

Crate, Crate Preparation, and Packing Materials Questionnaire Summary

Introduction

The Institute of Museum and Library Services awarded the Image Permanence Institute at Rochester Institute of Technology a National Leadership Grant for Museums to support a three-year research project designed to identify the most cost-efficient and environmentally responsible methods of preparing paper-based collection objects for transit and display. It will be the first research project to collect environmental data from multiple museums' shipping crates simultaneously. Laboratory experiments will include testing the safety and relative humidity buffering capacity of common crate packing and sealed frame package materials. Research will also involve identifying and testing new biodegradable and more environmentally responsible materials as possible replacements for materials currently in use for crate packing and sealed frame packages. June-August 2021, IPI conducted a crate, crate preparation, and packing materials questionnaire. The results of that questionnaire are summarized in this report and will inform a current inventory of common crate construction and packing materials used to prepare paper-based collection objects for transit. These materials will be evaluated for cost and environmental waste comparisons, and inform laboratory experiments of crates and crate packing configurations.

76 Respondents Working in

40 Museums

5 Art Galleries

5 Conservation Studios

5 Libraries

5 University Galleries/Collections

4 Archives

4 Federal/State/Provincial/Municipal Collections

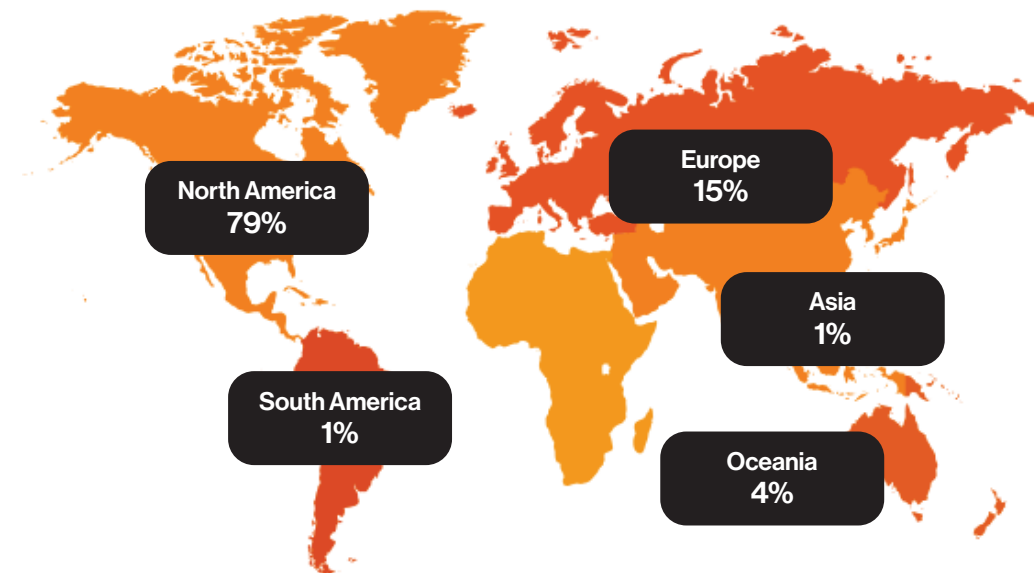
3 Artist Studios/Foundations

2 Fine Art Storage, Packing, Shipping, Companies

2 Private Collections

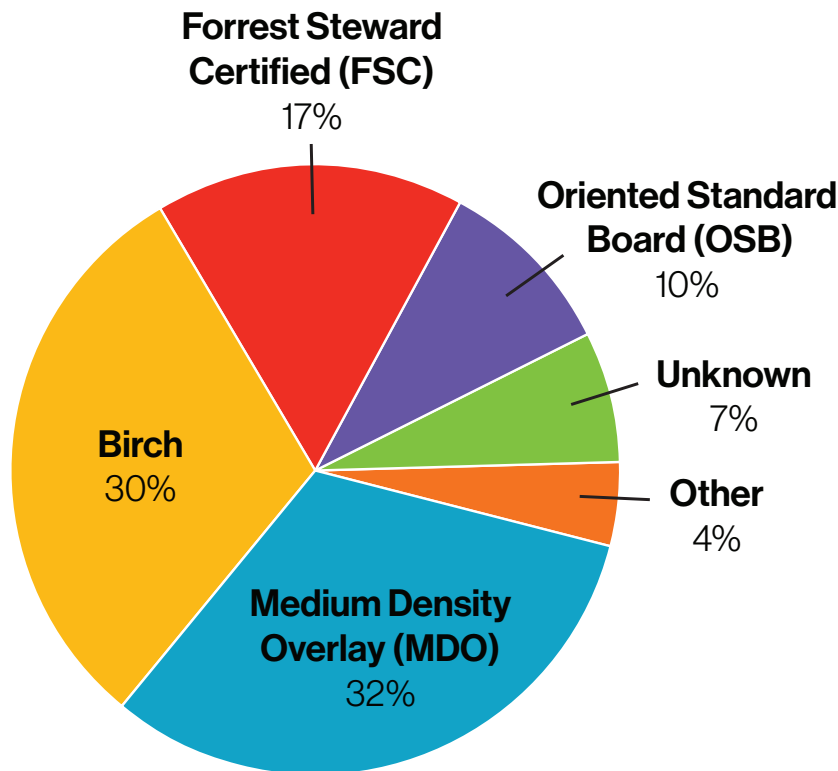
1 Manufacturer of Micro-Climate Enclosures

Respondents by Region

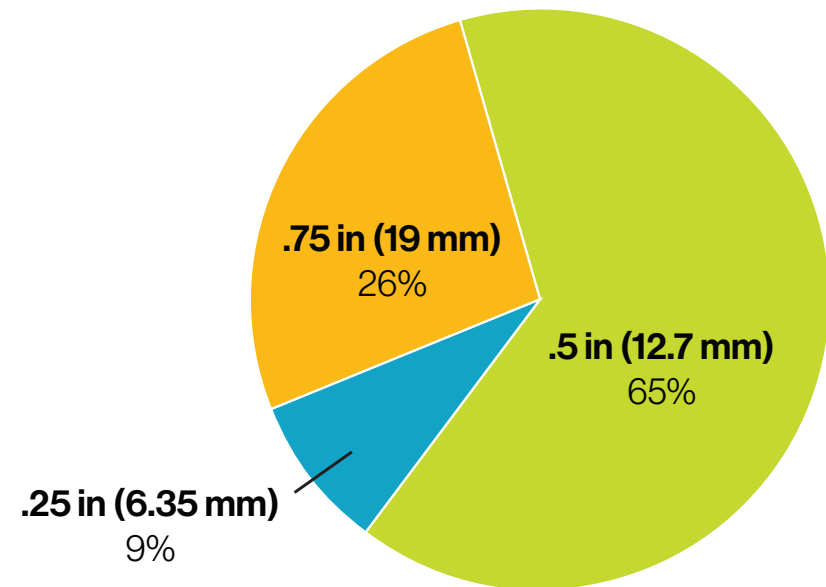


Most Common Crate Materials: Wooden Crates

Crate Wall Material



Crate Wall Thickness

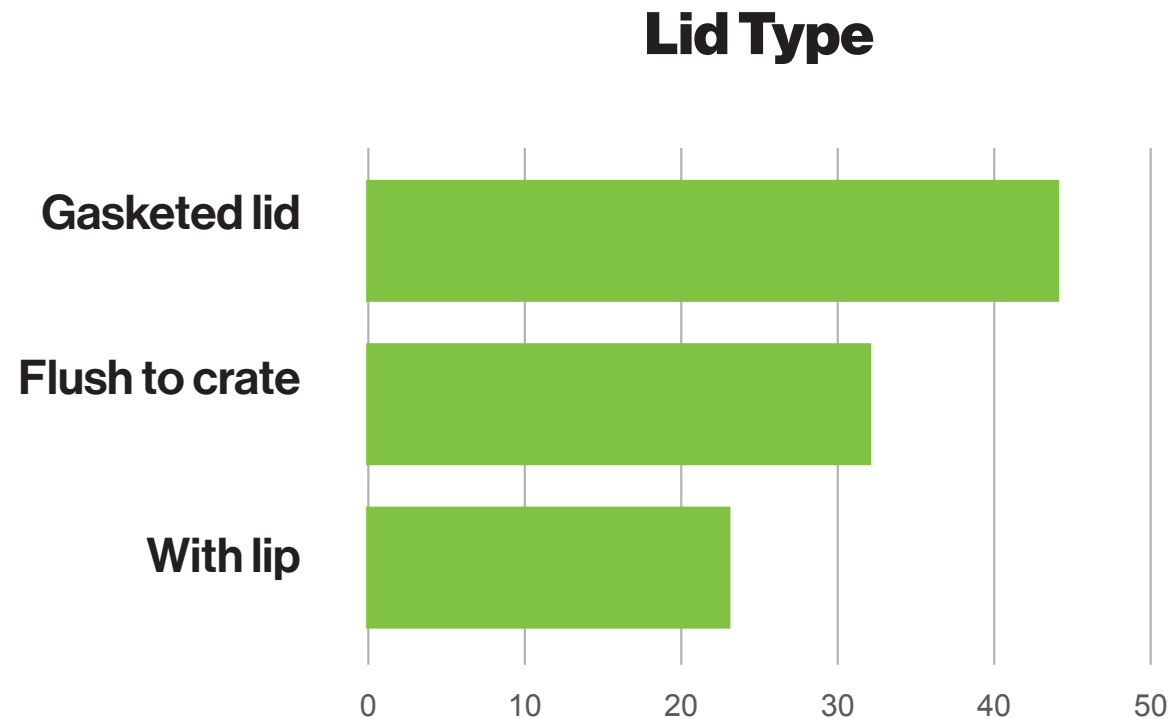


Main Points

Crate Walls and Battens:

Wooden crates are being used far more often than plastic, or other alternative materials. More than half of respondents, 55%, reported using 1-4 different types of plywood in varying thicknesses. This data reflects respondents using more than one crate design. 62% of respondents are using either **birch** or **medium density overlay (MDO)** plywood with **.5 inch** being the most common thickness cited by respondents for all wood types. Other plywood materials include fir, spruce, pine, and bamboo. 78% of respondents use **pine battens**. Alternatives to wood, such as bamboo and hemp, are used, but rarely.

Most Common Crate Materials: Wooden Crate Lid Type



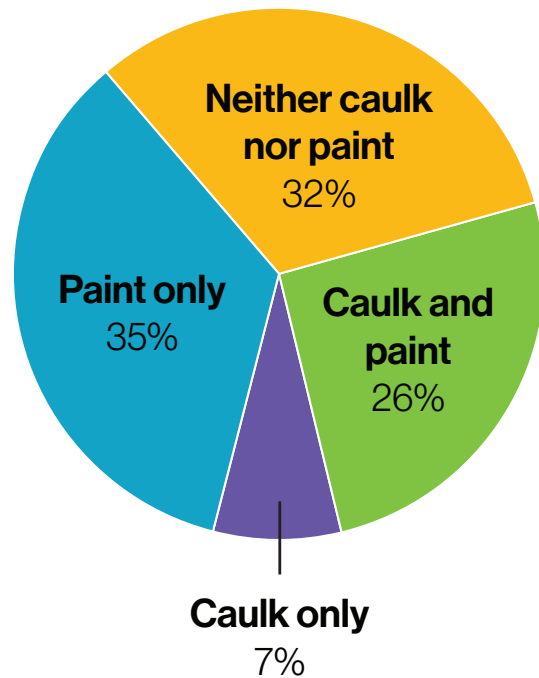
Main Points

Lid Type and Securing Method:

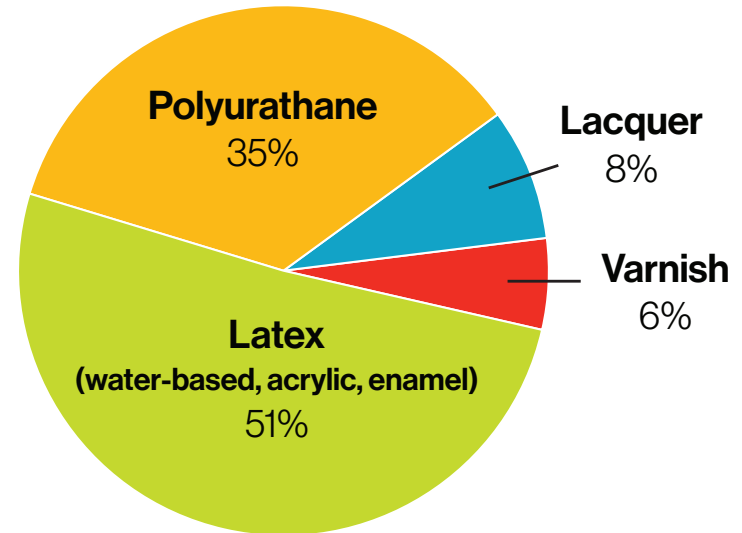
38% of respondents cited using more than one lid type reflecting respondents using multiple features in a single crate lid as well as those that use more than one crate design. Overall 66% are using **gasketed lids**. 68% of respondents cited securing crate lids with more than one method with both **bolts** and **screws** being the most common. This data indicates some respondents may be using multiple securing methods, such as screws and latches, and some use different methods of securing lids for different crate designs.

Most Common Wooden Crate Exterior Preparation:

Caulk Joints or Paint Exterior



Type of Paint/Sealant Used

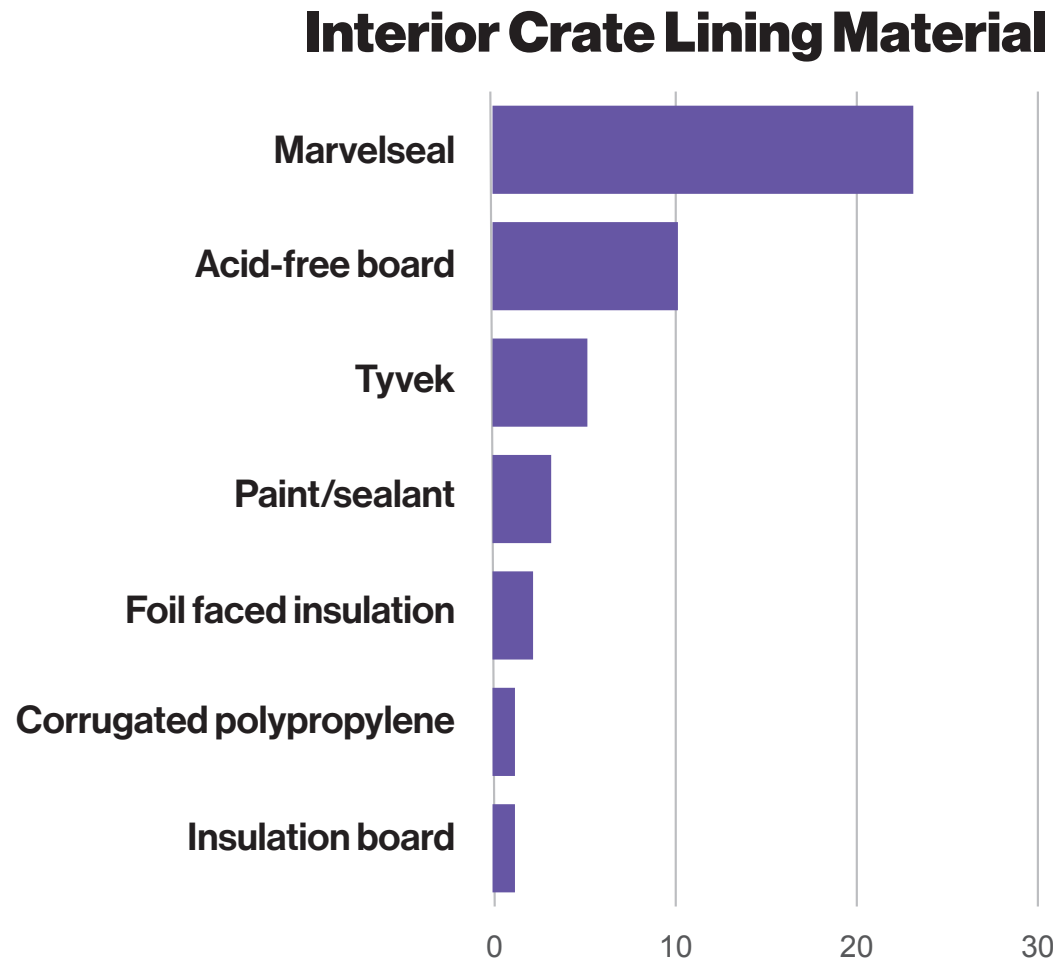


Main Points

Exterior Preparation:

68% of respondents reported sealing wooden crates with a **paint** or other sealant, **caulking** the joints, or **both**. Of the 61% of respondents that paint or seal the exterior of the crate, the majority use **latex paint**.

Most Common Wooden Crate Interior Preparation



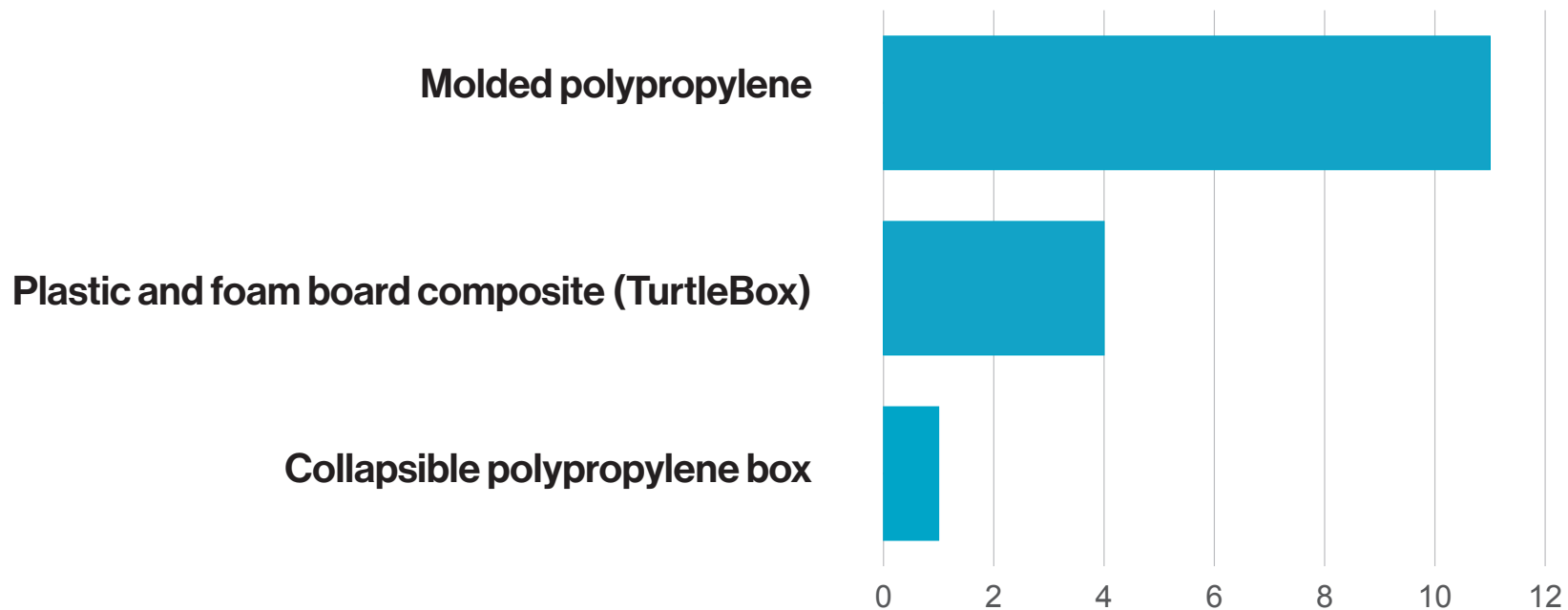
Main Points

Interior Lining:

64% of respondents seal the inside of their crates to mitigate off-gassing from crate construction materials. 25% of these respondents reported using more than one type of material to line the interior of the crate. **Aluminized nylon and polyethylene barrier film (Marvelseal)** was the most common material cited to line wooden crates.

Most Common Crate Materials: Plastic Crates

Types of Plastic Crates



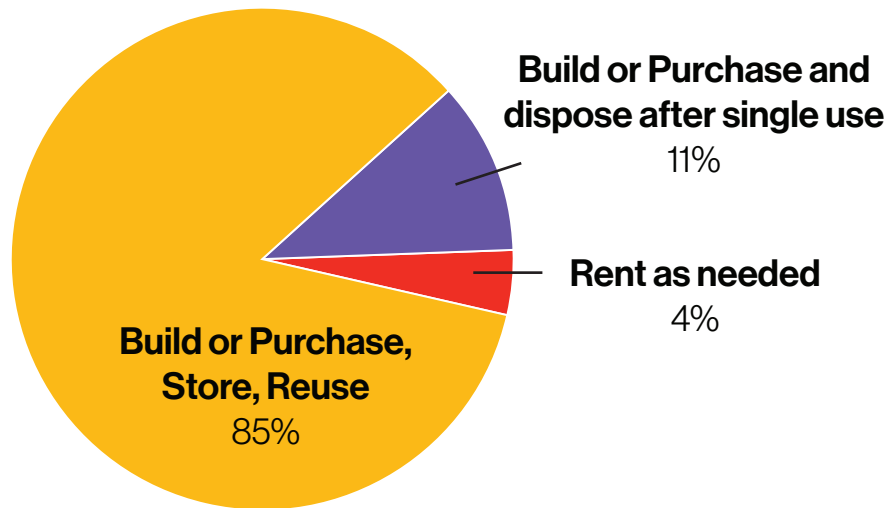
Main Points

Of the 16 respondents that reported using plastic crates, 69% use **molded polypropylene crates** (Pelican Hardigg and Star brands were cited). 25% use plastic and foam board composite (TurtleBox) crates. Other specifications respondents desired in plastic crates include: a gasketed lid, insulation, foam lining, crush-proof, lockable, water-tight, stackable, collapsible, and forklift access.

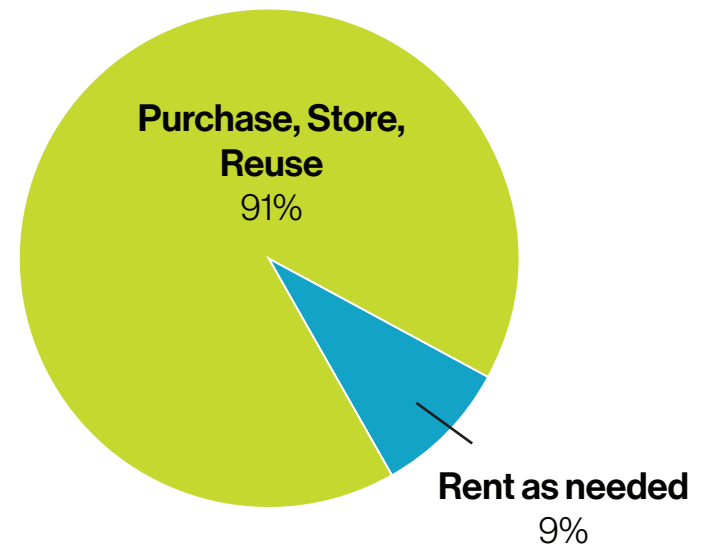
Reuse and Recycling of Crates

In addition to collecting data on materials commonly used for crate construction and packing, this project is also gathering data on recycling and reuse practices of crates and crate packing materials.

Wooden Crates

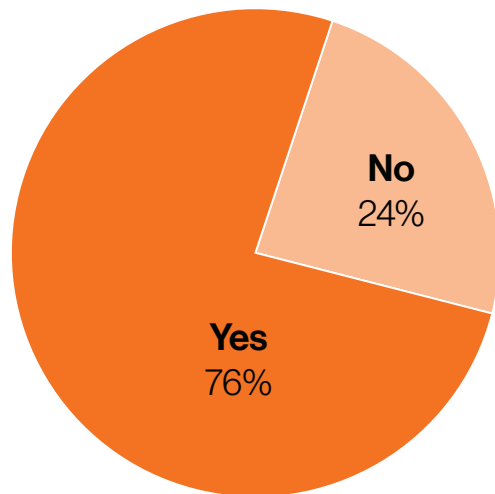


Plastic Crates

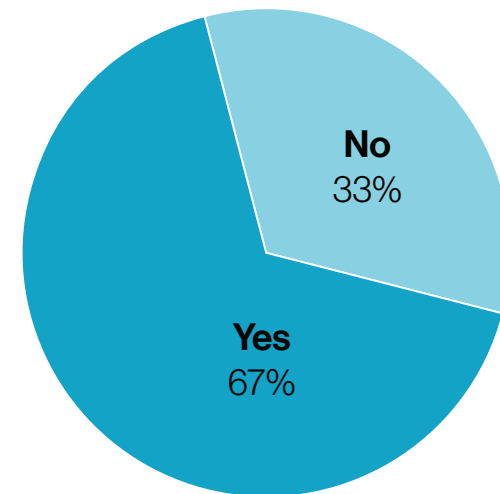


Shipping Crate and Packing Material Conditioning

Are **crates** stored in a conditioned environment or conditioned to specific environmental conditions prior to packing?



Are **crate packing materials** stored in a conditioned environmental or conditioned to specific environmental conditions prior to packing?

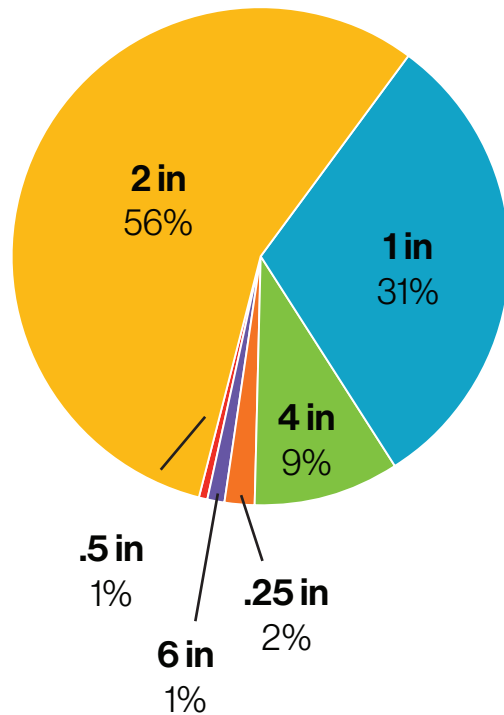


Main Points

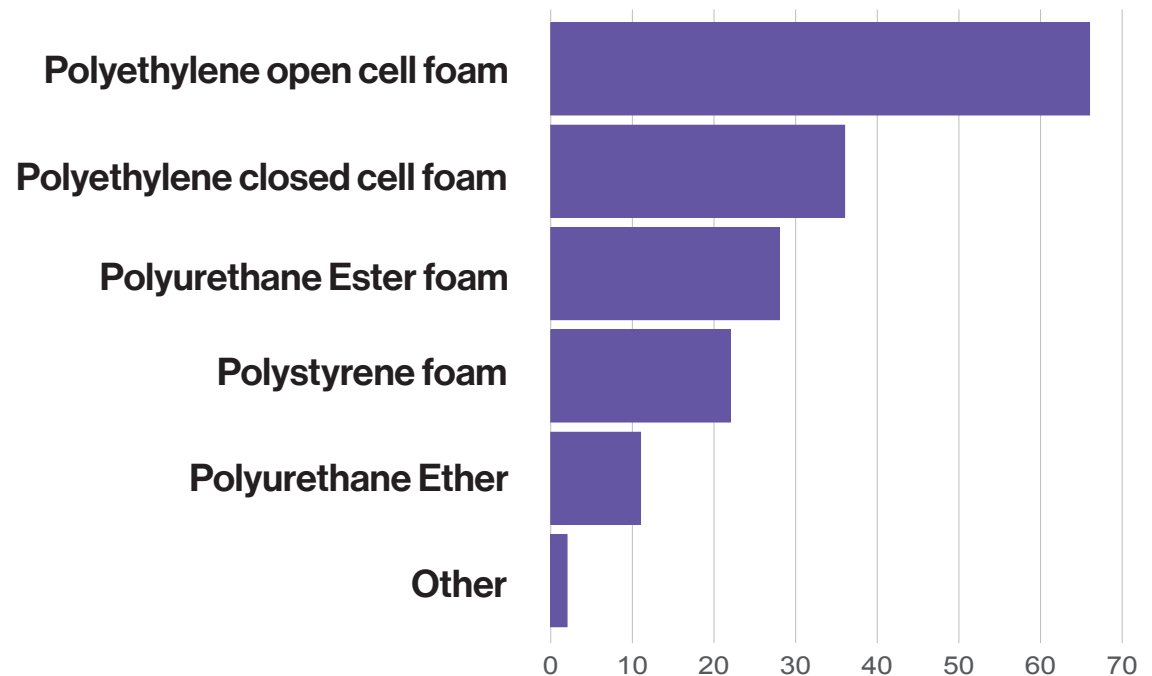
Most respondents store or condition crates and crate packing materials in a controlled environment ranging from **60-70°F** and **40-50% RH**. Some respondents store crates and packing materials in an environmentally controlled space while others move the crates and materials to a controlled space and allow them to equilibrate. Respondents' equilibration time ranged from 12 hours to several weeks with the most common response being **24-48 hours**.

Most Common Interior Packing Material: Lining, Padding, and Insulation

Interior Padding Material Thickness



Interior Padding/Insulation

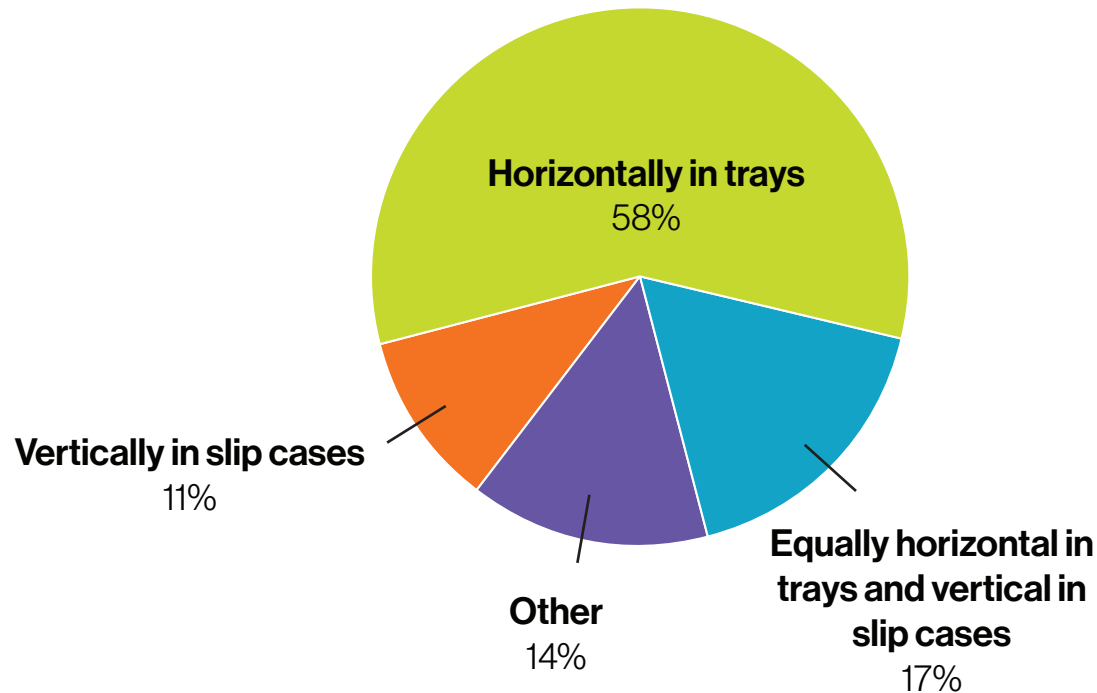


Main Points

The most common interior padding/insulation material is **2 inch open cell polyethylene foam (e.g. Ethafoam)**. 68% of respondents cited using more than one interior padding and/or insulation material. This data reflects respondents using more than one material in a single crate as well as respondents that use more than one crate design. 2 respondents do not use interior padding or insulation.

Most Common Interior Packing Materials: Orientation of Materials

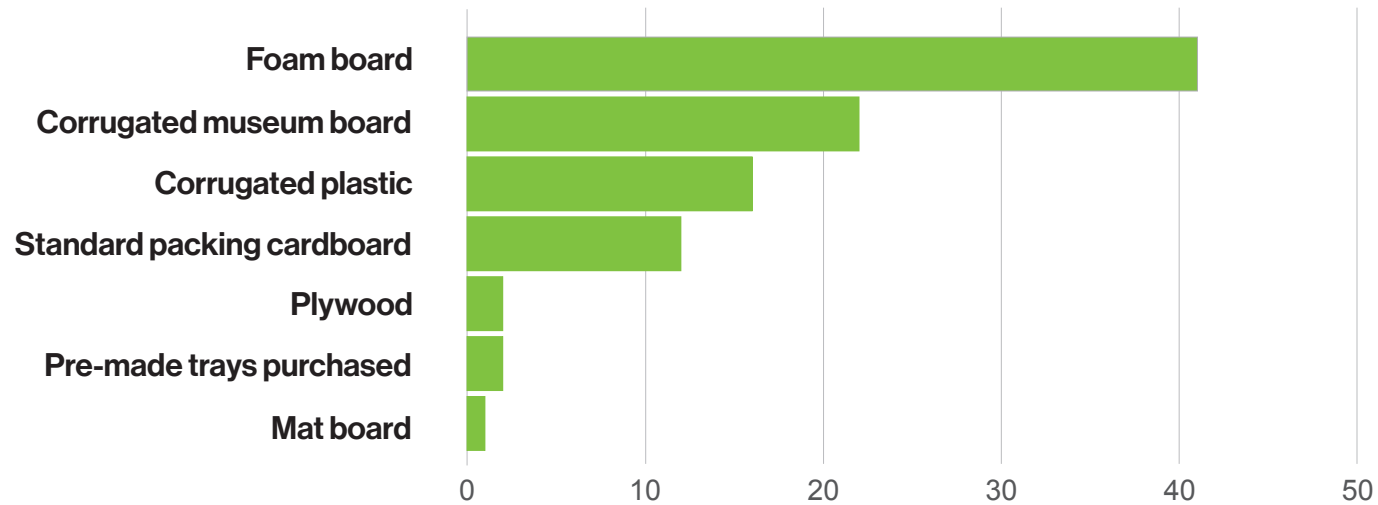
What is the most common orientation of paper-based objects when packed for transportation in a crate at your institution?



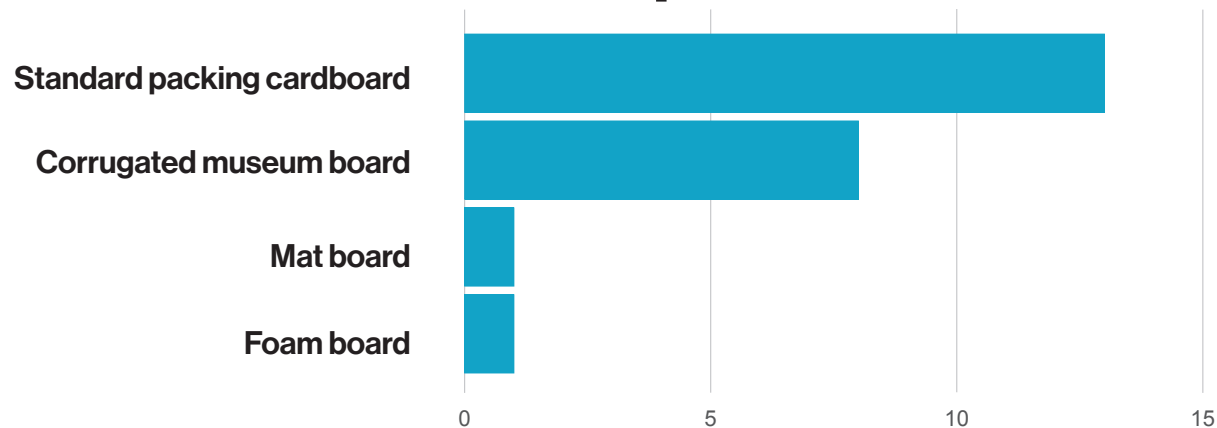
Main Points

Other object orientations cited include: horizontally wrapped in tissue; horizontally in slip cases; vertically in slots; vertically wrapped in Tyvek; the orientation depends on size, glazing materials, mounting method.

Tray Base Materials



Slip Case Materials

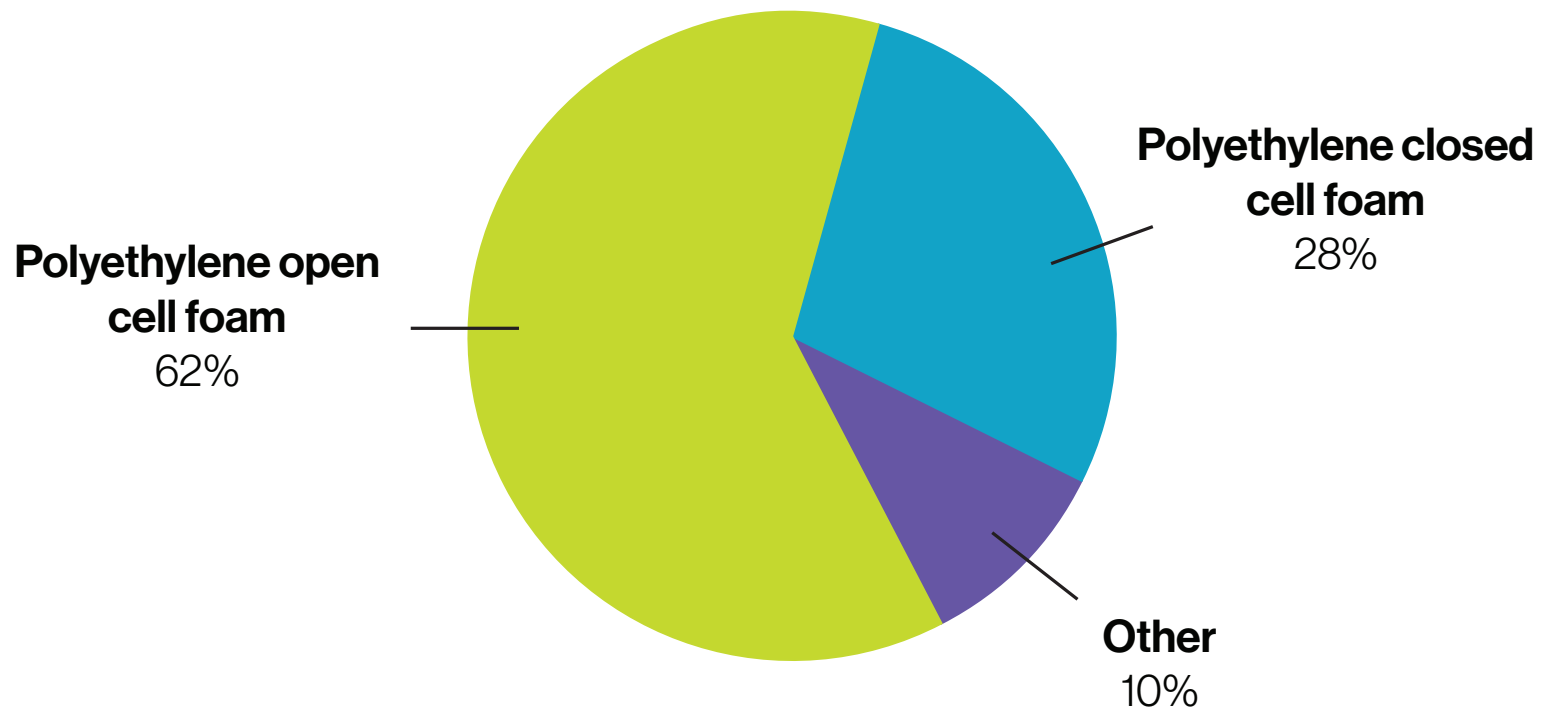


Main Points

Tray Base and Slip Case:

47% of the respondents that ship paper-based objects in trays cited using more than one type of material to create tray bases with **foam board** being the most common. Of respondents that use slip cases, 5 cited using multiple types of materials. Overall the most common material is **standard packing cardboard**.

Cavity and Padding Material



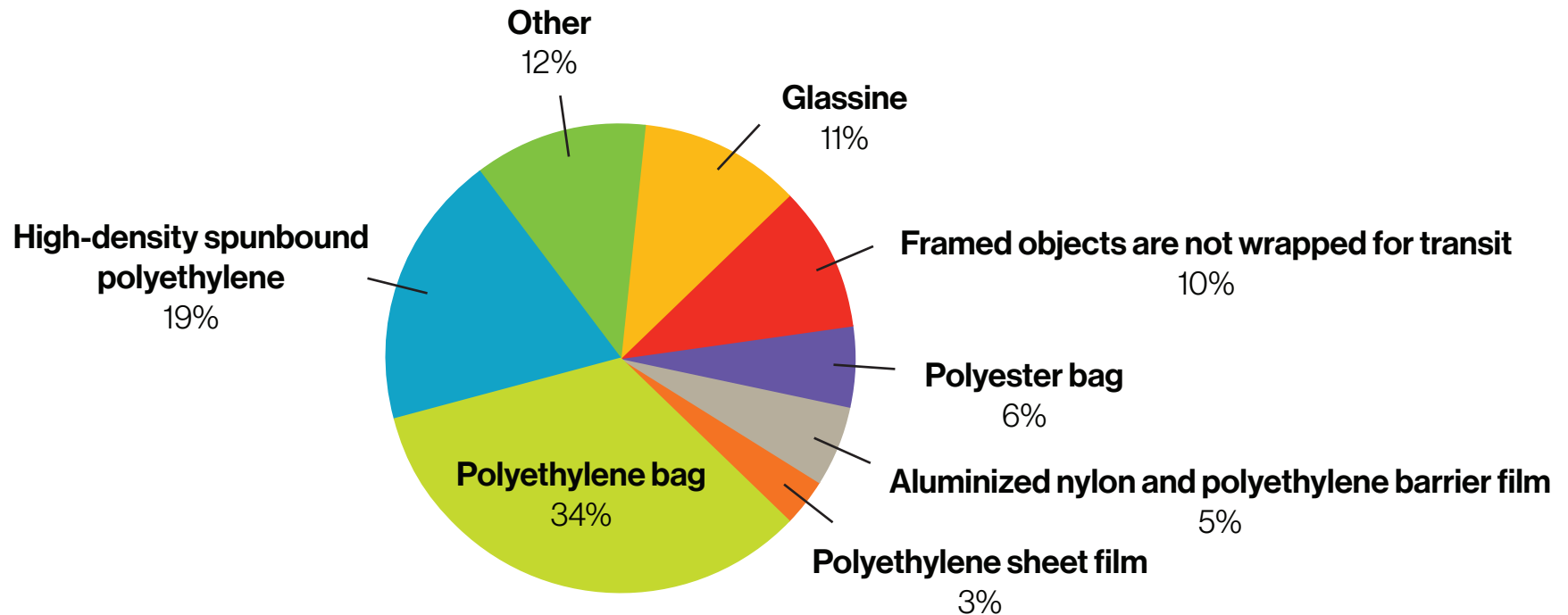
Main Points

Cavities and Padding:

45% of respondents reported using more than one material to pad and create a tray/slip case cavity. 38% use a combination of **polyethylene open cell foam** and **polyethylene closed cell foam**. 10% of respondents also cited using bubble foil insulation (aluminum bubble insulation foil polyethylene film compound), felt, honeycomb board, polypropylene foam, polyurethane foam, Tyvek, and bubble wrap.

Most Common Interior Packing Materials: Wrapping Framed Objects and Moisture Buffers

Wrapping Material



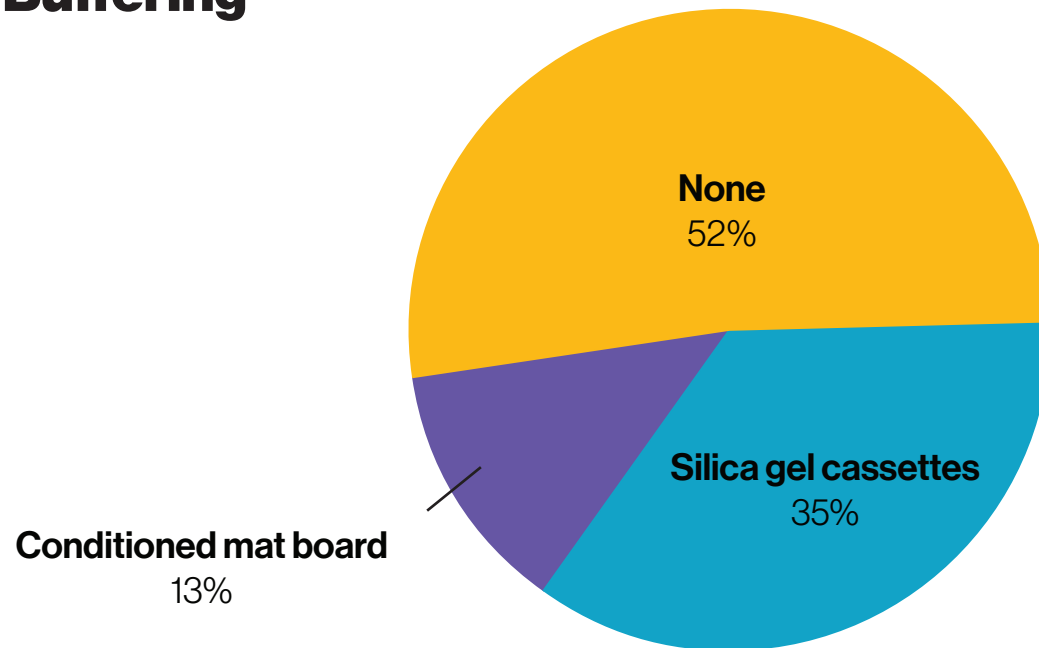
Main Points

Wrapping Materials:

92% of respondents wrap framed objects before packing them into crates. 9 respondents sometimes wrap framed objects. **Polyethylene bags** are by far the most common wrapping material. Three or fewer respondents cited the following wrapping materials represented in "other": nylon film, silk paper, polypropylene sheet, bubble foil insulation (aluminum bubble insulation foil polyethylene film compound), acid free tissue, chemical wood pulp paper, bubble wrap, and corrugated board.

Most Common Interior Packing Materials: Wrapping Framed Objects and Moisture Buffers

Moisture Buffering



Main Points

Moisture Buffers:

52% of respondents do not include an additional moisture buffering material inside crates. Those that do, commonly use **silica gel cassettes**. 10 respondents cited creating micro-environments at the object level using sealed frame packages, placing silica gel sheets in the frame, or wrapping the object in corrugated museum board or polyethylene bags.

Reuse and Recycling of Interior Packing Materials

Material	Landfill	Reuse/Repurpose	Recycle
Lining	15	35	7
Foam Padding/Insulation	18	56	7
Corner Pad	10	39	7
Wrapping	45	33	14
Trays	12	48	8
Slip cases	12	21	13
Tray/slip case cavity foam	12	40	2

Main Points

96% of respondents **reuse or repurpose** much of their **interior lining, padding, and packing materials**. 45% of respondents recycle some materials. Much of the material not reused or repurposed is not recycled. 79% reported sending some materials to the landfill. Because materials can only be reused a finite number of times, most packing materials are eventually thrown away. Some respondents were unsure if materials were recycled and others cited institutional obstacles to recycling.

Next Steps: Experimental Testing

The data summarized in this report will inform additional phases of the project. IPI will test a selection of crate construction materials and crate interior packing materials under several different temperature and relative humidity profiles. These materials will also be evaluated for cost and environmental waste comparisons. Combined with field study data, the ultimate goal is to provide guidelines for the most cost-efficient and environmentally responsible methods for safely transporting paper-based objects.

Acknowledgments

Thank you to everyone who responded and provided us with valuable information to inform our research and to the Institute of Museum and Library Services for funding this project.

