This installation, part of *Pour Demain* (*Our Time on Earth*) at Musée de la civilization in Quebec City, Quebec, imagines a future banquet for all animal species where we celebrate the end of human activities that harm the natural world. The exhibition was designed using only reusable and low-carbon materials. The bio-based mycelium wall panels (engineered by Mycélium Remédium Mycotechnologies) effectively mitigated sound bleed in the galleries.

DOUGLAS FLANDRO

BUILDING EMPATHY BY DEVELOPING AN ETHICALLY SOURCED MATERIALS POLICY

Douglas Flandro

The building industry is beginning to catch up with the fashion and food industries in considering the provenance of its raw materials. In moving from prioritizing the least expensive materials at all costs, designers and consumers are beginning to ask where materials come from and who might be harmed by their extraction, manufacturing, or end-of-life processes.[1] This movement toward an ethical approach emphasizing the relationship between duty and morality, or a deontological system of ethics, has surprising ramifications for the building industry, where most supply chains are so complex that manufacturers have no idea from where on the earth their suppliers and subcontractors extract materials.

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As of 2024, the United States Environmental Protection Agency (EPA) advocated for environmental justice, which it defined as "the just treatment and meaningful involvement of all people, regardless of income, race, color, national origin, Tribal affiliation, or disability, in agency decision-making and other Federal activities that affect human health and the environment."[2] The definition went on to state that all people should have equal protection from pollution and environmental health hazards, including those caused by climate change. My work as an exhibit designer has made me keenly aware of the ethical questions that arise when sourcing materials that are considered inexpensive or convenient, knowing that the manufacturing or disposal of these materials harms disadvantaged and marginalized people. This has led me to investigate how much due diligence should be expected of museums and cultural institutions to investigate this complex maze of material sourcing and to find ways to effectively support their efforts.

What Will an Ethically Sourced Materials Policy Look Like?

As an exhibit designer at CambridgeSeven, my focus is on materials used in creating museum exhibitions, but the same principles apply to any materials that a museum is purchasing. An ethical sourcing policy may avoid some materials completely, encourage the use of low-carbon or other sustainably sourced materials, or formalize questions about the provenance of certain classes of materials. This article examines three of the most prevalent and concerning issues that result in unethical materials:

- Forced and child labor in the supply chain
- Pollution during production and disposal that disproportionately affects BIPOC communities
- Embodied carbon in exhibit materials that contributes to climate change.

We begin with an overview of each issue, before investigating first steps organizations can take to begin to address these concerns. Deeper dives for institutions able to dedicate more resources to investigating the origins of their materials conclude each section. A list of specific actions that museums can take to improve the ethics of their material purchasing concludes the article.

An ethically sourced material policy is most effective when it aligns with the priorities of the organization. For example, a children's museum may focus on making sure the materials it uses are not sourced from manufacturers known to use child labor, while a nature center may prioritize materials that minimize damage to ecosystems. While museums may not spend an enormous amount of money on materials compared with other industries, they are perfectly positioned to communicate the work they are doing to make the world a better place. To that end, they can make people aware of the importance of seeking out ethically sourced materials.

Fig. 1. The message of *The Shadow of a Face* (2023), a monument to abolitionist Harriet Tubman, was strengthened by artist Nina Cooke John's dedication to investigating her supply chains to avoid materials made using forced or child labor.

Forced and Child Labor in the Materials Supply Chain

While slavery is illegal in every country, 28 million people are estimated to be held in forced labor throughout the world, a number that has steadily risen in the last five years.[3] And, according to a report from the International Labor Organization and the United Nations Children's Fund, 160 million children were engaged in child labor at the beginning of 2020.[4]

Many products and components frequently used in museum exhibitions are at high risk for forced or child labor, including aluminum, artificial flowers, bamboo, brass, bricks, carpets, ceramic tile, concrete, copper, cotton, electronics, furniture, glass, granite, gypsum board, iron, jute, leather, lithium-ion batteries, lumber, nails, photovoltaic components, paints and dyes, PVC, rubber, sand, steel, stone, textiles, tin, toys, and zinc.[5] Much of this illegal labor occurs at mines, plantations, and factories that generate the raw and finished products frequently used in building materials in the United States.

First Steps

The United States Bureau of International Labor Affairs (ILAB) maintains a list of countries where companies known to use forced or child labor operate, paired with the material they produce. This list is easily accessed through the free ILAB Sweat & Toil app from the U.S. Department of Labor.[6]

A museum might start to address this issue by taking stock of three to five materials it commonly uses in its exhibitions and reaching out to suppliers to ask questions about the sources of these components. While working on the recently completed monument to Harriet Tubman, *The Shadow of a Face*, in Newark, New Jersey, artist Nina Cooke John was committed to the transparent sourcing of materials (fig. 1). She investigated the supply chains of over 20 products made of five materials – paint, timber, steel, concrete, and lighting.[7] By highlighting instances of child labor and modern slavery, Cooke John added powerful relevance to the story of Harriet Tubman.

Third-Party Certifications Addressing Forced and Child Labor

- **Cradle to Cradle Certified®**
  Products need to verify human rights and fair labor practices
- **B-Corp Certification**
  Companies need to meet verified standards of fair labor practices
- **SA8000® Standard**
  Verifies socially acceptable practices in the workplace

In our materials library, we mark materials with these certifications with a “Social Justice” sticker (fig. 2).

DOUGLAS FLANDRO

Fig. 2.

This sticker, designed by the author, is used in materials libraries at several design firms in the Boston area to designate materials with a third-party certification for ethical supply chains.

The monument was a Grace Farms Design for Freedom pilot project (discussed below). The artist forged a relationship with paint supplier Sherwin Williams, which instituted internal education programs to alert staff to the risks of forced labor in the supply chain and began to ask questions of its suppliers to ensure fair labor practices. The project originally specified the use of Ipe, a hardwood harvested in South America. When it proved difficult to verify this timber's sustainability and fair labor extraction, it was replaced with Black Locust, a weather-resistant invasive species sourced from Wisconsin. Similarly, the project's lighting was sourced from the United States to help minimize the risk of forced or child labor.

Deeper Dive

When Sharon Prince, CEO and Founder of Grace Farms Foundation, a cultural and humanitarian nonprofit, was involved in the construction of the River Building on their site in New Canaan, Connecticut, she started asking questions about the provenance of the building materials. When she realized that nobody knew the answers to her questions, she launched the Design for Freedom movement to raise awareness about slave labor in the building industry and to promote transparency in material supply chains.

Design for Freedom holds a summit each year in New Canaan and runs a series of pilot projects for organizations looking to learn more about their supply chains. Museums and designers looking to dig deeper into their supply chains can apply to become a Grace Farms pilot project, like Nina Cooke John's *The Shadow of a Face*. Pilot projects receive research and guidance in identifying whether materials they plan to use in a project may be at high risk for forced or child labor practices and in tracing their provenance through the supply chain from extraction to installation.[8] The goal is to bring awareness to owners, designers, and builders about the risk of exploitative practices and to give them the information they need to ask questions in order to reduce their use of products made from forced and child labor.

Pollution in the Materials Supply Chain and Its Effects on BIPOC and Vulnerable Communities

Museums commonly use display materials made with inexpensive, durable vinyl and other products containing polyvinyl chloride (PVC), which includes toxic additives that can cause infertility, shorten life spans, and create a host of other health problems.[9] These toxins are problematic for all, but they have an even greater effect on the workers who produce them and on communities living near the factories.

In the United States, most of these effects fall on Black communities in Texas and in Louisiana's "Cancer Alley," an 85-mile stretch along the Mississippi River that is home to over 150 oil refineries, plastic plants, and chemical facilities.[10] In the predominantly Black neighborhood of Reserve, for example, the risk of cancer is 50 times the national average.[11] Also, because vinyl is too toxic to burn and leaches toxic chemicals into landfills, there are no safe disposal methods. Recycling vinyl is expensive and often hazardous.[12] This disposal problem also disproportionately affects BIPOC

Fig. 3. The renovation of the Foundry 101 building in Cambridge, Massachusetts, included large, painted wayfinding numbers instead of cut vinyl. Architects chose low-carbon finishes such as the woodwork and the polished concrete floors.

COURTESY OF RISD MUSEUM. PHOTO BY BRENDAN CAMPBELL

Fig. 4.

Artist Shawn Gilheeney paints the background mural for *The Art of French Wallpaper Design* at the RISD Museum in Providence, Rhode Island.

communities, which are more likely to be located near landfills and other polluted sites.[13] In fact, in the United States race – not income – is the biggest indicator of whether one lives near a polluted site.[14] Years of racist and indifferent government policies created these disparities,[15] and they will take many years to fully dismantle, but there are steps we can take today to begin to lessen the effects of these chemicals by lessening our reliance on them.

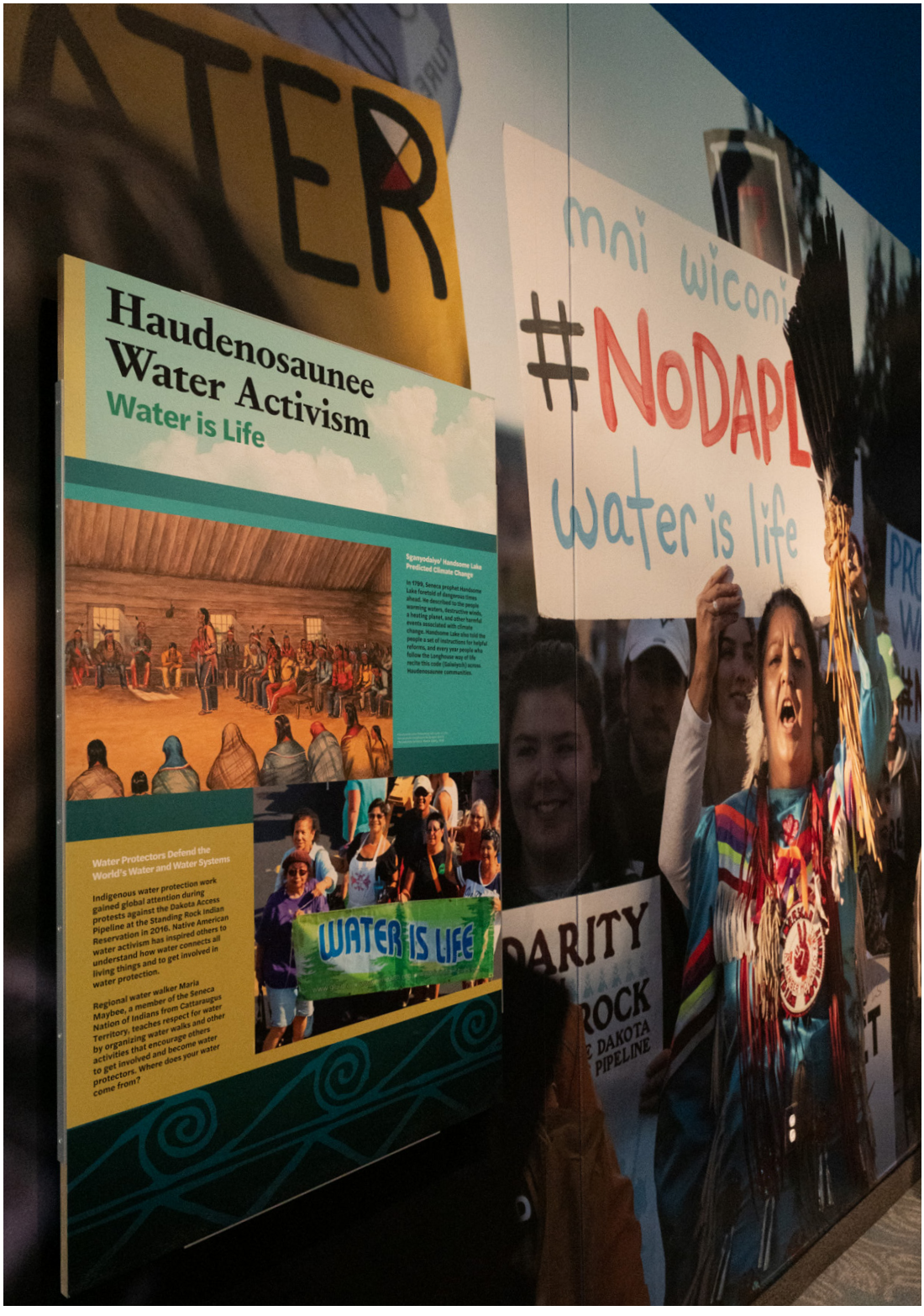
First Steps

Eliminating PVC from our interior finishes, exhibit furnishings, and graphics is an essential first step. Some of the more successful solutions to eliminating PVC come from asking a simple question:

> *How was this done before plastic was invented?*

We have seen many institutions turn to hand-lettering or mural artists to paint one-of-a-kind designs (fig. 3). These museums support local artists instead of far-away international corporations. In some cases, hiring a local artist may not even cost more money. Brendan Campbell, Senior Graphic Designer at the RISD Museum in Providence, Rhode Island, hired Shawn Gilheeney of Providence Painted Signs to paint some background murals for an exhibition titled, *The Art of French Wallpaper Design* (fig. 4). The decision to hand-paint the background mural originated from the museum's sustainability initiative, which includes a goal to reduce vinyl graphics. Campbell was surprised when the quoted price was less than the installation of a full vinyl mural made with PVC.

Many architects and designers have been specifying that they want PVC-free options, and products like durable commercial wallpaper and PVC-free adhesive murals are becoming more available. Digitally printed, silicone-edged fabric graphics can often replace vinyl murals and are much less susceptible to damage from heavy visitor traffic. They are also easier to quickly change out. At CambridgeSeven, we suggest indoor graphic panels be produced as direct-to-substrate prints on plywood that can be refinished and reprinted when exhibitions change (fig. 5, p. 56).



WONDERS OF *WATER*, RMSC, ROCHESTER, NEW YORK. COURTESY OF CAMBRIDGESEVEN

Fig. 5. The graphic panel in the foreground is printed on high-grade plywood that can be refinished and reprinted once the exhibition closes. It is mounted to the wall with metal z-mounts that are also designed to be reused.

PVC-Free Alternatives to Vinyl Wall Murals

- Monadnock Envi Commercial Wallpaper
- Moss SustainaWallcovering
- Acrovyn By Design wall protection panels (durable, PVC-free, seams every 4 ft.)
- 3M Envision Print Wrap Films (PVC-free)
- Moss SustainaPSA
- Digitally printed fabric such as Moss SustainaTex Ocean
- High Pressure Laminate or phenolic (FSC available through Wilsonart)
- Hand-painted murals

Alternatives to PVC Substrates for Graphic Panels

- BioBoard
- Eco-fi Fabric
- Moss SustainaPaper Board
- Moss SustainaPlexi
- PVC-free options by Cooley Group in Rhode Island
- Plyboo or ApplePly panels

Alternatives to Vinyl Lettering

- Contour-cut, direct-to-substrate prints on wood, mounted to the wall
- Hand-painted letters
- Cardboard or chipboard stencils
- Wheat-paste paper letters or posters[16]
- Dry-transfer lettering

Deeper Dive

To become more involved in protecting BIPOC and vulnerable communities, museums can research more materials and chemicals of concern and take steps to avoid them. A good place to start is the Green Science Policy Institute's "Six Classes Approach to Reducing Chemical Harm."[17] These classes of chemicals – per- and polyfluoroalkyl substances (PFAS), antimicrobials, flame retardants, bisphenols & phthalates, some solvents, and certain metals – are all known to be hazardous to human health. Six videos, each less than five minutes long, give valuable information on these chemicals and helpful guidance on how to avoid them. The videos lend themselves well to staff or department meetings.

Museums can also be inspired by nature. *The Biomimicry Resource Handbook*, by Dr. Dayna Baumeister, is a good resource for this practice. Baumeister and Janine Benyus founded Biomimicry 3.8, a consultancy working with many innovators and international companies to change the way they do business.[18] They challenge standard practices of dominating nature and encourage us all to look to nature, which recycles and upcycles everything, avoids toxic chemicals, and uses water as a solvent through life-friendly chemistry, as our mentor (intro image).

COURTESY OF THE MADISON CHILDREN'S MUSEUM. PHOTO BY KATE ROWELL

Fig. 6. The trees in the Madison Children's Museum's *Nice Age Trail* exhibition are constructed from recycled lumber, wood screws, cardboard, and wheat paste.

Reducing Embodied Carbon

Although many of the petrochemical-based materials discussed above are both toxic and require large amounts of energy, the term "embodied carbon" looks specifically at the emissions that are sent into the atmosphere during the life cycle of a product. Greenhouse gases, like CO_2 and others, are not toxic to humans, but they do become trapped in the atmosphere and warm the planet. To improve the sustainability of materials, we must reduce the energy and embodied carbon used in their manufacture. Recycling, using local products and bio-based materials, and reducing material use, all lower emissions.

Manufacturers are increasingly creating Environmental Product Declarations (EPDs) that examine the embodied carbon of products. Manufacturers and architects are seeking ways to reduce the embodied carbon of building materials to reduce the effects of climate change which disproportionately affect Black and brown communities who have been historically disadvantaged and suppressed:

> Studies of adults have found evidence of racial disparities related to climatic changes with respect to mortality, respiratory and cardiovascular disease, mental health, and heat-related illness. Children are particularly vulnerable to the health impacts of climate change,

> and infants and children of color have experienced adverse perinatal outcomes, occupational heat stress, and increases in emergency department visits associated with extreme weather.[19]

Taking steps that lower the carbon footprint of our museums and exhibitions benefits climate health for everyone as well as social health and equity.

First Steps

Generally, local, bio-based, and minimally processed materials take less energy to produce and, therefore, have a lower embodied carbon footprint. For example, a solid block of wood will generally have a lower carbon footprint than a processed piece of plywood or MDF. Metals and petrochemical-derived products generally have a higher embodied carbon footprint than bio-based materials.

Nice Age Trail at the Madison Children's Museum in Madison, Wisconsin, features a beaver lodge made from straw and clay. The exhibits team built trees using recycled wood and cardboard (fig. 6). These elements are built to be dismantled and reused or composted. Staff even used edible wheat paste instead of synthetic wood glue. The museum reports that exhibits have held up well and are easy to repair (fig. 7).

"Design for deconstruction," also known as "design for disassembly," refers to the practice of building structures so their components can be easily disassembled and reused. In the context of exhibition design, this means designing the details of how everything fits together with the assumption that at the end of the exhibition's life, the cases, plinths, and substrates will be disassembled and reused in new exhibitions. In other words:

> *Clips and screws, not nails or glues.*

COURTESY OF THE MADISON CHILDREN'S MUSEUM. PHOTO BY ANDY MANIS

Fig. 7. A young visitor uses the slide on the beaver lodge made from compostable straw and clay.

Exhibition designers can ask: Are there creative ways to fasten materials together so they can be disassembled without destroying the materials? (This will often mean that visible screws become an acceptable design standard.) Design for deconstruction can also mean allowing some degree of standardization to govern more than one exhibition. At the San Francisco Museum of Modern Art (SFMOMA), design director Bosco Hernández is working with their team to standardize gallery walls. Instead of building new gypsum walls for every exhibition, galleries will be outfitted with movable walls connected to a ceiling grid so they can be moved around to many different configurations. These moveable walls will provide a large degree of flexibility and save an enormous amount of material from going to the landfill. Similar tactics can be used to standardize exhibition furnishings, display cases, and graphic panels so they work from one exhibition to another.

With some effort, museum staff can find second homes for many of their outgoing exhibitions or exhibition components or serve as a second home to reused exhibit elements. It can be more difficult to design new exhibitions using salvaged materials, but reusing materials is key to establishing a truly circular economy.

Our current economy is linear, moving from low-cost production to the landfill. The circular economy is based on minimizing waste and creating higher-quality products that can be renewed, repaired, and reused.[20] This requires more of a learning curve and directly challenges the ways designers are currently being trained. However, we all tell stories that could be made richer or more compelling by gathering objects

Online Resources for Salvaged Materials

allforreuse.org/ecosystem-map
Open-source map highlighting local businesses that support the circular economy

barder.art
Caters primarily to art museums; lists free or for-sale items such as display cases, vitrines, crates, etc.; can be filtered by location

craigslist.org
Look under “For Sale” and then under “Free” to find no-cost furniture, plywood, other wood scraps, acrylic, etc., available in your neighborhood

culturenut.com
Marketplace that assists museums in recycling and upcycling a variety of materials; hosted by Exhibitions Development Group, LLC, a St. Paul, Minnesota–based company that rents out temporary exhibitions; museum-specific but not local to your community and often requires shipping fees

facebook.com
Affinity groups often have marketplaces and can be excellent places to post items that you would like to acquire or offload

freecycle.org
The Freecycle Network is dedicated to keeping good stuff out of landfills; will connect you to people who are gifting items; not museum-specific, but it is local to your community

COURTESY OF OH WOW!

Fig. 8. Staff at the OH WOW! Children's Science & Technology Center in Youngstown, Ohio, asked the community to contribute yellow objects that made them happy to the "Wall of Shine," part of an exhibit about mental health.

or materials from the community. Salvaged materials often have a deeper connection to the people in your community or the history of a place (fig. 8).

Deeper Dive

Comprehensive life-cycle embodied carbon studies are becoming easier to conduct. This can be especially helpful when choosing between different material options. Embodied carbon should be considered along with durability and cost. Useful tools for quickly finding good information about the embodied carbon footprints of various materials include:

- **Sustainability Tools in Cultural Heritage (STICH) Carbon Calculator**
  This website was created through a grant from the National Endowment for the Humanities. It is incomplete but provides the carbon footprint in carbon dioxide equivalent (CO_2e) for many materials used in museums and cultural heritage institutions.

- **The Embodied Carbon in Construction Calculator (EC3)**
  This powerful online tool requires registration but is free to use. It was created by the nonprofit 501(c)(3) organization Building Transparency,

based in Washington state. It is primarily intended for architects but is a great place to go when looking for the carbon footprint of a building material that is not listed on the STICH website.

CambridgeSeven has worked with numerous museums and cultural institutions, including the Museum of Discovery and Science in Fort Lauderdale, Florida, the Cape Cod Chamber of Commerce in Massachusetts, and the Charles H. Wright Museum of African American History in Detroit, Michigan, to consider the desired lifespan of their materials. We advise avoiding high-carbon footprint materials that last 30 years for exhibitions that will only be on view for one year. We also avoid using materials that will only last one or two years in an exhibition that is planned to last for decades unless the cost, embodied carbon, and internal labor capacity allow for frequent replacement.

We recently showed that outdoor fabric graphics would have been a lower-carbon footprint option than laminated graphic panels for an outdoor installation – even if they were replaced three times during the lifespan of the exhibition. At the Charles H. Wright Museum, Leslie Tom, Korzell Coe, and other designers chose to use plywood rather than MDF to build exhibit furniture because it had a lower carbon footprint. And on Cape Cod, the Expedition Blue outdoor kiosks use steel helical piles instead of concrete foundations because the corkscrew foundations had much lower embodied carbon and were much quicker to install (fig. 9).

Individually, no designer or institution can fix all these problems, but together, we can make real change. It helps to keep a growth mindset – don't let perfection get in the way of making progress.

Fig. 9. Chris Muskopf of CambridgeSeven worked closely with Mystic Scenic to design and fabricate these low carbon footprint public kiosks with graphic panels that informed people of the history of the Cape Cod waterfront and the "Blue" economy.

COURTESY OF CAMBRIDGE SEVEN

Moving Forward Together

There are other issues concerning the ethics of materials that are not addressed in this article, including material sourcing that depletes rainforests or harms other ecosystems, products made by employers who are discriminatory or who do not provide safe, clean places to work, and products that profit from bribery, organized crime, or criminal government corruption. Some materials might seem to be a great solution for low embodied carbon and human health but conversely pose a risk for forced labor. Ethically sourcing materials can seem overwhelming when viewed as a whole. Individually, no designer or institution can fix all these problems, but together, we can make real change. It helps to keep a growth mindset – don't let perfection get in the way of making progress. In addition to the steps listed above, museums can make progress by:

- *Signing the* Museum Exhibition Materials Pledge
  Add your logo to the letter to join other cultural institutions and designers asking manufacturers for more sustainable and equitable materials. The pledge states that if manufacturers make more sustainable materials, we will use them in our work.

- *Hosting Workshops and Trainings*
  Host workshops and training sessions for staff on ethical sourcing, supply chain transparency, materials at high risk for harmful pollution, and prioritizing low-carbon materials.

- *Conducting Internal Audits*
  Conduct internal audits of current procurement practices to identify areas where improvements can be made in ethical sourcing.

- *Collaborating and Sharing*
  Share best practices and lessons learned through networks, conferences, and online forums. This collaborative approach promotes collective learning and problem-solving.

- *Engaging the Public*
  Exhibitions, educational programs, and community events can discuss the issue of ethical sourcing; exhibitions and events on other topics can feature graphic panels or case studies that highlight successes and failures of material transparency, reducing pollution, and striving for low-carbon materials.

- *Developing Policies*
  Develop formal written policies on ethically sourced materials, ensuring transparency and accountability in practice.

No one can do this work alone. By collaborating with others to learn new skills, museums and designers will have a more nuanced understanding of the human impact of the materials they are choosing to use. This will be especially helpful when comparing the costs and benefits of two possible options. Changing how we design and install exhibitions is vital as we work together to find solutions that lessen harmful impacts on vulnerable people and ecosystems, with the ultimate goal of regenerative design that does more good than harm.

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