Unit 08: High Rise Residential Buildings

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

Brief Summary of Unit

Introduction

Students will apply knowledge and skills developed through the study of high-rise buildings and interior design to the design of a residential building. Through the examination of residential building systems, space planning, and architectural design principles, students will develop an understanding of how functional, aesthetic, and regulatory requirements influence residential design. Students will explore residential building codes, zoning regulations, accessibility considerations, and life-safety requirements, and examine how these standards impact the planning, organization, and design of residential structures. Using CAD software and professional design practices, students will create and communicate residential design solutions that address the needs of occupants while meeting applicable design and code requirements.

Revision Date: July 2026

Essential Questions/Enduring Understandings

Essential Questions:

What factors influence the selection of the most appropriate structural system for a building?

How can the design loop be applied to develop effective solutions to design challenges?

How does the intended use of a building influence its design, layout, and construction?

Enduring Understandings:

Different construction systems, including steel, wood, concrete, and masonry, are used to address different design requirements and construction challenges.

Each construction system offers distinct advantages and disadvantages related to cost, structural performance, design flexibility, labor requirements, and the availability of materials and local resources.

The design loop is an iterative problem-solving process used to evaluate, refine, and develop solutions to the multiple challenges encountered throughout the building design process.

Students Will Know/Students Will Be Skilled At

Students will know:

The design loop is an iterative problem-solving process used to address and refine multiple challenges encountered throughout the building design process.

Unit vocabulary, including fenestration, means of egress, flat plate concrete construction, concrete, cement, aggregate, suite, ventilation, Floor Area Ratio (F.A.R.), apartment, condominium, townhouse, and demising wall.

Building codes establish the minimum requirements necessary to promote health, safety, and welfare within the built environment.

Building codes govern the minimum size requirements for habitable rooms.

Building codes require habitable rooms to provide natural light and ventilation in proportions appropriate to their size and occupancy.

Code requirements significantly influence the layout, organization, and design of buildings.

Mechanical systems require dedicated space within a building and must be considered during the design process.

The components and characteristics of flat plate concrete construction systems.

Students will be skilled at:

Creating technical drawings of flat plate concrete construction systems.

Selecting an appropriate structural system based on project requirements and programmatic needs.

Developing plan, section, and elevation drawings for an apartment building.

Designing interior floor plans for residential dwelling units.

Creating and presenting project work through a professional digital portfolio.

Learning Plan

- Preview the essential questions and establish connections to the concepts, skills, and learning objectives that will be explored throughout the unit.
- Examine guiding questions, including:
    - What are the defining characteristics of a steel-framed building?
    - When and why is steel selected as a structural material in building construction?
    - How do restroom requirements differ between residential and commercial buildings?
    - Where are HVAC and air-conditioning systems located within large buildings?

    - How can CAD be used to communicate the various systems incorporated within a large building?
    - What occurs within a building when a fire alarm is activated or during an emergency evacuation drill?
    - What features within our classroom and school relate to fire safety and life-safety systems?
    - What structural elements within our classroom contribute to supporting the building?
    - Why are ramps and other accessibility features incorporated into building design?
    - What are the major components of HVAC systems, and how do they contribute to building performance and occupant comfort?

- Participate in presentations by guest speakers representing engineering, architecture, construction, and related professional disciplines.
- Engage in lectures, discussions, and instructional activities focused on the guiding questions and key concepts of the unit.
- Research historically significant office buildings using library resources, internet sources, and/or interviews, and communicate findings through a written report and/or presentation.
- Formative assessments will be conducted throughout the research process to monitor student understanding and provide ongoing feedback.
- Summative assessment of the research project will be conducted collaboratively by the student and teacher using a rubric aligned with the project objectives and evaluation criteria.
- Observe teacher demonstrations and participate in guided activities focused on CAD rendering techniques, drafting standards, and visual communication methods.
- Design and develop a multi-story building project in Cranford that demonstrates the integration of the concepts, building systems, and design principles studied throughout the unit.
- Create multi-layered CAD drawings that accurately communicate architectural, structural, mechanical, and life-safety systems.
- Utilize CAD software and traditional drafting techniques to produce professional-quality presentation drawings.
- Develop drawings of typical building assemblies, including floor/ceiling systems, ceiling/roof systems, curtain wall systems, partition systems, and foundation/slab systems.
- Formative assessments will be conducted throughout the design process to evaluate progress, technical proficiency, and application of course concepts.
- Summative assessment of the building design project will be conducted collaboratively by the student and teacher using a rubric specific to the design challenge and project requirements.
- Design a shopping mall project that demonstrates the integration and coordination of the building

systems and design concepts studied throughout the unit.

- Formative assessments will be conducted throughout the shopping mall design process to monitor progress and support student learning.
- Summative assessment of the shopping mall project will be conducted collaboratively by the student and teacher using a rubric aligned with project objectives and design criteria.
- Construct a scale model of a curtain wall system and/or steel-framed building, demonstrating an understanding of structural systems, building components, and systems integration.
- Formative assessments will be conducted throughout the model-building process to assess understanding, craftsmanship, and technical accuracy.
- Summative assessment of the scale model project will be conducted collaboratively by the student and teacher using a rubric specific to the project requirements.
- Complete a unit test or quiz assessing understanding of structural systems, building systems, life-safety concepts, accessibility requirements, and related course content.
- Complete a written response or writing prompt demonstrating understanding of key concepts, design decisions, and project outcomes.

Assessment

Formative Assessment:

Teacher review and feedback on student design logs.

Class discussion and critique to support understanding of residential design concepts, code requirements, and project development.

Demonstrate understanding and appropriate use of required vocabulary.

Summative Assessment:

Design and create presentation drawings for a building that demonstrate an understanding of means of egress and flat plate concrete construction. The presentation will include a written description explaining the technical aspects of the proposal.

Draw and design a high-rise residential building that demonstrates consideration of aesthetic requirements, historical influences, structural systems, life-safety concerns, and residential building needs.

Demonstrate the ability to use software and technical drawing conventions to communicate a design solution effectively and professionally.

Maintain a design log explaining how the design evolved, including sources of information, research,

feedback, revisions, and critiques.

Design and create presentation drawings for a building that demonstrate understanding of means of egress, curtain wall systems, and steel construction. The presentation will include a written description explaining the technical aspects of the proposal.

The completed presentation will be included in an electronic portfolio.

The presentation will be evaluated using teacher- and student-designed rubrics.

Complete written quizzes and tests assessing understanding of course content and subject materials.

Write a response to one or more writing prompts. Possible prompts may include: 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 most appropriate 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.

3-D printer and supplies

Safety glasses

INTERNET resources and tutorials on how to use CAD software.

Teacher e-board.

SmartBoard use for teacher presentation and interactive lessons

SmartBoard use for student presentations.

Model making materials, dependant on projects that used.

Standards

TECH.K-12.1.1	Empowered Learner
9.2.12.CAP	Career Awareness and Planning
9.4.12.CI	Creativity and Innovation
L.SS.9–10.1	Demonstrate command of the system and structure of the English language when writing or speaking.
	There are strategies to improve one’s professional value and marketability.
TECH.K-12.1.1.a	articulate and set personal learning goals, develop strategies leveraging technology to achieve them and reflect on the learning process itself to improve learning outcomes.
9.2.12.CAP.2	Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.
	Innovative ideas or innovation can lead to career opportunities.
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.K-12.1.1.c	use technology to seek feedback that informs and improves their practice and to demonstrate their learning in a variety of ways.
9.2.12.CAP.3	Investigate how continuing education contributes to one's career and personal growth.
9.4.12.CI.3	Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
	Career planning requires purposeful planning based on research, self-knowledge, and informed choices.
TECH.K-12.1.2	Digital Citizen
9.4.12.CT	Critical Thinking and Problem-solving
	Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.
9.2.12.CAP.5	Assess and modify a personal plan to support current interests and post-secondary plans.
L.KL.9–10.2	Apply knowledge of language to make effective choices for meaning, or style, and to comprehend more fully when reading, writing, speaking or listening.
9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
9.2.12.CAP.7	Use online resources to examine licensing, certification, and credentialing requirements at the local, state, and national levels to maintain compliance with industry requirements in areas of career interest.
9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
TECH.K-12.1.2.c	demonstrate an understanding of and respect for the rights and obligations of using and sharing intellectual property.

L.VL.9–10.3	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 9–10 reading and content, including technical meanings, choosing flexibly from a range of strategies.
TECH.K-12.1.2.d	manage their personal data to maintain digital privacy and security and are aware of data-collection technology used to track their navigation online.
TECH.K-12.1.3	Knowledge Constructor
TECH.K-12.1.3.a	plan and employ effective research strategies to locate information and other resources for their intellectual or creative pursuits.
LA.RST.9-10	Reading Science and Technical Subjects
	Key Ideas and Details
TECH.K-12.1.3.c	curate information from digital resources using a variety of tools and methods to create collections of artifacts that demonstrate meaningful connections or conclusions.
L.VI.9–10.4	Demonstrate understanding of figurative language, word relationships, and nuances in word meanings, including connotative meanings.
TECH.K-12.1.3.d	build knowledge by actively exploring real-world issues and problems, developing ideas and theories and pursuing answers and solutions.
TECH.K-12.1.4	Innovative Designer
TECH.K-12.1.4.a	know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.
TECH.K-12.1.4.b	select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.
TECH.K-12.1.4.c	develop, test and refine prototypes as part of a cyclical design process.
9.4.12.GCA	Global and Cultural Awareness
9.4.12.GCA.1	Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political. economic, cultural) may work better than others (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.IL.IPERS.7, 8.2.12.ETW.3).
TECH.K-12.1.6	Creative Communicator
TECH.K-12.1.6.a	choose the appropriate platforms and tools for meeting the desired objectives of their creation or communication.
TECH.K-12.1.6.b	create original works or responsibly repurpose or remix digital resources into new creations.
TECH.K-12.1.6.c	communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models or simulations.
TECH.K-12.1.6.d	publish or present content that customizes the message and medium for their intended audiences.
9.4.12.TL	Technology Literacy
	Digital tools differ in features, capacities, and styles. Knowledge of different digital tools is helpful in selecting the best tool for a given task.
9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
	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.
	Collaborative digital tools can be used to access, record and share different viewpoints and to collect and tabulate the views of groups of people.

8.2.12.ED.1	Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
8.2.12.ED.2	Create scaled engineering drawings for a new product or system and make modification to increase optimization based on feedback.
8.2.12.ED.3	Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis.
8.2.12.ED.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.
	Engineering design evaluation, a process for determining how well a solution meets requirements, involves systematic comparisons between requirements, specifications, and constraints.
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).
ETW	Effects of Technology on the Natural World
	Development and modification of any technological system needs to take into account how the operation of the system will affect natural resources and ecosystems. Impacts of technological systems on the environment need to be monitored and must inform decision-making. Many technologies have been designed to have a positive impact on the environment and to monitor environmental change over time.
HS-ETS1	Engineering Design
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.
	Asking Questions and Defining Problems
	Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.
ETS1.A	Delimiting Engineering Problems
	Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them.
	Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities.
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
ETS1.C	Optimizing the Design Solution

Integrated Accommodation and Modifications, Special Education students, English Language Learners, At-Risk Students, Gifted and Talented students, Career Education, and those with 504s