King County

Department of Executive Services
Finance and Business Operations Division
Procurement and Contract Services Section
Environmental Purchasing Program
www.kingcounty.gov/procurement/green
206-263-9294 TTY Relay: 711

Plastic Lumber

- **INTRODUCTION**
  - Plastic Lumber Types
  - Product Benefits
  - Purchasing Costs
- **STANDARDS AND GUIDELINES**
  - ASTM Recycled Plastic Lumber Standards
- **USAGE HISTORY AND EXPERIENCE**
- **BID AND CONTRACT SPECIFICATIONS**
  - King County
  - City of Seattle
- **FOR MORE INFORMATION**
- **VENDOR INFORMATION**

INTRODUCTION

Recycled plastic lumber is a product made from recovered plastic or recovered plastic mixed with other materials, which can be used as a substitute for concrete, wood, and metals. It is produced in sizes and shapes (profiles) typical in the lumber industry. Because of its resistance to decay, plastic lumber is an excellent material for decking, landscaping, and recreational equipment, particularly where it comes into contact with soil or water.

Recycled Plastic Bench

The technology for manufacturing recycled plastic lumber has been in place since the early 1980s. Plastic lumber is most commonly manufactured from post-consumer high density polyethylene (HDPE – common in milk jugs and plastic bottles), but linear low density polyethylene (LLDPE) and low density polyethylene (LDPE) are also used. These plastic feed stocks are derived from such raw materials as post-consumer milk jugs, grocery bags, plastic wrap, bubble rap, detergent bottles, and water bottles, and other used plastic commodities.

The recovered plastic is cleaned, shredded, and ground. The material is then melted and mixed with UV stabilizers and pigments, then it is molded or extruded into typical lumber shapes, (2x4 4x4, etc), or other shapes. This plastic lumber can then be transformed by consumers and manufacturers into a wide range of products including decks & docks, landscape timbers, parking stops, picnic tables, benches, trash receptacles, planters, and numerous custom applications.

Plastic Lumber Types

There are several types of plastic lumber:

<u>All Plastic</u>

This lumber is made out of high density polyethylene (HDPE) plastic and can be used in many conventional wood lumber applications, though it has different structural requirements and is not a direct

substitute for wood in all applications. Because of its excellent performance and resistance to decay, this is a superior material for decks and docks, where reduced maintenance and replacement costs justify the higher initial costs.

Wood/Plastic Composites

Usually a blend of 50 percent plastic is mixed with sawdust or other recycled fiber. This material is a little stiffer than all-plastic lumber, but is less expensive which makes it very popular with home owners. This material is primarily used for decks and docks with most companies now offering boards that look less like plastic and have a wood-grain texture that come in a variety of colors. The wood fibers are encapsulated in plastic. As with wood, these composites need to be cleaned and maintained according to manufacturers care instructions because they will show stains like wood and there can be mold and mildew, or decay problems.

Fiber-Reinforced

Fiber-reinforced plastic lumber consists of plastic mixed with chopped or continuous strands of glass fiber. The initial cost of this type is the highest of all, but its benefits are also greater, as it is the strongest of the three and may be used for structural applications.

Product Benefits

- Less inclined to rot, chip, splinter, peel, or crack.
- Ants, termites and other wood-boring insects will not damage plastic lumber and it does not promote bacterial or barnacle growth.
- Impervious to moisture, salt or fresh water, and will not mildew.
- Does not contain toxins (e.g., copper, chromium, and arsenic) found in treated wood.
- Graffiti is generally easily removed.
- Difficult to ignite. Ordinarily it will self extinguish when a flame is withdrawn from it.
- Easy to maintain and durable.
- Diverts plastics from the waste stream.
- Cost effective because of avoided long-term maintenance and replacement costs

Purchasing Costs

Recycled plastic lumber currently has a higher purchase price (initial cost) than virgin wood, but lasts longer than wood. When maintenance, replacement, and disposal costs are included in the analysis, recycled plastic products are the best value.

Purchase prices of plastic lumber are expected to decrease as technology improves and demand increases. Wood prices are expected to continue to increase. More and more of these plastic alternatives are available at your local hardware/lumber retail store.

STANDARDS AND GUIDELINES

ASTM Recycled Plastic Lumber Standards

ASTM International has played an important role in creating standardized, material-appropriate testing methods for recycled plastic lumber and developing purchasing specifications.

Follow these links to a free summary of the ASTM standards. Each reference includes information on how to obtain the full standard.

Standard Test Methods for Plastic Lumber:

Compressive Properties of Plastic Lumber and Shapes - D6108-09

Flexural Properties of Unreinforced and Reinforced Plastic Lumber and Related Products - D6109-10

Bulk Density and Specific Gravity of Plastic Lumber and Shapes by Displacement - D6111-09

Compressive and Flexural Creep and Creep-Rupture of Plastic Lumber and Shapes - D6112-10Mechanical Fasteners In Plastic Lumber and Shapes - D6117-10

Determination of the Linear Coefficient of Thermal Expansion of Plastic Lumber and Plastic Lumber Shapes Between -30 and 140°F (-34.4 and 60°C) - D6341-10

Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates - D2344 / D2344M - 00(2006)

Polyolefin-Based Plastic Lumber Decking Board - D6662-09

Establishing Performance Ratings for Wood-Plastic Composite Deck Boards and Guardrail Systems (Guards or Handrails) - D7032 - 10a

Guide for Evaluating Mechanical and Physical Properties of Wood-Plastic Composite Products - D7031 - 11

USAGE HISTORY AND EXPERIENCE

Park Sign Post

King County agencies have used and evaluated several recycled plastic products, including plastic "lumber", can-liners, bench slat replacement, truck sideboards, playground equipment, bollards, and other products.

The Renton Maintenance Facility of the Fleet Administration Division requires new dump trucks to be outfitted with recycled plastic sideboards before delivery. High-quality old growth Douglas-fir had been conventionally used in this application, but it is increasingly scarce and expensive. Since 1996, they have used recycled plastic because it is more impact-resistant and needs to be replaced less frequently, saving money in the long-term despite its higher initial cost. Replacement was immediately reduced from two wooden sideboards per week to less than one plastic sideboard per month which saves $10,000 per year in materials costs alone.

The King County Parks and Recreation Division has used recycled plastic lumber since 1993 for various applications, such as benches, tables and boardwalks. In 2005, because of the durability and low maintenance of these products, they purchased fifteen six-foot recycled plastic picnic tables for the Tolt River Campground at a cost of less than $7,000.

Stadium Administration Maintenance Section personnel used recycled plastic lumber to replace wooden 4"x4"x8' "channel boards" to secure the Kingdome artificial turf from 1994 to 2000. The performance of this material proved superior to that of virgin lumber and demonstrated a longer replacement schedule and lower life-cycle cost. The use of recycled plastic lumber for channel boards was also adopted by other stadia, including the Minneapolis Metrodome and B.C. Place in Vancouver B.C., Canada. The County-operated stadium was demolished in 2000 to make room for a new football stadium.

In 2006, improvements at Marymoor Park included the use of plastic lumber as part of the synthetic turf fastening system.

The City of Seattle regularly uses recycled plastic lumber for their Park Rainbow Signs and have used in various applications in their parks from pier-decking to a pedestrian bridge in city parks.

BID AND CONTRACT SPECIFICATIONS

King County

Plastic lumber contract provisions - Equipment Shop, Fleet Administration

- Recycled plastic truck sideboards 16' long
- one piece construction 3" x 9-1/4" x 16'
- round one long edge/square one long edge

Language used in new dump truck contracts:

Sideboard Pockets: 3/16” front and rear pockets with side boards (3” x 10”) one piece recycled plastic. Two equally spaced inner/outer sideboard supports per side.

Plastic Truck Sideboard

City of Seattle

Park Sign Specification

The City regularly uses recycled plastic lumber for their Park Rainbow Signs

City Rainbow Park Sign

Recycled Plastic Pedestrian Bridge

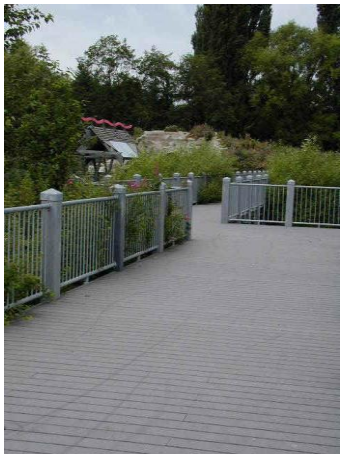
The City of Seattle built a recycled plastic pedestrian bridge in 1996 across a storm water retention pond at Meadowbrook Pond. They decided to use recycled plastic lumber because Thornton Creek was being rehabilitated as a salmon stream and they wanted to avoid the use of toxic preservatives.

At the time, plastic lumber was brand new to the marketplace, not widely available, and did not have a long usage history. The design team had to make adjustments to their original wood design because plastic is a different material than wood. Three different types of plastic lumber were sourced for this project:

- Recycled plastic 8"x8"s, reinforced with four steel bars (re-bar), were used for pilings and support members. The cost was approximately 1.5 times the cost of treated lumber.
- Fiberglass reinforced recycled plastic 2"x8"s were used for the joists, at a cost of about 2.7 times that of treated lumber.
- Recycled plastic/wood composite 2"x6"s were used for decking at a cost of about twice that of treated lumber.

This is probably the largest project that the City has done using recycled plastic lumber, but they have done several plastic lumber decking projects, park rainbow signs, and more.

Meadowbrook Pond Bridge



Meadowbrook Pond boardwalk

FOR MORE INFORMATION

Specific information on applications described in this publication may be obtained by contacting:

American Society for Testing and Materials (ASTM)
Customer Services
(610) 832-9500

Bob Toppen (sideboards)
King County Department of Transportation
155 Monroe Ave NE
Renton, WA 98056
(206)296-8159

Other information

- Health Building Network's Guide to Plastic Lumber (June, 2005)
- Plastic Lumber Product Ratings

VENDOR INFORMATION

- Contacts for Plastic Lumber Companies from Health Building Network's Guide to Plastic Lumber (June, 2005)
- Washington State Manufacturer's

  NewWood – new plant in Elma, WA

  OrcaBoard – Durable Plastic Designs, WA