

Exhibitions Brave the Elements

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Outdoor exhibitions have long been essential for museums where much of the visitor experience is inherently outdoors, such as zoos and botanic gardens. In recent decades, though, museums and related institutions have brought more and more experiences beyond their walls and into outdoor environments where they must withstand an array of climatic conditions and security challenges. Environmental considerations include wind, precipitation, and sunlight as well as fluctuations in temperature and humidity. Outdoor exhibitions are generally more challenging to secure, and thus more subject to damage from graffiti and vandalism.

As a professor of exhibition and experience design in the Visual Presentation and Exhibition Design program at the Fashion Institute of Technology, I have seen growing interest among my students in creating outdoor experiences. For me, this interest really came into focus when COVID-19 public health concerns forced many museums to close their doors, and many exhibition

development and design teams looked for ways to bring exhibitions into the open air. This article was inspired by my students' interest and this growing shift.

Those looking to create outdoor exhibition experiences can choose from an array of proven strategies as well as new opportunities that emerge with technological and social change. Of course, there are many more techniques and materials than could possibly be included in an article of this length. My intention here is to briefly introduce some key options. I focus specifically on graphic and structural elements, since these are common elements in many outdoor interpretive and experiential environments.

I've compiled the information in this article from conversations with exhibit fabricators, designers, and industry representatives. Specific companies or products mentioned here are for informational purposes and are not intended as endorsements. And of course, new technologies mean the field is always changing.¹



Fig. 1. An HPL panel mounted to stainless-steel structure for the Astrobiology Walk at the NASA Goddard Visitor Center in Greenbelt, Maryland.

GRAPHIC APPROACH

High Pressure Laminates (HPL)

High-pressure laminate panels (figs. 1, 2, & 3) are produced by using high temperature and pressure to fuse digitally printed images with layers of paper and phenolic resin. This process makes them impervious to moisture and highly resistant to fading from ultraviolet damage, graffiti, burns, scratches, and other physical impacts. The fact that manufacturers of HPL typically guarantee their products for up to 10 years is a plus.

Panel thickness can vary from .028 inch to 1 inch. Thicknesses of .5 inch or more can be combined with



Fig. 2. A contour-cut HPL panel interprets anteaters at California's Santa Ana Zoo at Prentice Park.



Fig. 3. Here, an HPL panel is used as a durable top for an activity table with attached objects at the Brooklyn Botanic Garden in New York.

other structural elements, such as metal and wood railings, walls, and posts using concealed threaded inserts; HPL panels can be drilled through for other hardware fasteners. It's also possible to contour cut HPL panels to create different shapes, which can also be combined with dimensional and tactile components. Costs for HPL graphics are generally lower than other highly durable options (such as powder-coated graphics or porcelain enamel). Manufacturers of HPL graphics include Fossil Industries, Izone Imaging, and Folia.



Fig. 4. This marker along the Brewing Heritage Trail in Cincinnati, Ohio, was produced with powder-coated graphics on a steel structure.

GRAPHIC APPROACH

Powder-Coated Graphics

Powder-coated graphics (figs. 4 & 5) give fabricators the ability to apply high-resolution images to an array of materials, including steel, aluminum, glass, and ceramics. It is possible to print both on flat surfaces and three-dimensional ones. Because powder coating can wrap over the edges of flat graphics, it can provide a highly finished look without framing.

A benefit of this process is that it allows for precise color matching and exceptional color intensity. It is also durable; powder coating integrates a polyurethane coating that protects graphics from exterior weather conditions, UV damage, and scratches. Different manufacturers have different specialties. For example, Direct Embed Coating Systems offers powder-coated graphics on a variety of surfaces; ALTO specializes in graphics on aluminum surfaces. Manufacturers generally warranty powder-coated graphics – which can be recycled at the end of their use – for up to 10 years.

Fig. 5. Powder-coated graphics were used for this tactile sign with dimensional text and Braille letters, created as a test sample.





WINSOR FIREFORM

Fig. 6. This wayside in Yellowstone National Park features porcelain enamel interpretive graphics.

GRAPHIC APPROACH

Porcelain Enamel Graphics

Porcelain enamel (fig. 6), made by fusing a thin layer of ceramic or glass to metal, is among the most durable materials for signage and graphics. Commonly used for cookware, home appliances, and more, the material is extremely resistant to graffiti; markers and paint can be removed easily. Porcelain graphics are also highly scratch and fire resistant. These qualities make it a superior choice for unsupervised installations and

extreme weather environments. Porcelain enamel can be used for photographic images and offers a very broad range of colors (including metallic ones) and the ability to customize colors. Because the substrate for porcelain enamel graphics is typically steel, panels created for marine environments should be sealed on the edges and backs to prevent oxidation. Graphic porcelain tiles can also be inlaid into pavement.

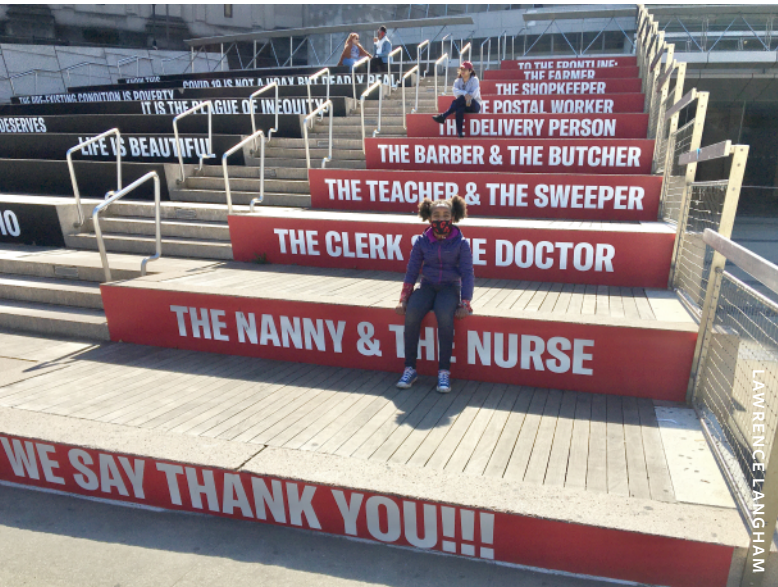


Fig. 7. Adhesive vinyl graphics on concrete steps at the Brooklyn Museum in New York.

GRAPHIC APPROACH

Adhesive Graphics

Adhesive graphics are a comparatively inexpensive way to apply full-color or single-color graphics to existing surfaces. They can be used on an array of architectural and structural elements, including wood, metal, glass, concrete, and brick, and are especially useful for installations covering large surface that are intended to transform public spaces (fig. 7). Adhesive appliques can also be overlaid on other graphic substrates, including porcelain enamel, which makes it a quick approach for updating existing signage.

Adhesive vinyl graphics applied to flat surfaces are typically pressed on with a squeegee or similar tool. They are removable, which makes them effective for temporary installations. There are different grades of vinyl products, including more expensive products engineered for longer term installations that can last from 7 to 10 years. Vinyl adhesive graphics are widely used for environmental graphics in advertising and marketing, with 3M and Avery Dennison the largest suppliers of adhesive vinyl for exterior applications.

There are certain characteristics that should be considered before choosing this medium. For one, on some textured surfaces, such as brick and pavement, they must be applied with a heat gun. This typically requires a professional installer. Also, because vinyl is a petroleum-based product, it cannot be recycled after removal.

Foil-based adhesive graphics (fig. 8) are made from aluminum foil and offer a recyclable alternative to vinyl (they can be tossed in with everyday recycling). They were developed by Ohio-based AlumiGraphics, which makes products for both wall and pavement applications. The material is rugged and can be used on both smooth (e.g., metal) and deeply textured materials (such as pavement). The material costs of foil-based graphics is greater than vinyl, but it does not require professional installation. Applied using a rubber roller, these graphics do not require heat or a laminate overlay, making the installation fairly straightforward.

Fig. 8. Here, adhesive foil graphics are adhered to a stone surface for a sidewalk photography display in Dilworth Park, Philadelphia.



GRAPHIC APPROACH

Digital Printing on Laminated Safety Glass

Durable digital images can be printed with ceramic inks onto laminated safety glass for exterior installations, including outdoor exhibits. Safety glass is a composite of glass and plastic manufactured to prevent shattering in case of accidental damage or vandalism. **Figure 9** shows printed glass panels incorporated into boardwalk railings at the Jefferson Patterson Park & Museum in Maryland. The technique provides a wide range of levels of transparency and opportunities for interplay of the exhibition design with light and view of the site.

Fig. 9. Here, the translucency of the graphics on safety glass responds to the environment's changing light.



STRUCTURAL APPROACH

Stainless Steel and Aluminum

Two materials extensively used to exterior exhibitions are aluminum (fig. 10) and stainless steel (fig. 11). The two materials have distinct differences in characteristics to consider in choosing which to use for a project.

Weight and strength Stainless steel has a much greater density, weight, and strength than aluminum. The lightness of aluminum can be advantageous for signage or for temporary installations that need to be shipped, while the tensile strength of steel may be better for structural elements. Aluminum is easier to bend; it is also more subject to impact damage.



LAWRENCE LANGHAM

Fig. 11. C&G Partners used marine-grade stainless steel to create a durable replica of an industrial water wheel at the West Point Foundry Reserve in Cold Spring, New York.

EXHIBITOLOGY



Fig. 10. Interpretive graphics in an extruded aluminum frame structure at the Lincoln Home National Historic Site in Springfield, Illinois.

Cost Aluminum is typically cheaper by volume than stainless steel.

Corrosion resistance Aluminum creates a passivation layer that helps it resist oxidation and corrosion. There are different alloys of aluminum, with most material either 5052 or 6061 (the numbers refer to grades); 5052 is considered marine grade and is more resistant to corrosion than 6061.

There are various kinds of stainless steel with corrosion resistant properties. The two most common alloys are 304 and 316. The most specified type is 304; 316 is referred to as marine-grade stainless steel. It costs more than 304, but lasts longer, particularly in coastal regions that are exposed to atmospheric salt that can cause corrosion.

Weldability Stainless steel is more easily welded than aluminum.

Both aluminum (fig. 12) and steel may be treated with powder coating, which provides protection from corrosion and offers a very broad array of color



Fig. 12. A powder-coated aluminum sculpture by artist Deborah Kass in front of the Brooklyn Museum.

options. Powder coating is typically produced by spraying electrostatically charged polyester-based microbeads onto base materials (the charge enables them to adhere to the surface) and then placing the materials in a curing oven or under ultraviolet light. This curing process creates a tough and durable finish that is resistant to corrosion, peeling, and flaking.

Compared with most typical, highly durable exterior paints, powder coating contains very small amounts of volatile organic compounds (VOCs); plus, its custom-color options allow for exhibit components with strong visual impact. A variety of steel alloys can be powder coated, including types that are less expensive than

stainless steel. A downside to powder-coated steel is that while it is highly resistant to rust, if it sustains damage that cracks the coating, moisture can cause rust to form on the exposed steel. This is not an issue with aluminum, which does not rust.

Another metal infrastructure option is weathering steel (**fig. 13**). Unlike typical low-carbon steels, it has alloying elements which give it more strength and corrosion resistance. It does not need to be coated. The surface of the material develops a distinctive rust colored appearance after oxidation from prolonged exposure to exterior conditions. It can also be pre-treated to achieve a consistent effect prior to installation. The rough surfaces of oxidized weathering steel are stable and corrosion resistant. COR-TEN, whose registered trademark is held by U.S. Steel, is a genericized trademark for weathering steel. Weathering steel is not directly used as a substrate for graphics but can be combined with other materials for interpretive signage.

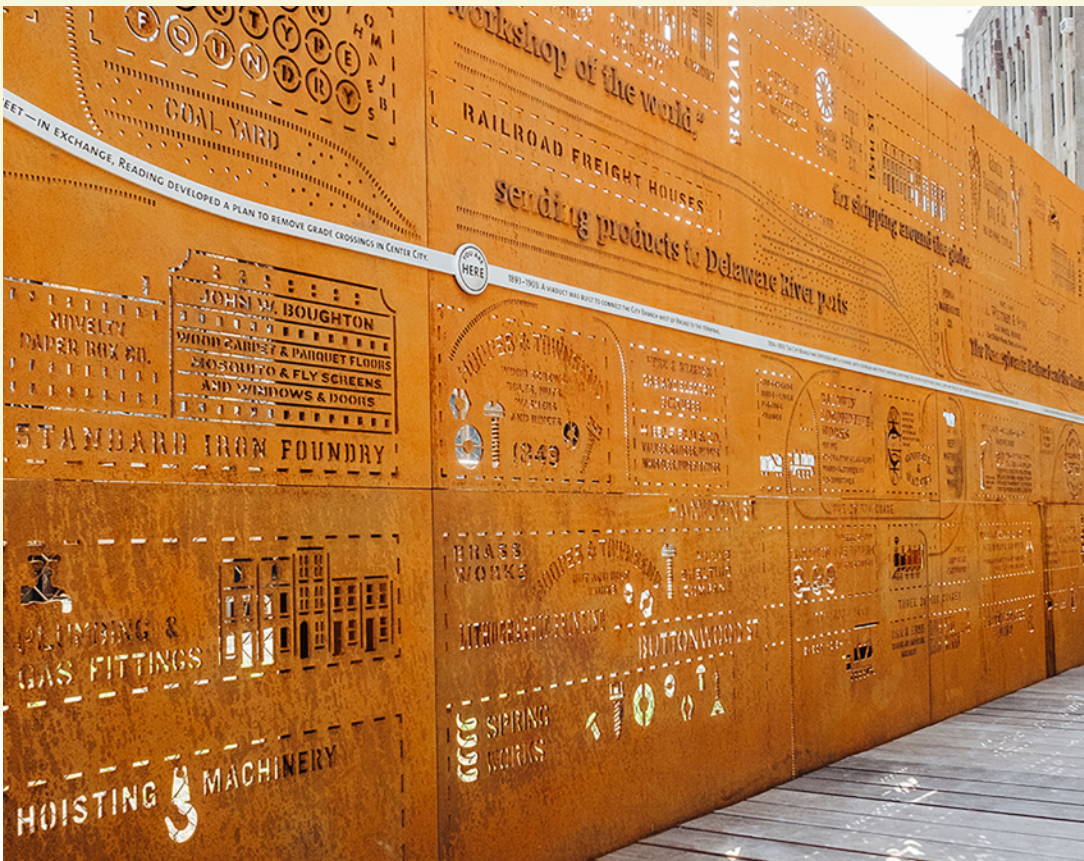


Fig. 13.

Laser-cut, weathering steel-wall installation at the Reading Viaduct Rail Park in Philadelphia, Pennsylvania.



Fig. 14. At Boston Harbor Islands National & State Park, a cedar-frame structure with brass fittings supports a sloped interpretive panel.

STRUCTURAL APPROACH

Wood

Wood can be a good structural material for exterior projects because of its relative low cost and aesthetic qualities. Wood options for outdoor projects include 1) species that have naturally occurring preservatives and 2) chemically treated lumber. Western red cedar, redwood, and cypress are the three most commonly available woods that naturally resist rotting and insect damage (fig. 14). In the western United States, redwood is widely available, while in other areas, such as the Midwest, western red cedar is more commonly sold. Cypress has greater availability, and is a better value, in the South and Southeast closer to where it is grown. In general, the location of a project may determine the availability and cost of these materials.

Insect-resistant woods, such as western red cedar and redwood, have certain benefits. For example, their natural colors can be highly desirable as a design element. A downside is that they can bleed tannins – naturally occurring compounds that appear

as yellowish-brown discolorations – through to the surface, interfering with painting and puddling around fasteners. However, the wood will successfully accept stains and clear finishes.

Chemically treated wood is very widely used for outdoor construction, as it is strong, rot resistant, commonly available, relatively low cost, and will accept paint. It is typically made from southern yellow pine. Prior to 2004, chemically treated lumber was made using a treatment that contained arsenic. Today, treated lumber is commonly made using the less toxic ACQ (alkaline copper quat), a water-based chemical that is forced into the wood. Consequently, treated lumber is saturated and heavy. Kiln drying lumber removes the moisture and makes the material lighter, but is twice the cost of typical treated lumber that has not been kiln dried. While these are good options when structural strength is needed at relatively low cost, any type of chemically treated lumber is typically not chosen by designers for its beauty.

Test, Test, Test

For these or any other materials, industry professionals encourage testing and prototyping – especially when using new techniques and materials. David Egner, Vice President for Museum Services at the fabrication firm Art Guild, Inc., advises that prototyping and testing is crucial for novel techniques. In addition to testing prototypes for interactives, Art Guild installs material samples outdoors and leaves them there for extended periods of time to observe the performance through seasonal cycles, including periods of freezing and other environmental changes. A case in point is the Discovery Garden at the Brooklyn Botanic Garden, where Art Guild used proven, high-pressure laminates for outdoor graphic interpretative panels, then combined them with more unexpected techniques, including specimens displayed in jars and custom interactive features for children: a seed experimentation table with a corkscrew seed slide made from an auger bit and seed-racing slides made from high-density polyethylene, or HDPE (fig. 15). For these, Art Guild used HDPE, which is commonly used for such applications as kitchen chopping boards; because it is

fade resistant and the color goes through the material, scratches are not noticeable. Testing materials like these in exterior settings helps to ensure durability in exhibit installations.

These structures at the Discovery Garden were crafted using a variety of materials in combination. In a way, they are representative of the synergistic nature of creating exhibitions. The challenges of creating outdoor exhibitions can be addressed through collaboration and sharing of expertise among design, fabrication, and industry professionals. ■

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¹ For a useful guide to planning outdoor exhibits, see “Wayside Exhibits: A Guide to Developing Outdoor Interpretive Exhibits,” National Park Service, 2009, www.nps.gov/subjects/hfc/upload/Wayside-Guide-First-Edition.pdf.



LAWRENCE LANGHAM

Fig. 15.

Interactive table at the Brooklyn Botanic Garden.