

MISITES

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LETTER FROM THE PRESIDENT

Greetings ASLA members!

On behalf of the Michigan Chapter ASLA Executive Committee and the MiSITES Editorial Board, we are excited to bring you this latest chapter of MiSITES. We have a lot to catch you up on.

Earlier this month, we received news that the Biden administration has announced that **the profession of landscape architecture has officially been designated a STEM discipline**. More specifically, the landscape architecture CIP code (04.0601) has been added to the Department of Homeland Security's (DHS) STEM-designated degree program list. DHS received requests from 120 unique fields of study to be added to the 2023 list. Landscape Architecture was one of 8 disciplines selected! This designation will broaden the talent pool for university landscape architecture programs. In addition, as a STEM discipline, more young people will be introduced to the profession.

The Michigan Chapter is also working to introduce more young people to the profession by hosting the second annual **"Placemaking Through Landscape Design" Summer Camp at Lawrence Tech University** this month. There are 8 high school students enrolled for the week long summer camp that is run by volunteer chapter members, working to grow our ranks by introducing pre-college students to the profession.

Members of our Executive Committee are putting the finishing touches on a **"Continuing Ed 101" webinar that we will be rolling out soon**. This will be an informational webinar available to our members and will include answers to FAQ's regarding the recently enacted continuing education licensure requirements in the State of Michigan.

We are also putting the finishing touches on our annual **Conference on Landscape Architecture** which will take place on **October 12 in Bay City, Michigan**, at the Double Tree Hilton. We have a full slate of exciting content planned for the event. More information coming soon.

Later this year, the Michigan Chapter ASLA Foundation will be hosting a **fundraiser for the BIPOC student scholarship program**. A silent auction is in the works that will coincide with the annual conference in October. We are looking for donations to be included in the auction. Items can include gift cards, original artwork, timeshare allotments, handmade products, store bought products or whatever you think someone might bid on. Do you have an item for consideration? Do you know someone who does? Please contact president1@michiganasla.org.

Have a great summer and I look forward to seeing you at the annual conference!

Kyle Verseman, ASLA
President, Michigan Chapter ASLA

ON THE COVER: Green stormwater infrastructure flanks the drives and parking areas and anchors smaller greenspaces, providing habitat, cleaning stormwater, and serving as a recreational amenity. Image Credit: McClellan Design.

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SHARE AN IDEA!

We're currently filling our 2024 MiSITES editorial calendar. If you would like to contribute or suggest a topic or project to cover, please email: SITESpublication@michiganasla.org.

STUDYING FOR THE LARE?

To sign up for our LARE study groups, please email education@michiganasla.org.



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VERIDIAN AT COUNTY FARM: PUSHING THE BOUNDARIES OF SUSTAINABILITY

Susan Noblet, PLA | InSite Studio

The Veridian project is currently under construction in Ann Arbor near the intersection of Platt Road and South Huron Parkway, at the southeast corner of the 130-acre County Farm Park. The project is the outcome of public incentives, community advocacy, and a development team that used creative problem solving to push the boundary of what it means to develop a “sustainable” neighborhood when local initiatives aren’t always aligned with code and ordinances.

Veridian is lauded as being one of the first solar-powered, net zero communities in the United States and has been selected by the Earth Institute at Columbia University as a model of the United Nations’ sustainable development goals. The project began with a developer RFP issued by Washtenaw County in 2016. The county’s goals to provide affordable housing, while prioritizing sustainable design, neighborhood integration, and green technologies, were identified through the formation of an advisory council that conducted charrettes throughout the community. Washtenaw County officials concluded that the 13+ acres of land that had once housed the County’s Poor Farm and later its Juvenile Detention Center offices should be developed in accordance with these new goals. The joint proposal by developers THRIVE Collaborative and Avalon Housing was selected, and they were offered below-rate purchase agreements for the vacant parcel.

PROGRAMMATIC OBJECTIVES

The THRIVE and Avalon neighborhoods have discrete funding and ownership; however, programmatically and aesthetically, they will function as one community. THRIVE’s Veridian at County Farm Park development is located on the southern nine acres of the site and includes five different housing types, from studios to 4–5 bedroom homes. Avalon’s Grove development to the north

comprises 50 affordable housing units, 30 of which will be reserved for those transitioning from homelessness with less than 30% of the average median income, and 10 of the 30 are earmarked for young adults facing housing instability. “The Grove at Veridian will be affirming for people most impacted by homelessness, including young people who deserve stable housing at a time in their lives when they should be able to focus on things other than survival. Real change can happen when people come together with a shared vision, as our community has here,” said Aubrey Patiño, Avalon’s Executive Director.

SITE DESIGN

The design team was challenged on how to unite the two developments, because funding and revenue sources for affordable housing makes a more integrated approach unfeasible.

One solution was to jog the property line, creating a more varied interface between each site. This property boundary bisects a large park and flanks the Grove Community Center, which further knits the projects together and allows varied housing to face the same central greenspace. Public amenities are shared throughout the sites, from gathering spaces, parks, and greenways, to an amphitheater and multi-purpose community space in a restored 1860’s barn. There is a planned retail component in the Honeylocust Farmstop, a year-round farmer’s market that will be operated on the Argus model, and a designated area for community garden plots.

Architecturally, the building designs between the two developments are cohesive, featuring large porches that front pedestrian greenways, similar cladding materials, and building styles. Drives, stormwater infrastructure, and utilities are integrated across the two sites, functioning as a whole.

CIRCULATION AND TRANSPORTATION

Veridian and The Grove's location in proximity to the Washtenaw Avenue transit corridor is ideal for a pedestrian-oriented neighborhood. AAATA's bus route offers a quick ride to Ypsilanti, downtown Ann Arbor, and the UM campus, while groceries, retail, and a recreation center are a short walk away. The community's design also capitalizes on connections to the adjacent County Farm Park's trails and bikeways and provides an internal pedestrian-oriented circulation system that connects residents to shared gathering spaces.

Homes face these pedestrian routes, while the car is relegated to the back of the buildings; garages are provided in some units, but are designed such that they can be converted into living spaces. Parking is limited both on- and off-street, as the project seeks to provide streets that operate similar to the Dutch woonerf—those that encourage multiple uses and are not designed for the utility of cars alone. To do this, the project team classified the entire street system as a “parking lot,” making it possible to reduce the roadways from 26 feet—the narrowest width currently allowed per Ann Arbor code—to 20 feet, the typical width of a parking drive aisle. THRIVE is also investigating the potential for car- and bike- share programs on site, and is providing amenities to community members, such as covered bike parking and a bike maintenance barn, that encourage multi-modal transit.

LANDSCAPE AND STORMWATER DESIGN

The topography of the site slopes decidedly from north to south, and as a result, the stormwater strategy consists of a dispersed system of planted cells that are threaded throughout both projects, terminating in an underground detention structure beneath a landscaped area at the southern border of the site. The project's integrated green stormwater infrastructure allows it to be resilient in the face of climate change and the increased severity of storm events. However, this approach proved challenging due to local code, which requires detailed calculations for each separate drainage area, favoring a typical end-of-the-line detention structure. Though the high water table and heavy clay soils discourage traditional infiltration methods, the interconnected stormwater cells provide detention for a portion of the site's stormwater volume. These cells will be planted with native species and cultivars, containing a rich and varied plant palette that contributes to species diversity



amidst the site's unconventional landscape. Stormwater cells flank the drives and parking areas and anchor smaller greenspaces, providing habitat, cleaning stormwater, and serving as a recreational amenity. The underground detention system detains the remainder of the 100-year storm volume, so the site does not over-burden city infrastructure during peak events.

Prior to construction, the parcel had very little ecological quality beyond a few landmark trees, as invasive species had colonized what had once been farm fields and was subsequently an extensive mowed lawn. There is a high-quality oak-hickory remnant forest in County Farm Park, but much of the adjacent park's acreage is dominated by woody invasives. The THRIVE and Avalon projects will greatly increase the site's biodiversity, though nearby invasives will be an ongoing maintenance issue for Veridian—a project that encompasses shortgrass prairie, native plantings, unusual native fruit and nut trees, and minimal lawn. A stand of fifty-year-old honey locusts acts as a central



The Grove by Avalon Housing
Veridian by Thrive Collective

County Farm Park

Platt Rd

Grove Community Center

Community Park

Preserved Honey Locusts

Green Stormwater
Infrastructure Cells

Pedestrian Circulation

Farmhouse &
Honeylocust Farm Stop

Preserved Bur Oaks

Multi-use Parking
& Event Space

Bike Shed

Barn

Amphitheatre

Community Garden



organizing feature, anchoring various home typologies and serving as a focal point among connected pedestrian walkways. Protecting the group of century-old bur oaks within the Platt Road right-of-way was achieved through a series of negotiations with the City of Ann Arbor. A retaining wall was needed to provide accessible sidewalks while keeping the critical root zone of the trees undisturbed. Furthermore, to skirt the trees, the sidewalk would need to veer inside the property. In the end, THRIVE provided the city an easement for the sidewalk and assumed responsibility for the ongoing maintenance of the retaining wall with a legal agreement. Without the time and dedication of the THRIVE team, these oaks would have surely been cut down to satisfy well-meaning city regulations.

SUSTAINABLE ENERGY AND MATERIALS

One of the greatest accomplishments of the Veridian project is the work to decrease operational carbon footprints across the board, and this required careful coordination between disciplines. Both developments will be all-electric, while Veridian is working with DTE to launch one of the first solar smart grids, powered by rooftop solar. The Veridian project will be “net zero,” which means it will produce more energy than it uses, with 100% of the energy produced by non-combustible sources. A compact battery will be available to homeowners for power storage and EV charging will also be available. Housing orientation and tight building envelopes are both critical for the success of solar powered homes. Another important factor is the coordination of shade trees for solar access—smaller native understory trees have been placed to the south of the units and large canopy trees are carefully sited to provide morning and evening shade without conflicting with solar panel productivity. Heating and cooling will be provided by ground source heat pumps. Currently geothermal wells are being installed on site with between 300-450 feet of wells per unit.

Another core tenant of the Veridian project is the reduction of embodied carbon, that carbon which is inherent in the manufacture, shipping, and assembly of construction materials. The THRIVE team continues to question typical building components and look for opportunities for innovation. Project team members are utilizing the EC3 calculator (Embodied Carbon for Construction Calculator)





which allows them to accurately assess the embodied carbon in material components by uploading a Revit model. The model allows for the side-by-side comparison of materials so that more sustainable choices can be made. For instance, when the development team discovered that one cubic meter of cast-in-place concrete is equal to 349 kg of embodied carbon, they decided to propose as little concrete as possible in roadways and walkways. This has proved no small feat, as city code requires that driving surfaces be either asphalt, concrete, or porous pavers. A typical porous system isn't feasible, as both the underlying utilities and the site's high water table and heavy soils inhibit infiltration. The project team has been in conversation with Ann Arbor officials and is currently designing a semi-porous system using a product called Ecoraster, which is a recycled plastic geo-grid that is filled with local aggregates. The product holds up to the heavy traffic of recycling, garbage, and fire trucks, can be easily plowed in winter, and can be quickly cut or disassembled for future construction access to the utilities below. The system will be lined so that water does not compromise the integrity of the site utilities. Rather than being directed through a typical curb cut, stormwater will flow through the aggregate and geo-grid system, hit the liner, and move laterally into adjacent planted stormwater cells. The modularity of the Ecoraster system allows for varied infill components, such as pavers and truncated domes at accessible crossings, and discrete colored and textured aggregates that will differentiate pedestrian walkways from the roadway surface. The system will provide additional benefits beyond carbon reduction, such as a reduction in the urban heat island effect and the use of less roadway salt in the winter.

The Veridian at County Farm Park project has attracted much press and attention as well as garnered high praise, but being a forerunner certainly isn't easy. The success of the project rests on the persistence and innovative ideas of the project team in close coordination with city and county officials. •

VERIDIAN PROJECT TEAM

THRIVE Collaborative: Project Development
Union Studio: Architecture and Site Layout
InSite Design Studio: Landscape Design
Midwestern Consulting: Civil Engineer
Biohabitats: Stormwater Concept
McClellan Design: Conceptual Renderings

.....
All images courtesy McClellan design.

Image 1: Trillium Trail Bioswale (page 4)

Green infrastructure and native plantings activate pedestrian walkways.

Image 2: Veridian Morning at the Park (page 6)

Families often reserve the space for reunions and birthday parties, utilizing the grills and picnic tables.

Image 3: Veridian Master Plan (page 7)

The Veridian project encompasses over 13 acres at the southeast corner of County Farm Park in Ann Arbor.

Image 4: Neighborhood Morning at the Park (page 9)

Site Plan. Improvements at the heart of the 12-acre park included a gathering space, nature-based play, outdoor classroom, and restroom facility.

Image 5: Locust Tree Park (page 10)

A group of existing honey locusts will serve as a focal point and gathering place among connected pedestrian walkways.



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featuring:

Phillip Fernberg, Utah State University



Wicked Problems, Wicked Partnerships:

Can artificial intelligence help landscape architects to fulfill our ambitions?



MICHIGAN'S 2023 LAF OLMSTED SCHOLARS

The LAF Olmsted Scholars Program recognizes and supports students with exceptional leadership potential who are using ideas, influence, communication, service, and leadership to advance sustainable design and foster human and societal benefits. Each year scholars are selected by their academic institution.



ISABELLA SHEHAB - UM

Izzy is a recent graduate of the University of Michigan's School for Environment and Sustainability, where she was pursuing a Master of Landscape Architecture and a Master of Science in Ecosystem Science and Management. Izzy is passionate about expanding the availability of greenspace in urban settings to create more equitable, healthy cities. Starting next fall, Izzy plans to continue her education at SEAS, beginning doctoral study. Her doctoral work will consist of conducting research that contributes to landscape architecture's support of incorporating ecological function and climate change resilience into human-centric spaces.



JORDAN WHITE - MSU

Jordan is currently pursuing a dual degree in Landscape Architecture and a Master's degree of Environmental Design at Michigan State University. Her dedication to her studies stems from a deep-rooted desire to make a positive impact on her community. In her research, Jordan focuses on the application of green infrastructure within residential neighborhoods in Southeast Michigan. Through this research, she aims to quantify the environmental, economic, and social benefits of implementing these systems. By doing so, she seeks to raise awareness among individuals about the vital role that landscape architects play in developing nature-based solutions to combat climate change.

Great Lakes Region Climate Action Seminar

Collaborating on Climate: partnerships among
landscape architects, educators and communities



2023 GREAT LAKES REGION CLIMATE ACTION SEMINAR RECAP

Lisa DuRussel, MiASLA VP of Education

MiASLA was pleased to support the 2023 Great Lakes Region Climate Action Seminar, a multi-chapter event held virtually on February 9-10, 2023. The event aimed to explore and expand landscape architecture's role regarding climate change impacts occurring in urban and natural systems across the Great Lakes Region. Host Chapters included New York Upstate, Ohio, Michigan, Illinois and Minnesota chapters.

The chapter would like to recognize members Lisa DuRussel, Patrick Judd and Alison Marusic for their participation on the seminar planning committee as well as the following seminar sponsors: Parkitects, Victor Stanley, Craig Bergmann Landscape Design, Maglin Site Furniture, Unilock, Midwest Groundcovers, CHA, and Joy Kuebler Landscape Architecture. The two-day seminar offered CEU's for both landscape architects and planners.

The theme of the 2023 seminar was *Collaborating on Climate: Partnerships among landscape architects, educators, and communities to strengthen climate action*. The Great Lakes Region is one of the most significant ecosystems on Earth, containing 95% of freshwater in North America and home to over 50 Million people in the United States. Although the region's climate is considered less volatile than other regions and coastlines of the US, the Great Lakes are not exempt from the impacts of climate change. This seminar brought together landscape architects, educators, and communities to talk about the pressing challenges facing our region and to unpack how critical partnerships are taking shape to address new challenges and opportunities.

HIGHLIGHTS FROM DAY 1

The seminar kicked off with a keynote address by Joyce Coffee, President of Climate Resilience Consulting out of Chicago, IL who presented her work titled "Weathering the Storm: Resilience to Climate Change." Highlighting risk assessment to net zero carbonization, this talk identified how both mitigation

and resilience are needed now in the face of inevitable climate change.

Education sessions from day one included Community Collective: Enhancing Equitable Access and Climate Resilience on the Great Lakes from presenters Jason Stangland and Jake Jenkins of SmithGroup with Bridget Brown of the Great Lakes and St. Lawrence Cities Initiative. Best practices for shoreline stabilization were presented along with community resilience, offering a wider variety of community access to recreational opportunities along lakefronts. Case studies in Euclid, Ohio and Cuyahoga County, Ohio showed how these strategies have been successfully applied.



Keynote speaker Joyce Coffee opened the conference. (Image - from a different event - courtesy Climate Resilience Consulting.)

A combined session to learn from two shoreline coastal engineering projects followed, the first titled Illinois State Beach Park Natural Shoreline; from presenters: Jack Cox of Edgewater Resources and Laura Verden from the State of Illinois. The presenters showed how they were able to stop the shoreline's retreat while preserving and creating new habitat through a unique approach: mimic and leverage nature's natural processes to achieve sustainable results rather than employing brute tactics and solutions.

This presentation was followed by Peter Truax of Baird Inc. with Marquette, MI Lake Superior Shoreline Restoration Project which focuses on the design for the restoration of 4,000 feet of Lake Superior shoreline and 12.5 acres of sandy dune and swale habitat. The site is also challenged as a previous failing stone revetment shoreline protecting a demolished chemical plant which contains a contaminated groundwater plume.

The afternoon session, Collaborative Partnership for Visualizing Sustainable Forest Management to Mitigate Climate Change in the Great Lakes Region featured presenters Aiden Ackerman of SUNY-ESF, and Lauren Cooper, Daphna Gadoth-Goodman, and Emily Esch of MSU. This session presented a collaborative partnership which creates science-informed visual media to communicate and educate communities on the principles and benefits of sustainable forest management throughout the Great Lakes Region.

HIGHLIGHTS FROM DAY 2

The second day of the seminar began with an opening session that highlighted the efforts of the ASLA Climate Action Plan/Government Affairs in the Great Lakes, featuring presenters Scott Bishop of Bishop Land Design, Aida Curtis of Curtis Rogers, and Joy Kuebler of Joy Kuebler Landscape Architecture. The ambitious plan seeks to transform the practice of landscape architecture by 2040 through actions taken by ASLA and its members focused on climate mitigation and adaptation, ecological restoration, biodiversity, equity, and economic development.

Education sessions from day two included Irishtown Bend Park: A Community Joins Forces to Build Climate and Social Resiliency from presenters Scott Cataffa of Plural Studio, Tiffany Graham of LAND Studio, and Caroline Tait of Holden Arboretum and Gardens. This project showcases how various

government agencies, funders, and community groups can come together around shared values and goals for climate action.

A combined session to learn from two climate planning projects followed, the first titled Chicago Regional Action Planning, A Multi-Level Approach to Regional Resilience from speakers Edith Makra of the Metropolitan Mayor Caucus and Ted Haffner of Chicago Wilderness Alliance Climate Initiative. This plan was created with a broadly collaborative approach to leverage knowledge, momentum, political will, and partnerships.

The second, titled A Resilient Toolkit for Michigan Communities, from Kathleen Duffy, Alicia Adams, and Catherine Clark of SmithGroup, and Pablo Majano of the Michigan Economic Development Corporation (MEDC) taught attendees about their resiliency toolkit which was created as part of MEDC's pandemic recovery strategy to assess their resiliency approach holistically across people, place, infrastructure, and economy.

The afternoon session, The Sustainable Square Mile - Healing a Community with GOD (Garden Oriented Development) featured presenters David Yocca of Green Infrastructure Foundation and Naomi Davis from Blacks in Green NFP. Their project used a collaborative team to project, model, quantify, and illustrate the potential to transform West Woodlawn as a model Net-Positive water, energy, and nutrient exchange (food) community through a comprehensive application/integration of best practices in Living Green Infrastructure. This session provided an overview of the Sustainable Square Mile™, the Green Infrastructure Charrette program, performance benchmarks, modeled economic outcomes, and community engagement strategies.

The seminar concluded with a panel discussion with all invited presenters.

Attendees of the seminar were from the Great Lakes host states, as well as Arkansas, California, Connecticut, Florida, Georgia, Indiana, Pennsylvania, Texas, Washington, Wisconsin and Ontario. Attendance was up 40% compared to the 2021 seminar. Thank you to all who attended.

Stay tuned for the next Great Lakes Climate Action Seminar to be held in late 2024 or early 2025. •



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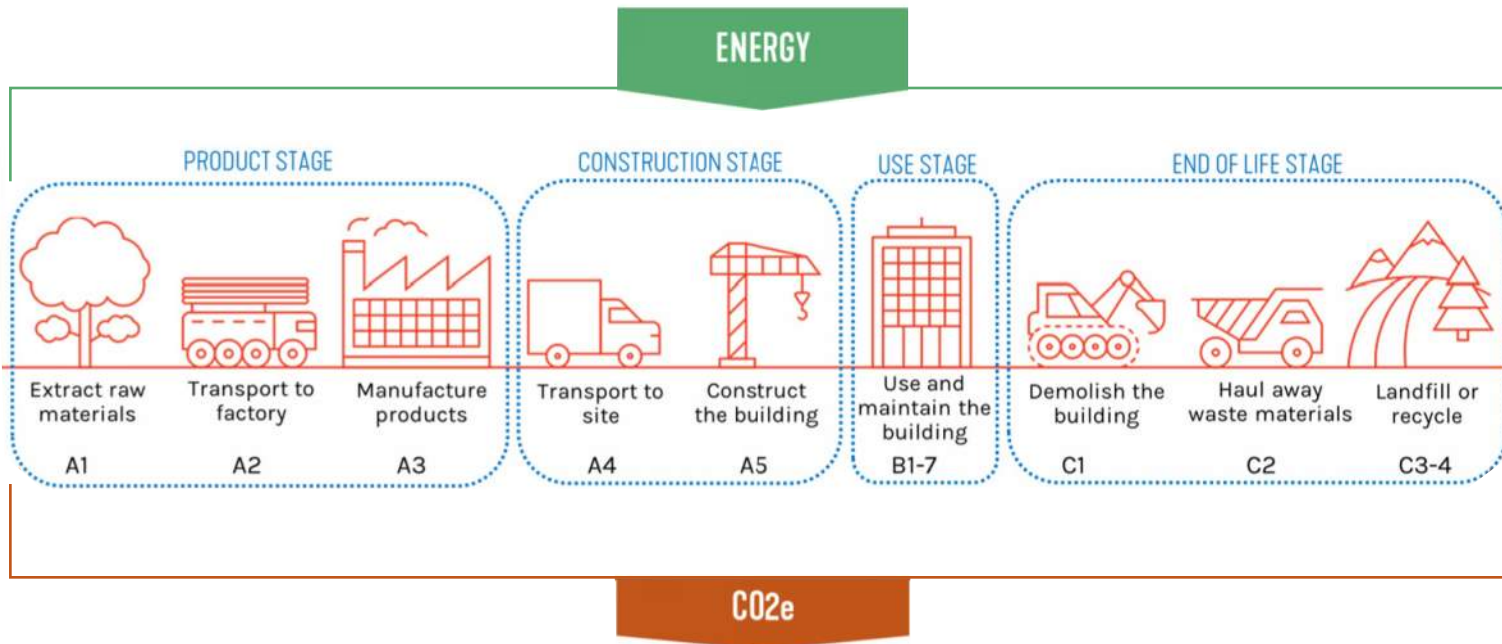


Figure 1. Embodied Carbon Life Cycle

All graphics by SmithGroup

THE ROAD TO ZERO EMBODIED CARBON ON SITE DESIGN PROJECTS

Eva Koester, PE | SmithGroup

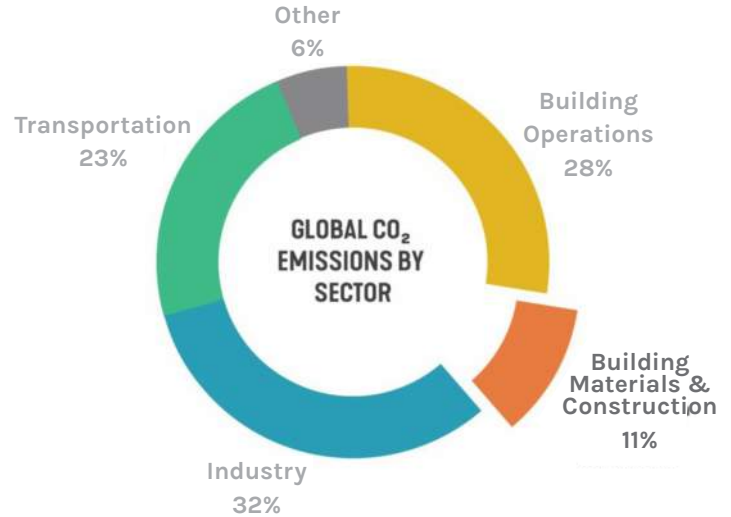
UNDERSTANDING EMBODIED CARBON

With an urgent climate crisis looming, architects, landscape architects, and engineers have an important role to play in mitigating climate change. One of the main avenues for landscape architects to do so is by reducing the embodied carbon of the materials used on site design projects.

Embodied carbon is a measurement of the greenhouse gas emissions created by the manufacturing, transportation, installation, maintenance, and disposal of materials (Figure 1). Embodied carbon from materials used by the building materials and construction industry accounts for 11 percent of global carbon emissions and could make up 60% of emissions by 2050 if trends continue (Figure 2).

Additionally, in order to limit the planet's warming to below 1.5 degrees Celsius — a critical threshold to avoid the most serious impacts of climate change — significant action must be taken in the next decade. The sooner and more rapidly we reduce our emissions, the better our chances of staying below 1.5 degrees Celsius change. Compared with operational carbon, which occurs over a project's lifetime, embodied carbon emissions occur upfront during the project's installation. Therefore, reducing embodied carbon in projects now is even more impactful than operational carbon, given the urgent need to cut carbon emissions in the next decade.

Through SmithGroup's Exploration Grant program, I was able to explore this important topic to determine how to measure and reduce the embodied carbon of site design projects. The following summarizes my process and findings.



Source: ©2018 2030, Inc. | Architecture 2030
Data Source: Global Alliance for Buildings and Construction
2018 Global Status Report

Figure 2. Emissions by Sector



Figure 3. Functional Unit Definition

MEASURING EMBODIED CARBON WITH LCA

Embodied carbon of site and infrastructure projects can be measured with the use of life cycle assessment (LCA) modeling tools. These tools can be used to identify carbon 'hot spots' in site design projects (see more on hot spots below), compare material options, and determine low-carbon product types to specify. Some tools can also estimate the carbon sequestered by the proposed planting in a site design project and compare that with the carbon footprint of construction.

To get started, there are several free LCA tools available, including:

- Pathfinder from Climate Positive Design (app.climatepositivedesign.com)
- EC3 from Building Transparency (buildingtransparency.org)
- Athena Pavement LCA from Athena Sustainable Materials Institute (athenasmi.org)

LCA CASE STUDY

To test the evaluation of embodied carbon for site projects, I utilized a case study site: a landscape for a new building higher education project. Using an LCA tool, I modeled the embodied carbon of a standard concrete sidewalk as compared to the embodied carbon of a paver system for the hardscape in the team's site design. The analysis used a common baseline of comparison, called a functional unit. In this case, the functional unit for each alternative was the hardscape. There are a few factors to consider when defining the functional unit, to ensure the comparison is apples-to-apples (Figure 3).

- **Function:** Ensure that each alternative represents the same function. In the study, the additional stormwater created by using a concrete sidewalk needed to be detained on site. To ensure an equivalent function in the comparison, the embodied carbon of the additional stormwater detention required for the concrete pavement was included in the carbon analysis.
- **Quantity:** Ensure that the quantities selected for each design alternative have the same function. For example, the designs were compared using the same square feet of final hardscape, rather than the same volume of materials, to account for the different depths required for different pavement sections.
- **Quality:** Ensure all design alternatives meet the quality standards required of the design. The study used the client's standard details and specifications to determine the pavement sections for each alternative.
- **Duration:** Compare your design alternatives over the entire design life of the project. Both design alternatives had the same design life of the project at 60 years, so replacement did not need to be included.

With the functional units defined, I established an inventory of quantities, split out by material type for each alternative, to be input into my LCA modeling software. In the LCA tool, I was able to map each material type to a corresponding impact built into the software. The software then multiplied the inventory by the impact to calculate the total embodied carbon for each alternative (Figure 4).



Figure 4. Embodied Carbon Equation

Through this analysis I was able to determine that the concrete sidewalk design had a much lower embodied carbon than the paver design, even when accounting for the additional stormwater detention that would be required. To minimize the embodied carbon even further, the client agreed to waive their standard by reducing the concrete profile thickness from 8" to 6" and specifying 40 percent minimum supplemental cementitious materials. Overall, our final concrete pavement design was 124 tons of CO2 equivalent lower than the initial proposed paver design (Figure 5).

LOW-CARBON BEST PRACTICES

So, how can we effectively lower embodied carbon on site projects? Even when running an LCA isn't possible, there are several best practices that should be used to reliably lower embodied carbon:

- **Build less.** The lowest embodied carbon build is no build at all. Extend the life of existing infrastructure or right-size the proposed design to avoid unnecessary construction.
- **Build to last.** Consider resiliency, flexibility, and longevity in the design. Extending the design life will avoid the future need for new construction.
- **Build efficiently.** Minimize the material used for the given design and design for efficient construction by minimizing earthwork.
- **Use low-carbon material types.** Swap high-carbon material types such as concrete for low-carbon material types such as wood when possible.

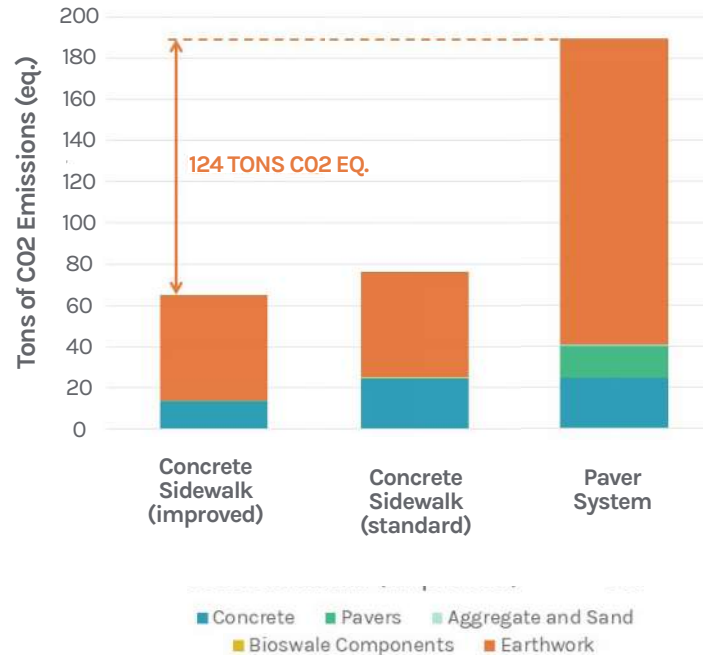


Figure 5. Case Study Findings

- **Specify low-carbon products.** When using high-carbon material types, specify the lowest-carbon alternative possible, for example specifying minimum percent supplemental cementitious material for concrete pavement.

EMBODIED CARBON HOT SPOTS

On site design projects, analysis should be focused on concrete, asphalt, and earthwork, which tend to drive the carbon emissions for the project overall. Manufacturing and transport of concrete and asphalt typically make up the majority of emissions on roadway projects, while the construction phase only accounts for 4 to 14 percent of total emissions (Cass and Mukherjee, 2011; Kayo et al., 2015; Noland and Hanson, 2015). However, when emissions associated with earthwork is included, the construction phase can quickly become the largest emitter. In some earthwork-intensive roadway projects, the construction phase can account for 62 to 85 percent of total emissions (Barandica et al., 2013).

As my case study findings reveal, earthwork was the largest contributor to embodied carbon for each alternative (Figure 5). It was the biggest contributor for the paver system alternative, as that had a thicker section profile requiring more extensive and deeper excavation.

Some design best practices for lowering the embodied carbon from these hot spots are as follows:

CONCRETE

- Avoid overdesigning concrete elements with excess redundancy to reduce volume.
- Use higher strength concrete in order to use less concrete overall.
- Replace concrete with other lower-carbon materials where possible.
- Specify supplemental cementitious materials to replace Portland cement.
- Utilize carbon mineralization technology, such as carbon cure, to sequester carbon in concrete.

ASPHALT

- Avoid overdesigning asphalt elements with excess redundancy.
- Minimize road width and parking stall size to minimize overall asphalt surface area.
- Specify minimum reclaimed asphalt pavement and recycled asphalt shingle content.
- Use warm mix asphalt instead of hot mix asphalt.

EARTHWORK

- Follow existing contours and minimize disturbance limits wherever possible.
- Balance cut fill volumes to avoid transporting earth offsite.
- Minimize excess excavation required in design.
- Preserve and reuse topsoil or spoils (non-hazardous only).
- Develop an Earthwork Management Plan to provide guidance on positioning and stockpiling to reduce hauling.

CONCLUSION

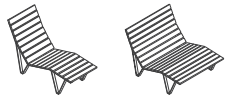
Reducing the embodied carbon on site projects is a critical step in mitigating the impacts of climate change. Site designers can help by measuring our embodied carbon using LCA tools, utilizing low-carbon best practices, and focusing efforts on embodied carbon hot spots like concrete, asphalt, and earth work. As designers continue to request data on embodied carbon and select low-carbon alternatives, the industry becomes increasingly incentivized to produce cost comparable, low-carbon options.

How can you lower the embodied carbon on your projects today? •



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