

Sustainability Infusion Project White Paper

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Title of Module/Activity

Module: Sustainability and Resiliency of Construction Materials

Course Name and Course Number

CIVE 378: Materials of Construction

Length of Module/Activity

The module is integrated into CIVE 378. The last three weeks of CIVE 378 focuses on the module.

Primary Learning Outcomes

Upon successful completion of this course, the students are expected to be able to do the following:

1. Understand the fundamentals of materials engineering, which includes the basic mechanistic properties of materials, environmental influences, and basic material classes.
2. Understand the basic characteristics of materials used in civil and construction engineering, which includes the characteristics of the primary material types used in civil and construction engineering.
3. Conduct experiments independently for the evaluation of materials.

Resilience and/or Sustainability Connections

Civil engineers have the responsibility to ensure that structures are both sustainable and resilient. This module focuses on the sustainability and resiliency issues of our construction materials.

Sustainability – the ability of our construction materials and our infrastructural system to be durable, reliable, and economically affordable during its entire lifetime. The production process should utilize waste materials and recycled materials, minimize energy consumption, reduce the carbon footprint and environmental impact.

Resiliency – the capacity of our construction materials and our infrastructural system to withstand and rapidly recover from all hazards.

Identify One or More of the Key Sustainability Competencies Addressed

1. Improve knowledge related to sustainability and resilience: Students will be able to distinguish between sustainability and resilience and explain the role that engineering plays in creating sustainable and resilient construction materials.

2. Connect discipline to societal challenges: Students will be able to connect the societal challenge of plastic waste and the benefit of utilizing plastic waste in construction materials.
3. Make use of authentic and credible data: Students will be able to conduct the life-cycle cost analysis and life-cycle assessment of construction materials with plastic waste incorporated.
4. Foster systems thinking: Students will be able to analyze the complexity and uncertainty of different approaches to tackle the plastic waste issues.

Instructional Strategies:

Part 1: Lectures on definition of sustainability and resilience, the environmental, economic and social aspects of sustainability and resilience of construction materials.

Think-pair-share Activity: Discuss how sustainability and resilience of construction materials are interrelated to societal challenges.

Part 2: Lectures on how to apply systems thinking to explain the sustainability and resilience problems of construction materials in a structured way.

Think-pair-share Activity: Discuss their interactions between economic, environmental, and societal dimensions.

Part 3: Lectures on how to identify the benefits of sustainable and resilient construction materials or processes by conducting the life-cycle cost analysis and life-cycle assessment.

Think-pair-share Activity: Discuss how to identify construction materials or processes that have a high carbon footprint.

Part 4: Lectures on how to propose sustainable alternatives to the construction materials or processes that have a high carbon footprint.

Think-pair-share Activity: Discuss how to evaluate environmental, economic and social impact of each alternative and find the best alternative.

Assessment Strategy:

1. Formative Assessment

- a) Quiz at the end of each class using Kahoot!, which is an online platform to conduct in-class quizzes.
- b) Homework to conduct the life-cycle cost analysis and life-cycle assessment of construction materials with plastic waste incorporated.

2. Summative Assessment

- a) Research paper on sustainability and resilience of construction materials.
- b) Anonymous teaching survey for the students to evaluate the effectiveness of the module.
- c) Students' feedback to the on-line course survey EvaluationKIT will be collected and analyzed.