VANDERBILT UNIVERSITY

HIGH-PERFORMANCE AND RESILIENT INFRASTRUCTURE DESIGN GUIDELINES

High-Performance and Resilient Infrastructure Design Guidelines

The following High-Performance and Resilient Infrastructure Design Guidelines (HPRIDG) support the Built Environment (BE) organization's vision to create spaces where Dare to Grow becomes possible. The BE organization creates, operates and maintains spaces for Vanderbilt's students, faculty, and staff to grow ethically, socially, safely and intellectually by providing a world-class built environment. The HPRIDG seek to integrate efficiency and resiliency concepts into the workflow of individual infrastructure projects to support overall university energy efficiency, energy independence, and resiliency goals. Design professionals and contractors should incorporate these guidelines into their projects to the greatest extent practicable.

Priorities and Approach

Vanderbilt University is a globally recognized leader in resilient and sustainable building and is committed to resiliency by creating an energy efficient and optimized future with an emphasis on connectivity, collaboration, resiliency, adaptability, and resourcefulness. Every infrastructure project should make all reasonable efforts to follow industry-leading resilient and high-performing building standards that adhere to the following:

- Reduction of utility consumption and cost.
- Reduction of pollution and waste generation and costs.
- Increase in onsite efficient energy generation and energy independence.
- Increase in adaptive and resilient infrastructure, systems, and functions.
- Increase in green spaces across campus.

Integrating resiliency in the earliest stages of the project is imperative. Integrated design from the beginning allows for achievement of the optimal benefits of resiliency. Adding such considerations late in the design and construction process typically involves added cost and re-work, while also compromising the benefits. A collaborative approach should look at the entire life cycle of the project and aim to include integrated design processes such as:

- Early performance-based energy modeling and analysis;
- A thematic charette, as applicable;
- Determination of Energy Use Intensity (EUI) and Water Use Intensity (WUI) targets;
- Renewable energy assessment to determine options for the site, as appropriate;
- An environmental and resiliency risk analysis with mitigation strategies, and
- Development of the Owner's Project Requirements (OPR).

High-Performance Infrastructure Benchmarking

Though the potential scope and impact of Vanderbilt's infrastructure projects vary widely, projects are expected to apply these resilient and high-performance design guidelines whenever practical. As such, all projects should employ the **LEED Gold certification standards** (or equally acceptable and applicable standards as authorized by VU) **as baseline guidance for benchmarking purposes** with an evaluation of the possible application of LEED Platinum, Living Building petal, Net Zero, WELL, Fitwel, Zero Waste certification standards and/or other resilient and high-performing building standards to the project, whenever feasible. Though formal certification may not be desirable, the design expectations outlined in these performance standards are expected as guideposts for the full execution of VU projects. While all projects should evaluate their design strategies and goals for energy efficiency, energy savings, resource conservation, resiliency, and overall stewardship, project evaluations considering guidance outside of LEED should be reviewed with the BE Resiliency team before implementation.

Additional resiliency-related design elements and specifications may be found in other sections of the A&E guidelines. Any potential conflicting guidance should be resolved with the BE Resiliency team.

Resilient and High-Performance Infrastructure Design Elements and Benchmark Metrics

Element	Design Guideline	Benchmark
Energy		
Energy Modeling	Conduct energy modeling that aims for energy efficiencies	At least 50% below ASHRAE 90.1-2016 or 20% below ASHRAE 100-2024, as appropriate for the project
Metering	Evaluate submetering and installing smart meters for all utilities, when appropriate by project scope	New construction or major renovation projects should separately meter all utilities; other project types should evaluate feasibility
Energy Use Intensity (EUI)	Projects should align the EUI of various building types with industry accepted targets for near-term projects (2025-2035) and long-term projects (2035-2050)	At least 50% below ASHRAE 90.1-2016 or 20% below ASHRAE 100-2024, as appropriate for the project
Energy Conservation	Design decisions regarding technology, equipment, lighting, heating and cooling should be made with the primary goal of saving energy balanced with ensuring a safe environment for the occupants	At least 50% below ASHRAE 90.1-2016 or at least 20% below ASHRAE 100-2024, as appropriate for the project
Equipment & Products	Consider the usage of high-performance, energy efficient electrified equipment, whenever feasible	Use Energy Star rated or best-in-class energy efficient equipment wherever possible
Water		
Water Management	Projects should aim to minimize overall water demand	At least a 30-50% reduction from LEED v5 minimum water efficiency requirements
Potable Water and Water Use Intensity (WUI)	Projects should aim to minimize the demand for potable water	Aim for 17 – 24 gal/sq ft WUI
Outdoor Water	Projects should aim to reduce outdoor water usage	At least 50% reduction from peak watering month
Equipment & Products	Use best-in-class water efficient equipment	Products should have the WaterSense label or be best-in-class water efficient equipment wherever possible.
Waste		
Recycling & Composting	Projects should prioritize waste minimization, reuse, recycling, and composting of waste to support achievement of Zero Waste goals	At least 65% of waste should be diverted from landfills
Construction and Demolition	Projects should incorporate waste reuse and source reduction design strategies	Divert at least 75% of the total construction and demolition materials from landfills
Material Selection	All projects must use energy and resource-efficient materials to the maximum extent possible	Use products that have an Environmental Product Declaration (EPD) or similar third-party verified quantification of environmental impacts of a product across its entire lifecycle

Embodied Carbon	Projects should identify and calculate the primary contributors to net embodied carbon (collectively >80%) during construction and operation	At least a 15% reduction in Embodied Carbon Intensity (ECI) baseline per building type as outlined on p.26 of Carbon Leadership Forum Embodied Carbon Benchmark Report
Materials of Concern	Reduce concentrations of chemical contaminants that can damage air quality and the environment, and protect the health and productivity of installers and building occupants	Use materials on the building interior that meet the low-emitting criteria as set by LEED v4.1
Outdoor Spaces		
Green Spaces	Projects should preserve and activate the outdoor environment by improving outdoor thermal comfort as well as emphasizing protection and restoration of plants, trees and natural habitat on campus and incorporating resilient landscape materials	Projects should provide outdoor space that is at least 30% of the total site area. At least 25% of that outdoor space must be vegetated (turf grass does not count) or have overhead vegetated canopy
Light Pollution & Energy	Outdoor lighting should be designed in a manner to ensure maximum optimizations, efficiency, safety, and aesthetics while avoiding light pollution to the largest extent practicable	Meet uplight and light trespass requirements as set by DarkSky standards
Outdoor Noise	Projects should reinforce the use of outdoor spaces by minimizing ambient noise levels and remaining within acceptable maximum exterior noise levels	Maximum exterior noise level (Lmax) should not exceed existing ambient levels and should not exceed 60 dBA
Resiliency		
Adaptation & Preparation	Project design and materials selection should be based on the project life cycle that consider extreme weather events possible in the project location	Conduct a baseline resiliency assessment to identify vulnerabilities and resilience measures for the project, including utility resiliency measures
Extreme Weather and Catastrophic Event Preparedness and Mitigation	Projects should incorporate systems, materials and strategies that reduce or mitigate extreme weather and catastrophic event impacts, such as tornadoes, frozen pipes, power outages, extreme temperature shifts, poor indoor air quality, mold growth, etc.	Conduct a baseline assessment to identify vulnerabilities and mitigation strategies. Implement a well-insulated building envelope to minimize heat transfer that incorporates mitigation strategies such as building entry vestibules, etc.. Meet or exceed International Energy Conservation Code (IECC) 2021 requirements for R-value and U-factors, such as fenestration U-factors of 0.30 or lower

Applicable Standards

Standards such as ASHRAE 90.1, ASHRAE 100, LEED, Energy Star, IECC, Metro codes, federal and state requirements, and others are subject to periodic updates. Project teams should apply the most recent applicable standard as long as the set benchmark is met or exceeded. Such changes should be evaluated with the BE Resiliency team.