Unit 08: High Rise Residential Buildings

Content Area: **Applied Technology**
Course(s):
Time Period: **Marking Period 3**
Length: **5 weeks**
Status: **Published**

Summary

Introduction

Students will apply high rise building and interior design concepts and knowledge to a residential building. Students will explore code requirements for residential buildings and how these requirements affect the design of buildings.

Revision Date: July 2021

MA.A-SSE	Seeing Structure in Expressions
LA.RH.11-12	Reading History
MA.A-SSE.A	Interpret the structure of expressions
	Key Ideas and Details
MA.A-SSE.A.1	Interpret expressions that represent a quantity in terms of its context.
LA.RH.11-12.1	Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.), to support analysis of primary and secondary sources, connecting insights gained from specific details to develop an understanding of the text as a whole.
MA.A-SSE.A.1a	Interpret parts of an expression, such as terms, factors, and coefficients.
LA.RH.11-12.2	Determine the theme, central ideas, information and/or perspective(s) presented in a primary or secondary source; provide an accurate summary of how key events, ideas and/or author's perspective(s) develop over the course of the text.
LA.RH.11-12.3	Evaluate various perspectives for actions or events; determine which explanation best accords with textual evidence, acknowledging where the text leaves matters uncertain.
MA.A-CED	Creating Equations
LA.WHST.11-12	Writing History, Science and Technical Subjects
	Text Types and Purposes
LA.WHST.11-12.1	Write arguments focused on discipline-specific content.
SCI.HS-ETS1	Engineering Design
	Asking Questions and Defining Problems
SCI.HS.ETS1.A	Delimiting Engineering Problems
SCI.HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
	Constructing Explanations and Designing Solutions
CS.9-12.8.2.12.EC.1	Analyze controversial technological issues and determine the degree to which individuals, businesses, and governments have an ethical role in decisions that are made.
CS.9-12.8.2.12.EC.2	Assess the positive and negative impacts of emerging technologies on developing countries and evaluate how individuals, non-profit organizations, and governments have responded.

CS.9-12.8.2.12.EC.3	Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture, society, and environment and share this information with the appropriate audience.
CS.9-12.8.2.12.ED.1	Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
CS.9-12.8.2.12.ED.2	Create scaled engineering drawings for a new product or system and make modification to increase optimization based on feedback.
CS.9-12.8.2.12.ED.3	Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.
CS.9-12.8.2.12.ED.4	Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
CS.9-12.8.2.12.ED.5	Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).
CS.9-12.8.2.12.ED.6	Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor).
CS.9-12.8.2.12.ETW.4	Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints.
CS.9-12.EC	Ethics & Culture
CS.9-12.ED	Engineering Design
CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP1.1	Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP5.1	Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies,

	understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP8.1	Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP11.1	Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.
SCI.HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
SCI.HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
SCI.HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
SCI.HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
SCI.HS-ETS1	Engineering Design
WRK.9.2.12.CAP	Career Awareness and Planning
TECH.8.1.12	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.1.12.A	Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.
TECH.8.1.12.A.1	Create a personal digital portfolio which reflects personal and academic interests, achievements, and career aspirations by using a variety of digital tools and resources.
TECH.8.1.12.A.2	Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.
TECH.8.1.12.A.CS1	Understand and use technology systems.
TECH.8.1.12.A.CS2	Select and use applications effectively and productively.
TECH.8.1.12.B	Creativity and Innovation: Students demonstrate creative thinking, construct knowledge

	and develop innovative products and process using technology.
TECH.8.1.12.B.2	Apply previous content knowledge by creating and piloting a digital learning game or tutorial.
TECH.8.1.12.B.CS1	Apply existing knowledge to generate new ideas, products, or processes.
TECH.8.1.12.C	Communication and Collaboration: Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
TECH.8.1.12.C.1	Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community.
TECH.8.1.12.C.CS1	Interact, collaborate, and publish with peers, experts, or others by employing a variety of digital environments and media.
TECH.8.1.12.D	Digital Citizenship: Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.
TECH.8.1.12.F	Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.
TECH.8.1.12.F.1	Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.
TECH.8.1.12.F.CS1	Identify and define authentic problems and significant questions for investigation.
TECH.8.1.12.F.CS2	Plan and manage activities to develop a solution or complete a project.
TECH.8.1.12.F.CS3	Collect and analyze data to identify solutions and/or make informed decisions.
TECH.8.1.12.F.CS4	Use multiple processes and diverse perspectives to explore alternative solutions.
TECH.8.2.12	Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.
TECH.8.2.12.A	The Nature of Technology: Creativity and Innovation: Technology systems impact every aspect of the world in which we live.
TECH.8.2.12.A.1	Propose an innovation to meet future demands supported by an analysis of the potential full costs, benefits, trade-offs and risks, related to the use of the innovation.
TECH.8.2.12.A.CS1	The characteristics and scope of technology.
TECH.8.2.12.B.4	Investigate a technology used in a given period of history, e.g., stone age, industrial revolution or information age, and identify their impact and how they may have changed to meet human needs and wants.
TECH.8.2.12.B.5	Research the historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product, and present the competing viewpoints to peers for review.
TECH.8.2.12.B.CS4	The influence of technology on history.
TECH.8.2.12.C	Design: The design process is a systematic approach to solving problems.
TECH.8.2.12.C.1	Explain how open source technologies follow the design process.
TECH.8.2.12.C.5	Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.
TECH.8.2.12.C.CS1	The attributes of design.
TECH.8.2.12.D	Abilities for a Technological World: The designed world is the product of a design process that provides the means to convert resources into products and systems.

TECH.8.2.12.D.1	Design and create a prototype to solve a real world problem using a design process, identify constraints addressed during the creation of the prototype, identify trade-offs made, and present the solution for peer review.
TECH.8.2.12.D.3	Determine and use the appropriate resources (e.g., CNC (Computer Numerical Control) equipment, 3D printers, CAD software) in the design, development and creation of a technological product or system.
TECH.8.2.12.D.CS1	Apply the design process.
TECH.8.2.12.D.CS2	Use and maintain technological products and systems.
TECH.8.2.12.D.CS3	Assess the impact of products and systems.
TECH.9.4.12.CI	Creativity and Innovation
TECH.9.4.12.CI.2	Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
TECH.9.4.12.CI.3	Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
TECH.9.4.12.CT	Critical Thinking and Problem-solving
TECH.9.4.12.TL	Technology Literacy
	Engineering design is a complex process in which creativity, content knowledge, research, and analysis are used to address local and global problems. Decisions on trade-offs involve systematic comparisons of all costs and benefits, and final steps that may involve redesigning for optimization.
	Career planning requires purposeful planning based on research, self-knowledge, and informed choices.
	Engineering design evaluation, a process for determining how well a solution meets requirements, involves systematic comparisons between requirements, specifications, and constraints.
	An individual's income and benefit needs and financial plan can change over time.
	Innovative ideas or innovation can lead to career opportunities.

Essential Questions/Enduring Understandings

Essential Questions:

What is the best structural system?

How is the design loop used to solve a problem?

How does a building's use affect design?

Enduring Understandings:

Different construction types (i.e. steel, wood, concrete, masonry) are used to solve different problems.

Different construction types have advantages and disadvantages relating to cost, flexibility of layout, labor expertise, availability of local resources.

The design loop is used an iterative process. It is used to solve multiple problems encountered in the design of

the building

Objectives

Students will know:

The design loop is used an iterative process. It is used to solve multiple problems encountered in the design of the buildingUnit vocabulary, i.e.: fenestration, means of egress, flat plate concrete construction, concrete, cement aggregate, suite, ventilation, F.A.R. (Floor Area Ratio), apartment, condominium, townhouse, demising wall.

Codes are minimum requirements.

Codes govern the minimum sizes of habitable rooms

Codes specify that habitable rooms must have windows and ventilation proportionate to their area.

Code requirements affect the layout of buildings.

Mechanical systems take up space.

The components of flat plate construction.

Students will be skilled at:

Drawing a flat plate concrete construction system.

Choosing a structural system to meet programmatic needs.

Make plans sections and elevations for an apartment house.

Developing interior floor plans for an apartment.

Developing a digital portfolio.

Learning Plan

Preview the essential questions and connect to learning throughout the unit.

Guiding questions: What are the characteristics of a steel building? When and why is steel used in buildings? What are the differences between restrooms at home and in a restaurant? Where is the air conditioning system in a large building? How do we communicate the different systems in a large building using CAD? What happens in our school building when the fire alarm goes off, or during a drill? What in our class room relates to fire safety? What in our class room relates to holding the building up? Why do we have ramps in front of buildings? Where are the systems (HVAC) that heat and cool a building? What are the components of HVAC systems?

Guest speakers to talk about their discipline in engineering or the construction industry

Lecture and discussion about guiding questions

Students will research (library, internet, and/or interview) and report and/or create a presentation on a historically significant office building or buildings.

Formative assessments will be conducted throughout the process.

Summative assessment will be conducted by the student and teacher using a rubric specific to the research problem.

Teacher will demonstrate and involve students in discovering techniques for rendering drawings in CAD. (LCD projector)

Students design and draw a multistory building in Cranford that demonstrates integration of the topics above. Create multilayered drawings. Use CAD and traditional techniques to create presentation drawings. Students will include drawings of typical assemblies-floor/ceiling; ceiling/roof; curtain wall; partition; foundation/slab systems.

Formative assessments will be conducted throughout the design process.

Summative assessment will be conducted by the student and teacher using a rubric specific to the design problem.

Students will design a shopping mall that demonstrates integration of the systems in this unit.

Formative assessments will be conducted throughout the design process.

Summative assessment will be conducted by the student and teacher using a rubric specific to the design problem.

Students will build a scale model of a curtain wall and/or steel building, with attention toward systems integration.

Formative assessments will be conducted throughout the design process.

Summative assessment will be conducted by the student and teacher using a rubric specific to the design problem.

Unit test or quiz.

Writing prompt.

Assessment

Formative Assessment:

Teacher review and Feedback for design log
Class discussion
Demonstrate understanding of required vocabulary.

Summative assessment:
Design and create presentation drawings for a building that demonstrates understanding of means of egress, flat plate concrete construction. The presentation will include a written description that describes the technical aspects of the proposal. The presentation will be evaluated using teacher and student designed rubrics. Draw and design a high rise residential building. The building should demonstrate how it relates to aesthetic needs and historical buildings. Demonstrate the ability to use software and technical drawing conventions to communicate a design effectively. Maintain a log to explain how the design evolved, including sources of information and criticism. Design and create presentation drawings for a building that demonstrates understanding of means of egress, curtain wall and steel construction.The presentation will include a written description that describes the technical aspects of the proposal. The presentation will be included in an electronic portfolio. The presentation will be evaluated using teacher and student designed rubrics.

Pass written quizzes and tests about subject materials.
Write a response to one or more writing prompts. Possible prompts: How do human needs and code requirements affect the design of a bedroom? How is means of egress addressed in your building? What type of structural system was used and why was it the best choice?.

Alternative Assessment:
Presentation on bedroom design

Benchmark Assessment:
Final Exam

Materials

The CADD LAB-computers equipped with up-to-date AutoCAD and/or other design and drafting software, presentation software, productivity software, a scanner and printers/plotters.

Traditional drafting equipment and supplies-vellum, colored and graphite pencils, pen and ink, drawing boards, tape, scissors, t-squares, triangles etc.

Chip-board, X-acto knives and other model making supplies.

A computer with INTERNET based presentation software (i.e. Prezi and Google Slides) and Microsoft Powerpoint.

Smartboard for demonstrations by the teacher and presentations by students.

Integrated Accommodation and Modifications Spec Ed, ELL, At-Risk, G&T, Career Education, 504's

See the linked document for Integrated Accommodation and Modifications, Special Education, English Language Learners, At-Risk, Gifted and Talented, Career Education and 504s.