil will exhibit.			

Unit 4	**Commercial Building Design**		
Time Frame	**7 Weeks**		
4.1	**Commercial Building Design Problem**		
Key Concepts	**Essential Questions**	**PA Academic Standards**	**Terminology**
1. Detailed planning, documentation and management of a project is essential to its success.	Why is it important for every team member to understand and carry out the appropriate team role when working together on a project?	**CC.1.2.11-12.B** Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences and conclusions based on and related to an author's implicit and explicit assumptions and beliefs.	Architectural Programming Architectural Program Baseline Bearing Bench Mark (BM) Floor Plan Gantt Chart Land Patent Metes and Bounds Plat Principal Meridian Project Management Public Land Survey System Range Rectangular Survey System Section Setback Specifications Township Viability Analysis
2. People work in teams to produce solutions to complex problems.	As the developer of a piece of property, what factors must you consider for cost effectiveness and success of your development?	**CC.1.2.11-12.G** Integrate and evaluate multiple sources of information presented in different media or formats (e.g. visually, quantitatively) as well as in words in order to address a question or solve a problem.	
3. A legal description of property is used to identify real estate in a legal transaction and can be found in a deed, mortgage, plat or other purchase documents.	What types of information should you gather about a site before making a decision on site selection?	**CC.1.3.11-12.I** Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 11-12 reading and content, choosing flexibly from a range of strategies and tools.	

4. The selection of a site and the project being planned are interrelated. A site should be thoroughly research to determine whether it is compatible with the project to be built.	What is meant by "viability analysis"? What kinds of questions should a viability analysis answer?	**CC.1.3.11-12.J** Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.	
5. Legal, physical, and financial conditions as well as the needs of the surrounding community should be taken into consideration when determining the viability of a project.	What regulatory agencies should you know? Why is it important to work with them in preparing to develop property?	**CC.1.3.11-12.K** Read and comprehend literary fiction on grade level, reading independently and proficiently.	
	As an owner of the property, what issues are of concern to you and may affect the development of the property?	**CC.1.4.11-12.A** Write informative/ explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately.	
		CC.1.4.11-12.B Write with a sharp distinct focus identifying topic, task, and audience.	
		CC.1.4.11-12.F Demonstrate a grade-appropriate command of the conventions of standard English grammar, usage, capitalization, punctuation, and spelling.	
		CC.1.4.11-12.R Demonstrate a grade appropriate command of the conventions of standard English grammar and spelling.	
		CC.1.4.11-12.S Draw evidence from literary or informational texts to support analysis, reflection, and	

		research, applying grade level reading standards for literature and literary non-fiction.	
		CC.1.4.11-12.T Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.	
		CC.1.4.11-12.U Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments and information.	
		CC.1.4.11-12.V Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.	
		CC.1.4.11-12.W Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.	

		CC.1.4.11-12.X Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes and audiences.	
		CC.1.5.11-12.A Initiate and participate effectively in a range of collaborative discussions on grades level topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.	
		CC.1.5.11-12.D Present information, findings, and supporting evidence, conveying a clear and distinct perspective; organization, development, substance, and style are appropriate to purpose, audience, and task.	
		CC.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems.	
4.2	**Commercial Building Design Presentation**		
Key Concepts	**Essential Questions**	**PA Academic Standards**	**Terminology**
1. Critiques and reviews are used to inform and provide suggestions for improvement.	How can self-assessment, critiques, and peer reviews help improve our project and presentation skills?	**CC.1.3.11-12.E** Evaluate the structure of texts including how specific sentences, paragraphs and larger portions of the texts relate to each other and the whole.	
2. Presentations and displays of work provide the means to effectively promote the implementation of a project.	How do drawings, renderings, and other documentation relate to and support the	**CC.1.3.11-12.I** Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 11-12	

	goals and criteria of a presentation?	reading and content, choosing flexibly from a range of strategies and tools.	
3. A well-done presentation will enhance the quality of a team's project.		**CC.1.3.11-12.J** Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.	
		CC.1.4.11-12.L Demonstrate a grade appropriate command of the conventions of standard English grammar, usage, capitalization, punctuation, and spelling.	
		CC.1.5.11-12.A Initiate and participate effectively in a range of collaborative discussions on grades level topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.	
		CC.1.5.11-12.B Evaluate how the speaker's perspective, reasoning, and use of evidence and rhetoric affect the credibility of an argument through the author's stance, premises, links among ideas, word choice, points of emphasis, and tone.	
		CC.1.5.11-12.D Present information, findings, and supporting evidence, conveying a clear and distinct perspective; organization, development,	

		substance, and style are appropriate to purpose, audience, and task.	
		CC.1.5.11-12.E Make strategic use of digital media in presentations to add interest and enhance understanding of findings, reasoning, and evidence.	
		CC.1.5.11-12.G Demonstrate command of the conventions of standard English when speaking based on grade 11-12 level and content.	