Unit 3.2 Structures

Content Area: **Science**
Course(s): **Civil Eng & Arc**
Time Period: **Semester 2**
Length: **3 weeks**
Status: **Published**

Standards

CS.9-12.8.1.12.DA.6	Create and refine computational models to better represent the relationships among different elements of data collected from a phenomenon or process.
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.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.NT.1	Explain how different groups can contribute to the overall design of a product.
CS.9-12.8.2.12.NT.2	Redesign an existing product to improve form or function.
CS.9-12.DA	Data & Analysis
CS.9-12.ED	Engineering Design
CS.9-12.NT	Nature of Technology
SCI.9-12.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.9-12.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. Engineers use science, mathematics, and other disciplines to improve technology. Increased collaboration among engineers, scientists, and mathematicians can improve their work and designs. Technology, product, or system redesign can be more difficult than the original design. 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. The accuracy of predictions or inferences made from a computer model is affected by the amount, quality, and diversity of data. Engineering design evaluation, a process for determining how well a solution meets requirements, involves systematic comparisons between requirements, specifications, and constraints.

Enduring Understandings

- The purpose of a structure is to withstand all applied loads and forces and to transfer these forces to the Earth.
- 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.
- Design loads are often dictated by building codes.
- Structural design includes the determination of how structures disperse the applied loads.
- 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.

Essential Questions

- What is structural engineering?
- What is the function of a structure?
- How do you determine the loads that must be used to design a structure?
- In what ways is wind, snow, seismic, dead, and live loads similar to or different from each other?
- How does the design of a structure impact how loads are dispersed?
- How does the use of mathematics help in understanding and quantifying the forces and loads on a structure?
- How does the structure of a building affect the form and function of that building?

Knowledge and Skills

- Given a structural form, describe how the structural form resists and transfers applied loads.
- Use building codes and other resources to calculate roof loading to a structure and select appropriate roof beams to safely carry the load.
- Analyze a simply supported beam subjected to a given loading condition to determine reaction forces, sketch shear and moment diagrams, and determine the maximum moment resulting in the beam.
- Use beam formula to calculate end reactions and the maximum moments of a simply supported beam subjected to a given loading condition.
- Use structural analysis software to create shear and moment diagrams of simply supported beams subjected to a given loading condition.
- Calculate the deflection of a simply supported beam subjected to a given loading condition.
- Use building codes and other resources to determine the required floor loading and design a structural steel floor framing system (beams and girders) for a given building occupancy.
- Identify and describe the typical usage of foundation systems commonly used in commercial construction.
- Determine the loads transferred from a steel framed structure to the ground through a foundation.
- Size a spread footing for a given loading condition.
- Check structural calculations created by others for correctness.

Assessments

https://docs.google.com/document/d/1wR7bQF-8AQoRrt0g4C3hKja0yjwDjC9_BiAmONWbTcI/edit

Modifications

https://docs.google.com/document/d/1ODqaPP69YkcFiyG72fIT8XsUIe3K1VSG7nxuc4CpCec/edit

Resources

- 3.2.KT Structures.doc
- 3.2.1.P StructuralForms(Optional).doc
- 3.2.1.P.RU StructuralFormsRubric.doc
- 3.2.1.P IntroductionStructuralDesign.pptx
- 3.2.2.A Loads.doc
- 3.2.2.A LoadsandLoadPaths.ppt
- 3.2.2.A.SRb RoofDeckSpanLoadTable.pdf
- 3.2.2.A.SRc kSeriesJoistTable.pdf
- 3.2.3.A BeamAnalysis.doc
- 3.2.3.A BeamAnalysis.ppt
- 3.2.4.A BeamAnalysisShortCuts.docx
- 3.2.4.A BeamFormulas.ppt
- 3.2.6.A BeamDesign.docx
- 3.2.6.A BeamDesign.ppt
- 3.2.7.A KeystoneLibFloorFramingDesign(Optional).doc
- 3.2.7a.A KeystoneLibFloorFramingDsgnChkSht.doc
- 3.2.8.A FoundationTypes.doc
- 3.2.8.A CommercialFoundations.ppt
- 3.2.9.A SizingSpreadFooting.doc
- 3.2.9.A SpreadFootingDesign.ppt
- 3.2.10.A KeystoneLibrarySpreadFootingAnalysis.docx
- 3.2.10a.A KeystoneLibSpreadFootiAnalysisChkSht.doc