

2000 State of the Recycled Plastic Lumber Industry
Presented by Alan E. Robbins
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“The Question: How to grow the Plastic Lumber Industry?”

This document was presented in a draft form to the Plastic Lumber Trade Association (PLTA) membership at the Annual Meeting held November 16, 2000. It has been reviewed, discussed, amended for accuracy and pertinent information. The completed document is published on the PLTA website, www.plasticlumber.org.

The established goals of the PLTA are to promote the Recycled Plastic Lumber (RPL) Industry, develop test methods, provide quality standards and promote the use of recycled plastic materials. The Plastic Lumber Industry is leaving the early business cycles of emerging technology and growth and entering into more mature business cycles of growth and marketplace acceptance. 2000 has been an interesting year as business growth and market acceptance continues. As we prepare to answer the question: “How to grow the Plastic Lumber Industry?” we will review our ASTM accomplishments, the PLTA/Battelle Multi-Client program and related demonstration projects, survey the various competing technologies, analyze the growth of current and developing markets, view the stages of business cycle development, list recent publications and technical presentations, glimpse at the trends in raw material supply and offer a few thoughts for the future of the PLTA.

American Society of Testing and Materials (ASTM) Test Method Development:

To date there have been eight new ASTM test methods established. These tests represent a significant amount of work and effort of many members of the ASTM D20.20.01 Committee. For this we offer our sincerest thanks to those individuals involved.

D6108-97, Standard Test Method for Compressive Properties of Plastic Lumber and Shapes.

D6109-97, Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastic Lumber.

D6111-97, Standard Test Method for Bulk Density and Specific Gravity of Plastic Lumber and Shapes by Displacement.

D6112-97, Standard Test Method for Compressive and Flexural Creep and Creep Rupture of Plastic Lumber and Shapes.

D6117-97, Standard Test Method for Mechanical fasteners in Plastic Lumber and Shapes.

D6341-98, Standard Test Method for Determination of the Linear Coefficient of Thermal Expansion of Plastic Lumber and Plastic Lumber Shapes Between -30F and 140F (-34C and 60C).

D6435-99, Standard Test Method for Shear of Plastic Lumber and Shapes.

E108 (Modified), Residential Decking Flammability (Burning Brand Test).

The process for conducting the Precision and Bias review for each of the above ASTM Standards is just beginning. There is a five (5) year window for this work to be completed after a standard is established. The ASTM committees and testing laboratories must work cooperatively together to insure the validity of each standard.

In addition, there are several test methods that are currently in ballot and review by the ASTM D20.20.01 Committees. Most notable is the X-20-18, Standard Specification for Polyolefin Plastic Lumber Residential Decking Boards. Much progress has been made during the year 2000 on this document with the release of long term creep data from the doctoral dissertation of Jose Martinez, a Ph.D. candidate in Civil Engineering from Louisiana State University. The utilization of the long term creep model, developed under this research activity, has been a key component for the completion of this ASTM Standard. While there has been intellectual debate from the civil engineering design community to better understand the creep issues of viscoelastic materials, we are pleased to announce that there has been a consensus agreement on the technical issues for X-20-18 and it has been submitted for a full ASTM Main Ballot with final ballot review to be completed at the March ASTM meetings to be held in Phoenix, Arizona.

This ASTM activity hinges upon the completion of the relevant technical activity of X-20-18 before the following documents may proceed to completion. There are several other items in ballot and are listed as follows:

- X-20-28 Guide for Testing Plastic Lumber
- X-20-30 Guide for Plastic Lumber Deck Construction
- X-20-43 Specification for Plastic Lumber Joists
- X-20-44 Standard Specification for Engineered PVC Decking

There has been keen interest from the government sector to develop appropriate test methodology utilizing recycled materials for large scale marine/waterfront structures. This has resulted in a spin off ASTM Committee for Marine/Waterfront Markets, D20.20.04. To make this a meaningful committee, there must be a significant increase in participation from manufacturers and related government entities. In addition, significant dollar costs are related to the testing of these large scale products which will go beyond the technical and financial capability of most participating companies and will require substantial governmental funding to further this new product development process. The current work in process for this committee is as follows:

- X-20-41a, Standard Test Method to Determine the Flexural Properties of Unreinforced and Reinforced Polymeric Piles.
- X-20-48 Test Method for Radial Compression of Polymeric Fender Piles.
- X-20-49, Specification for Plastic Lumber used in Bulkhead Systems.
- X-20-51a, Standard Specification for Polymeric Piles Used for Marine Load Fendering Systems.

PLTA/Battelle Multi-Client Project:

The year 2000 marked the third and final year of the PLTA/Battelle Multi-Client Project, which is a cooperative effort from manufacturing, government, materials research and the civil design engineering communities to push RPL into the structural applications of decking, marine waterfront and material handling. Four manufacturers: Bedford Technologies, Worthington, Minnesota; RENEW Plastics, Luxemburg, Wisconsin; The Plastic Lumber Company, Akron, Ohio; US Plastic Lumber, Boca Raton, Florida have participated by financial contribution and the donation of materials for the demonstration projects. In addition, a special thanks to the technical input from the following individuals and organizations for their work, effort and financial support for this successful program: Battelle; Dr. Prabhat Krishnaswamy, principal investigator, Engineering Mechanics Corporation of Columbus; Richard Lampo, Army Corps of Engineers, Civil Engineering Research Laboratory; Mal McLaren, M. G McLaren Engineering; Dr. Roger Seals and Dr. Vijay Gopu, Louisiana State University; Dr. Tom Nosker and Dr. Richard Renfree, Rutgers University; the American Plastic Council; State of Ohio Department of Natural Resources, Division of Recycling and Litter Prevention and the State of New York, Department of Economic

Development.

September 1999 marked the successful completion of the full scale testing of our deck model. To date, three demonstration projects have been completed. The fourth and final demonstration project, a 200 foot boardwalk in the Redhook area of Brooklyn, New York, is under construction at the writing of this document. It is our hopes to have website links to give full reports on each of these activities. Listed below are projects and completion dates.

June 1998, Fort Leonard Wood, Missouri: A replacement of a 25 foot light vehicle bridge.

September 1999, Kelley's Island, Ohio: A 600 foot wetland walkway in the North Pond area in association with the Audubon Society, Ohio Department of Natural Resources and the American Plastic Council.

July 2000, New York City, Op Sail 2000: The construction of 8 floating docks which were used by the "tall ships" which visited New York Harbor for the July 4th, 2000 celebration and then are utilized throughout the New York Burroughs for various youth and water sport activities.

April 1999, another demonstration project, not related to the Multi-Client project, was initiated with the Army Corps of Engineers. A new wetland boardwalk and observation area utilizing an "all plastic" lumber substructure and decking boards was constructed at Fort Belvoir, Virginia; Jackson M. Abbot Wetland Refuge and Mulligan Pond.

Technologies:

Currently, there are several technologies and polymer resin systems competing within the market place. We will give an overview of each technology and see how each technology is fairing in the marketplace. This activity of following technologies has become quite a challenge as a flow of new products and new technologies are constantly entering the market place. The primary activities of PLTA have centered around polymer based material systems. However, many of the new material systems utilizing high percentages of wood filled materials are worthy of our comments as many of the competitive markets are shared.

1) Single Polymer Systems made from recycled HDPE (High Density Polyethylene) experienced a significant growth in production capacity. For the decking markets, the continuous extrusion of structurally foamed HDPE appears to be the clear leader in the decking board market of the all plastic material systems. In late 1999, the publically traded US Plastic Lumber (USPL) announced the planned addition of 37 new extrusion lines and also announced the completion of the BOCA (Building Officials and Code Administrators) Evaluation Review for their Carefree Decking product. However, these new capacity announcements have been tempered by recent announcements of the moth balling of manufacturing facilities through March 2001. This is an indicator that sales have not been able to keep up with production capacity growth. It also points to the issue of how to properly handle wide seasonal swings in demand brought about by the building and construction markets.

2) Extrusion Flow Molding systems experienced set backs in the year 1999 with Temple-Inland and US Plastic Lumber ceasing the manufacturing of lumber from the flow mold process. However, there appears to be sustained growth in the thick wall molding of large parts, which serve as components for park and recreation markets, along with other commercial markets. It is believed that several of the railroad tie products are manufactured by the extrusion flow molding process, which is discussed later in this document.

3) Fiberglass Reinforced RPL has made a nice recovery from the liquidation of Trimax in 1998. US Plastic Lumber purchased the assets and appears to have recovered lost market segments in the marine/waterfront after moving manufacturing to their Trenton, Tennessee facility. There have been several “all plastic lumber” projects announced over the past year. The most significant being the multi-level starting platform at the Lake Placid luge and bobsled run constructed in cooperation with the New York State Department of Economic Development.

One of the truly unique structures utilizing RPL has been an arched bridge designed by M. G. McLaren Engineering, for the New York State Department of Economic Development. This load carrying bridge was constructed by volunteers over two weekends in New Baltimore, New York near Albany, NY. This could easily be an award winning project. We hope to have additional information posted on our website in the near future.

The building and construction markets are continuing to look for products with enhanced physical properties. There is continued work in the placement of fiberglass reinforcements in the outer regions of the lumber profile to better optimize the flexural modulus of RPL. Also a number of start up and existing manufacturers are beginning to pursue technologies to manufacture structural plastic lumber components.

4) Polymer/Polymer systems have furthered their gain in the marketplace and of particular note is the activity of Polywood, a New Jersey manufacturer, who participated in Army Corps projects as joist members in bridge and wetland boardwalk projects. In addition, Polywood is manufacturing railroad ties with patent licensing agreements from Rutgers University. The Polyethylene/Polystyrene resin systems are reporting physical properties higher than the chopped fiberglass competitive products. This is certainly a new technology segment worthy of observing. Several bids for railroad ties have been won by Polywood, including the Chicago Transit Authority, along with other rail transit authorities.

5) The PVC Industry is another technology area of great significance as they have substantial activity in the decking and railing markets. The PLTA has worked cooperatively with the American Architectural Manufacturers Association (AAMA), which is developing a PVC Decking Standard through their own organization. The PVC industry is a significantly more mature industry with enormous capital resources and has been working within the building products marketplace for many years. There has been significant activity utilizing RPL decking and PVC Railing components in the marketplace. It is important to watch the relationship of these technologies as the consumer decides what products they will purchase and install.

6) The Wood Filled/Thermal-plastic composites systems are worthy of noting even though they **do not** meet the ASTM definition for Plastic Lumber, as they are more wood material than plastic. This technology and their related building product markets closely parallel those within the RPL industry thereby making it important to mention their successes and activities. Most notable is the activities of the publicly held Trex (TWP trading symbol), a Winchester, Virginia based corporation. Recent public announcements have noted Trex's 2000 sales volume near \$100 million. The primary Trex market segment is residential decking with extensive distribution throughout the US building product markets. It is important to note that the annual sales of Trex is higher than the RPL industry's sales as a whole.

Other Wood/Plastic decking products have been active, the most visible being Timbertech, Smartdeck and Choicedeck. Recent product announcements by Certainteed, Louisiana Pacific and other forest products companies will make keen competition in this marketplace. The January 2001 Builders Show in Dallas, Texas might be very interesting as the new and existing products are paraded in front of the marketplace. It is rumored that many of the major forest product and

building product companies are developing their own plastic/wood and/or wood/plastic lumber products. Most of this activity still resides within their research and development departments and no significant public announcements have been made to date.

There has been several new wood/plastic product entries coming from Canada. Of particular note are Toronto based CRT Technologies and CPI. Also, the University of Toronto has an active research program centering around the micro-cellular foaming of wood/thermal plastic composites.

The Markets for RPL:

Sales volume estimates still remain hard to project, given that most manufacturers still remain privately held or are divisions of larger companies. Gross revenue estimates have moved to \$70 to \$90 million from last year's \$60 to \$80 million estimate. With the merger consolidation experienced over the past years, it is difficult to place an overall market growth. Certainly with the new capacity added in year 2000 there will be continued revenue growth for 2001. The residential decking market is close to surpassing the long time leader of the Park and Recreation Market as the largest single market segment. Additional OEM activity is taking place in the hot tub/spa industry as they search out new and innovative products to replace the traditional redwood material systems.

Also of particular notice has been the Railroad Tie market segment, most notable being that Polywood and US Plastic Lumber were announced as finalists in the Charles Pankow Award for Innovation by the Civil Engineering Research Foundation. There have been several announced demonstration projects throughout the US and four companies have announced they are making railroad tie products. The railroad tie market offers a sales dollar which is higher than the residential decking market. One should stay alert to new announcements in this market segment.

Our best estimates for the percentage ranges of market share of the \$70 to \$90 million dollars of the gross sales revenue are as follows.

	<u>Market Share</u>
Commercial and Residential Decking	30% to 40%
Park and Recreation	20% to 30%
Industrial/OEM/Agriculture	20% to 25%
Marine Waterfront	5% to 15%
Railroad Tie	2% to 4%
Material Handling	1% to 2%
Fencing	1% to 2%

Recent Publications:

Lampo, Richard. "Standards Boost an Industry, Recycled Plastic Lumber Gains Ground," ASTM Standardization News, July 1999

Wilson, Alex. "Recycled Plastic Lumber in the Landscape," Landscape Architecture, Sept. 1999

Krishnaswamy, Prabhat and Donna Stusek. "Structural Applications for Recycled Plastic Lumber," Resource Recycling, October 1999.

Notable Technical Presentations:

"Recycled Plastic Lumber, Technical Session," R2000, Toronto, Ontario, June 2000.

"Development of ASTM Standards for Plastic Lumber, a Comprehensive Overview of Standards to

Date and Work in Process.” Alan Robbins, Society of Plastic Engineers, Annual Recycling Conference, November 1999, Dearborn, Michigan.

“Recycled Plastic Lumber, Technical Session,” International Composites Expo, May 1999, Cincinnati, Ohio, various presenters.

Business Cycle Development:

A natural evolution in a business cycle is the consolidation of manufacturers. US Plastic Lumber (USPL) has continued its use of the public stock to aggressively consolidate the RPL marketplace by purchasing 13 various plastic lumber and plastic slip sheet manufacturing entities, vertically integrating raw materials and announcing two new large manufacturing facilities in Fontana, California and Ocala, Florida. Their most notable 1999 acquisition was the Eaglebrook Companies, Chicago, Illinois. From SEC filings, it is estimated that USPL's plastic lumber division revenues will top \$60,000,000 in 2000.

A secondary activity within the merging industry business cycle is the spinoff cottage industries created by those individuals displaced by the consolidated businesses. We are only beginning to see this aspect beginning to reveal itself and unable to ascertain the total market impact that this will have on the industry.

A third activity in the business development cycle as new markets establish their legitimacy is the entry of new and larger market players. We are beginning to see the first waves of this activity and expect to see more in the years to come. This activity can signal many issues as companies move outside of their core technical competencies to explore new technology markets. This market penetration can have mixed results, but will certainly be interesting to watch the overall progress of new market entries as they attempt to establish their brand identity in the already established building products industry.

Raw Materials:

All plastic resin materials experienced significant price increases through 1999-2000. The cost of HDPE plastic resin rose nearly 35% over the past year. The pricing began to flatten out into the third quarter 2000 and started a slight down trend heading into the end of 2000. New HDPE capacity is expected to enter the supply chain which should help relieve pricing pressure. We must continue to watch resin pricing trends as there still appears to be no stable pricing model from which to base your business plan. Of particular concern is that, for several months, recycled HDPE dairy bottles traded 10% to 20% higher than wide spec HDPE. The buying markets will have difficulty purchasing recycled materials with a price spread of this magnitude. Recycled materials will need to seek an economic price equilibrium to sustain their growth in the raw material markets.

A large part of the plastic lumber technologies and markets developed from the recycled materials that are fueled by the on going availability of natural colored, unpigmented plastic resins. Particularly, the use of recycled dairy bottle materials (HDPE) has added much to the growth of our industry. This allows the plastic lumber manufacturer to add attractive colorants to the recycled plastic resin and enhance the commercial acceptance of their product.

There is a rather disturbing change in the raw materials supply beginning to develop within the dairy industry. This is the change to a pigmented milk jug. There are estimates that nearly 50% to 70% of the dairies are considering a move to a colored milk jug. This change in raw materials could significantly alter the raw material supply chain and force manufacturers to buy wide-spec or prime virgin resins to meet capacity needs, thereby significantly increasing cost of goods sold. This

movement to pigmented dairy bottles could derail the RPL industry's commitment to recycled plastics and damage the vertical integration into the raw material supply that several manufacturers have enacted.

How to grow the Plastic Lumber Industry?:

Much more could be written about the underlying fundamentals of the Plastic Lumber market place. The RPL industry is quite young from a business cycle stand point and has only begun to leave the emerging technology cycle into the business growth cycle. Much work needs to be done in both depth and breadth of technology and product development before RPL will gain permanent market place acceptance. The various RPL technologies and the markets represented by these technologies will compete in the open market against other new developing material systems along with the traditional wood materials they are attempting to displace. The competing companies will need to work cooperatively to resolve industry problems, continue to create relevant ASTM Standards, develop quality standards, provide competent demonstration projects, gain building code approval, be accepted by the consumer and efficiency in distribution networks that will allow these materials to enter the marketplace effectively.

The buyers are vocal as to their need for material consistency, quality standards and on time delivery. To compete effectively in the US Building Products Markets the Plastic Lumber Industry must be represented by a competent trade association. There needs to be a renewed commitment by all primary manufacturers, design engineers, researchers, marketers and end users to have a sound trade association representing their market interests.

While in the past few years the rapid merger aspects of this industry and the shrinking number of manufacturers has stressed this trade association's ability to effectively serve its constituents, the opposite may very well be the case. Rapid entry of new material systems of either plastic, wood or combination of each could create greater market confusion upon the buyers and strain their ability to discern which product they feel is best suited for their application. The PLTA will continue to access its role within the industry and explore ways that better serve the future of Recycled Plastic Lumber. We must not become complacent with our successes and early business cycle growth and miss the opportunities which will technically advance our products and move our industry totally into the market acceptance for our products. We feel our key market strength is to facilitate the work of ASTM and provide a forum for new and old members to discuss industry issues. We look forward to continuing that work in the year 2001 and beyond.

Respectfully Submitted, November 16, 2000
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