Project Objectives and Goals

- Providing benchmark data to aid the evaluation of the life-cycle impacts of mid-rise office buildings
- Comparing the environmental impacts of four professionally-designed archetypes: different combinations of foundation, structure and envelope (FSE) assemblies
- Detailed operational energy modeling using the EnergyPlus framework

Background

- Minimizing environmental impacts over a building’s life cycle is critical to achieving sustainable communities
- Early design is the most critical step to improve construction’s sustainability, as the majority of important decisions have not yet been made [1].
- The implementation of sustainability assessment in early design is data- and effort-intensive [2]
- The first step is to provide a dataset on environmental performance of different designs. [3]

Numerical analysis

- Using ATHENA
- Energy modeling using integrated environment of OpenStudio (Sketchup+EnergyPlus)
- Charleston: Climate 3A (Hot & Humid)
- Ideal air load assumption in EnergyPlus

Data and Results

- Embodied VS. operational impacts:
  - Embodied impact by building assemblies
- Comparison of different LCA stages (Embodied Only):
  - Global Warming
  - Energy use
  - Aridification

Future studies

- Quantifying the impact of natural hazards on sustainability of the archetypes
- Evaluating the uncertainties associated with LCA assessment through repeated LCA assessment and different LCA programs

Acknowledgement

This research is supported by the US National Science Foundation, Division of Civil, Mechanical, and Material Innovation, through Resilient Sustainable Buildings Award #1455466.