

2001-2002 State of the Recycled Plastic Lumber Industry
Presented by Alan E. Robbins
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The Plastic Lumber Industry in Competitive Markets

This document was presented in draft form to the Plastic Lumber Trade Association (PLTA) membership at the Annual Meeting held March 11, 2002. It has been reviewed, discussed and amended for accuracy and pertinent information. The completed document is published on the PLTA website, www.plasticlumber.org. With apologies, our final 2001 meeting was lost due to post 9/11 travel security issues. In an effort to simplify our reporting process we have combined the 2001 and 2002 report within this document.

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. In the 2000 State of RPL, it was mentioned that our industry is leaving the early business cycle of emerging technologies and entering into the more mature business cycle stages of business growth and market acceptance. As we prepare to ponder the question: “Can the Plastic Lumber Industry survive in competitive markets?” we will review our ASTM accomplishments, the completion of the PLTA/Battelle Multi-Client program and its related demonstration projects, survey the competing technologies, analyze the current and developing markets, view the stages of business cycle development, 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:

Our most recent standard issue, D6662-01 Standard Specification for Polyolefin-Based Plastic Lumber Decking Boards, was added to the 8 existing test standards in March of 2001. This standard helps guide the marketplace to the proper use of RPL and resolves issues regarding the use of RPL in decking boards, such as dimensional tolerances, creep, allowable material properties for structural design, outdoor weathering and UV Exposure. These issues are referenced in more detail in Krishnaswamy and Lampo’s article, *Recycled-Plastic Lumber Standards: from waste plastics to markets for plastic-lumber bridges*. The following standards represent the significant amount of work and effort of many members of the ASTM D20.20.01 Committee. For this we offer our sincerest thanks to the individuals involved.

- D6108-97, Standard Test Method for Compressive Properties of Plastic Lumber and Shapes
- D6109-97, Standard Test Method for Flexural Properties of Un-reinforced 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
- D6662-01 Standard Specification for Polyolefin-Based Plastic Lumber Decking Boards
- E108 (Modified), Residential Decking Flammability (Burning Brand Test)

The process for conducting the Precision and Bias (P & B) review for each of the above ASTM Standards has begun and is being conducted under the direction of Dr. Prabhat Krishnaswamy with direction from Ms. Barbara Guideon, Body Coat Broutman. There is a five year (5) window of time for this work to be completed after a standard is established. The ASTM committees and testing laboratories are working cooperatively to insure the validity of each standard.

The results of the first round of P & B testing were presented at the March 12, 2002 meeting of the ASTM D20.20.01 Committee. It is anticipated that all completed P & B activities will be ready for ballot prior to the November meetings, with the exception of D6109 Flexural Creep. To date, we have been unsuccessful in arranging the proper lab facilities to conduct this test because of the long time duration of testing over different temperatures ranges. We are still continuing to locate viable participants for the completion of this activity.

With the completion of D6662, there are several additional ASTM documents that need to be reactivated for ballot.

- 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 and beams

As reported in the past, there has been keen interest from the government sector to develop the appropriate test methodology utilizing recycled materials for large scale marine/waterfront structures. This market need resulted in a spin-off committee, ASTM D20.20.04 for Marine Waterfront Applications. However, this committee has not had an active ballot in two years and considerable discussions have surrounded how to revitalize this committee to be a productive and meaningful contributor to the ASTM Standards Development. To further this cause, there were special task group meetings of D20.20.04 and the structural aspects of D20.20.01 committees which were held Friday, May 17, 2002 and September 20, 2002 at the offices of M.G. McLaren Engineering in West Nyack, New York. Because of the large scale testing required for these materials, there needs to be great cooperation among many university and government testing facilities 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 the 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

ASTM standards can be purchased at www.astm.org.

PLTA/Battelle Multi-Client Project:

The PLTA/Battelle Multi-Client Project was initiated in 1997 as a collaborative effort of the PLTA membership, manufacturers, State Governments, material researchers and the civil design engineering communities to further the development and understanding of RPL products into structural applications of residential decking, marine waterfront and material handling. Four manufacturers: Bedford Technologies of Worthington, Minnesota; RENEW Plastics of Luxemburg, Wisconsin; The Plastic Lumber Company of Akron, Ohio and US Plastic Lumber of Boca Raton, Florida participated by financial contribution and the donation of materials for the various demonstration projects. This project was guided under the direction of Dr. Prabhat Krishnaswamy as our Principal Investigator. A special thanks is extended to the following individuals and their recognition from the ASTM D20.20.01 Committee: Battelle, Columbus, Ohio; Dr. Prabhat Krishnaswamy, Engineering Mechanics Corporation of Columbus, Richard Lampo, Army Corps of Engineers, Civil Engineering Research Laboratories; Mal McLaren, M. G. McLaren Engineering; Dr. Roger Seals, Dr. Vijay Gopu and Doctoral student Jose Martinez Guerrero, Louisiana State University; Dr. Tom Nosker and Dr. Richard Renfree, Rutgers University; the American Plastic Council; the State of Ohio Department of Natural Resources, Division of Recycling and Litter Prevention and the State of New York, Department of Economic Development.

To follow is a brief chronology of the various demonstration projects of “Multi-Client”. This project was extended through 2001 to allow for the completion and inclusion of the ASTM D6662 Residential Decking Board Standard, which was a focal point of this project. More information on this project can be found at www.battelle.org.

June 2001, New Baltimore, New York: Completion of the *first*, all-plastic lumber, H15 class vehicle bridge designed by M.G. McLaren Engineering and constructed by volunteers over two weekends. The structure has received significant recognition and has been featured in the ASTM Methods Publication and Civil Engineering Review. You may view these articles at www.eswp.com; paper no. is IBC-01-65.

July 2000, New York City, Op Sail 2000: The construction of 8 floating docks that were utilized by the “tall ships,” which visited the New York Harbor for the July 4th, 2000 Independence Day celebrations. The docks were then disbursed throughout the New

York Burroughs for various youth and water sport activities. This project was designed by M.G. McLaren Engineering and constructed by volunteers. You may review this project on the internet at www.mgmclaren.com and www.waterwire.net/index.

February 2000, Lake Placid, NY: Construction of the Lake Placid Luge Platform was completed. A review of this project can be found at www.plasticsresource.com/recycling/other_resources/NewYork.html.

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

April 1999, Fort Belvoir, Virginia: A project initiated in conjunction with the Army Corps of Engineers that entailed the construction of an all plastic lumber wetland boardwalk and observation area, including substructure and decking boards, at the Jackson M. Abbot Wetland refuge and Mulligan Pond.

June 1998, Fort Leonard Wood, Missouri: The successful replacement of a 25 foot light vehicle bridge was completed.

All of these projects are discussed in the article by Dr. Prabhat Krishnaswamy, "Recycled-Plastic Lumber Standards," which can be viewed online at www.astm.org/SNEWS/DECEMBER_2001, and also in power point format at www.ohiodnr.com/recycling/pages/rplproj.htm.

Technologies:

As we have reported in previous State of the RPL Industry, there are several technologies and polymer resin systems competing within the marketplace. We are seeing a significant broadening of various material systems competing for market share. There are a number of new entries by manufacturers of wood/plastic (Bio-Composite) composite resin systems. These material systems are governed by the ASTM D7.02.07 committee. We are very disappointed that this committee has not effectively brought any new standards forward that properly show the physical properties of these materials. There will be additional comments on Bio-Composites later in this document.

1) **Single Polymer Resin Systems** made from recycled HDPE (High Density Polyethylene) showed mixed growth during 2001. The continuous extrusion of structurally foamed HDPE is the clear leader in the all-plastic decking board markets. A poll of privately held manufacturers shows a plus 14% growth pattern for 2001. The Akron, Ohio based The Plastic Lumber Company announced the completion of an additional 40% capacity growth for 2001 and additional capacity expansions targeted for completion during the 4th quarter 2002.

The publicly traded, Boca Raton based US Plastic Lumber Company (USPL) reversed 1999 announcements of capacity growth with the consolidation of

manufacturing into three operating facilities in an effort to improve manufacturing efficiencies. In addition, USPL has recently announced the sale of their Clean Earth division which will leave the Plastic Lumber Division as a stand alone operating company.

2) **Extrusion Flow-Molding Systems** appear to be adding some technologies and some market growth to the RPL industry. Bedford technologies have introduced a “structural lumber” product from their flow-molding process. It is also believed that some railroad tie production is utilizing flow-molding systems. However, there are indications of moving towards continuous extrusion in the railroad tie business. Much of the large dimension marine piling with metal reinforcements is manufactured utilizing flow-molding technologies.

3) **Fiberglass Reinforced RPL** has been making a slow recovery from the 1998 liquidation of Trimax whose assets were purchased by US Plastic Lumber. Much of the truly unique engineered projects have been designed utilizing the fiberglass reinforced material systems. Two of the most visible projects have been designed by M.G. McLaren Engineering, West Nyack, NY. This includes the award-winning, load bearing H15 arched bridge constructed in New Baltimore, NY. This project was done in cooperation with Mr. Keith Lashway, New York State Department of Economic Development.

The building and construction markets continue to demand and seek structural material systems with enhanced physical properties. In the 1st quarter 2002, the US Environmental Protection Agency announced the 3 to 5 year phase out of permits for the manufacturers of CCA pressure treated lumber, the primary wood used as an outdoor construction material. While the hazards of CCA are well known and this EPA announcement does not come as a great surprise, it does dramatically increase the demand for alternate material systems along with a challenge to the lumber industry to convert to other processes for the replacement of the current pressure treated lumber. As was mentioned earlier in this paper, the ASTM D20.20.04 committee has been somewhat frustrated by the lack of progress in the development of standards in the structural materials area, especially in the marine/waterfront markets. This furthers the significance of the May 17 and September 20, 2002 meetings held at the M.G. McLaren offices in the effort to bring important standards development work to the forefront of research.

It is known that several companies have been working on structural lumber systems, but there have been no public announcements of product launches to date. At the PLTA website there will be published references to such announcements as they become available.

4) **Polymer/Polymer Systems** have furthered their market acceptance over the past year with additional penetration into the railroad tie market place. Of particular note is the activity of Polywood located in Edison, New Jersey, who manufactures an immiscible polymer blend of polyethylene/polystyrene. Polywood uses this patented technology licensed from Rutgers University.

Early in 2002, Rutgers University announced the formation of a new technology center, Advanced Materials via Immiscible Polymer Processing (AMIPP). This is a very interesting multi-tier project centering on the processing of immiscible polymer blends of various resins. Richard L. Lehman is the Director. Thomas Nosker is the Principal Investigator. You may view updates on AMIPP's website at www.amipp.rutgers.edu.

5) **The PVC industry** has been notably active within the residential decking and railing markets. The PLTA and the American Architectural Manufacturers Association (AAMA), www.aamanet.org, are working cooperatively through ASTM to address common industry concerns within the marketplace. Also, members of the AAMA organization include many of the companies involved within the Bio-Composite markets which will be discussed later within this article. This author has noted significant activity utilizing RPL decking and PVC residential railing components within the building products marketplace. It is important to watch the relationship of the materials and technologies to the consumer and the marketplace in order to notice what materials, or combination of materials, are purchased and installed.

Of particular note are the activities of Marley Molding, a division of Royal Group Technologies Limited, whose work in the development of specialty applications into the dimensional lumber markets has been very innovative. This author has seen significant activity within the hot tub/spa industry for siding applications in the replacement of traditional redwood. To the best of our knowledge, these PVC products have no recycled content

6) **The Polystyrene industry** has been introducing new products into to the specialty lumber markets. Of particular note is the activity of CPI, Toronto, Ontario. This author also notes CPI's activities in the hot tub/spa industry as well as the newly introduced products into the residential decking and railing markets. To the best knowledge of this author there are no recycled content within these products.

7) **Bio-Composites** are being defined as those material systems that combine wood or other biological materials, e.g. flax, rice hulls and etc., within a thermoplastic matrix. There have been many introductions of new bio-composite material systems introduced over the past few years. These materials generally do not meet the ASTM D20 definition of plastic lumber as they contain over 50% bio-materials. The ASTM governing body for bio-composites lies within the D7 Wood Products Committee. Bio-Composites make up the largest component of the new material systems entering into the residential building products marketplace. Because of their presence and market size, it is important to mention their successes and activities with the publicly traded Trex (symbol TWP) being the most visible, having expected sales near \$125 million for 2002.

Many other bio-composites have entered the market in recent years and it is outside the reach of this author to identify these new market entries. The most visible trade names of these bio-composites are Fibron, Timbertech, Smart Deck, Choice Deck, and Boardwalk. The annual International Builders Show held every January seems to be the place to view the newest product offerings to the national marketplace. It is rumored that

many of the major forest product companies are developing their own plastic/wood and/or wood/plastic bio-composites in order to enter that market. To date there have been no significant public announcements made by the companies beyond the announcement of new manufacturing capacity being built.

The Markets for RPL:

Pinpointing precise sales volume for the RPL market remains a difficult task for this author given that most manufacturers remain privately held corporations or are operating divisions within larger corporations and their sales volumes are not presented in a format that is easily identifiable for a sales analysis tool. The affects of the 9/11 tragedy remains an unknown factor, other than it is generally accepted common knowledge that there was a significant business slow down after 9/11 through 1st quarter 2002. However it appears that from an informal pole of PLTA manufacturers that growth rates were above 15% for 2001 and predicted a continued but cautious growth through 2002. The Akron, Ohio based The Plastic Lumber Company announced additional expansion activities through the 4th quarter 2002. There have been no other capacity announcements beyond the USPL consolidation into 3 manufacturing facilities. This author is aware of new start-up operations throughout the United States and has recently become aware of extrusion flow-molding activities in the Southeastern United States. The Plastic Lumber Trade Association encourages all competent manufactures to become members of our organization to help further the growth and standards for our new materials systems. We feel comfortable holding the RPL sales volume in the dollar range similar to 2000 estimates of \$70 to \$90 million. It is unclear what market damage has been suffered with the consolidation of USPL. The general consensus is that other manufacturers have picked up market share while showing continued and sustained growth within the decking and OEM markets.

Most certainly the Decking market has established itself as the clear leader in market sales volume. While the Park and Recreation industry has had sustained and continued growth, it has lost velocity to the decking markets demand. Consumers and building product installers are becoming aware of the various material systems available to them. This activity coupled with the environmental concerns of pressure treated lumber materials has added additional horsepower to the decking markets. The OEM market applications appear to have continued growth, but due to the fractional nature of these markets, growth is difficult to define, though manufacturers are putting significant emphasis into this market.

The Railroad Tie Market seems to be picking up momentum, but is difficult to track and for the most part it can be only followed by the announcements of bids being awarded. The exception being the Tie Tack Railroad tie, rubber/plastic composite, which is sold by publicly trade North American Technologies (symbol NATK). It is recommended that one should stay alert to announcements within this market segment.

As has been done in the past, this author will try to give guidance by showing a percentage of market shares which represents a percentage of gross sales revenues within

the \$70 to \$90 million dollar RPL market. We have added a new market area, Structural Grade Plastic Lumber. Stay tuned as the market proceeds towards plastic lumber materials with higher physical properties.

	<u>% Market Share</u>
Commercial and Residential Decking	35% to 55%
Park and Recreation	20% to 30%
OEM/Industrial/Agriculture	20% to 30%
Railroad Tie	7% to 15%
Structural Grade Plastic Lumber	3% to 7%
Material Handling	1% to 2%
Fencing	1% to 2%

Business Cycle Development:

The natural business cycle of entrepreneurial start-ups consolidating to larger companies has slowed after the USPL acquisition spree. As a secondary activity, there are continued start-ups (or should we say re-start-ups) of those individuals displaced through industry consolidations as the non-compete agreements dissolve away over a time period and investors rally behind familiar faces. The impact of this activity is difficult to ascertain and quantify as these re-starts are usually launched without much public disclosure.

A third activity level within the RPL business cycle development accelerates as a new technology or product category gains legitimacy within the marketplace when larger companies begin their market entry. We have seen the first waves of this activity within the bio-composite markets, but have not seen significant larger capitalization activity after the initial flurry brought on by the US Plastic Lumber acquisition spree some 3 or 4 years ago. This will certainly be interesting to watch as companies vie for top brand positioning and market identity in the already crowded building products industry.

Raw Materials:

While global business demand for resin materials appeared to show flat or only modest growth, the basic resin pricing for polyethylene and recycled HDPE has had significant jumps since the beginning of 2002. Price increases are reported in the 30% range without macro economic justification beyond perceived additional demand for recycled materials or flat to lower supplies. The announced new capacity of HDPE to be added in late 2002 should put downward pressure on resin pricing, but the markets continue to defy gravity and it is beyond the scope of this article to have knowledge of future raw material pricing. However, erratic resin pricing will have a negative effect on profit margins and could cause the additional increase in selling price of the end product, thereby losing the ability to continue market penetration when compared to lower cost traditional forest products.

As had been mentioned in previous “State of the RPL Industry” writings, there is great concern for the recycled HDPE markets with the continued production of pigmented

dairy bottles which will diminish the supply of natural HDPE dairy bottle materials. Unpigmented dairy bottles have been the long time material feed stock for the higher grade plastic lumber industry. This activity of the dairy industry has recently come to the attention of the National Recycling Coalition and other organizations that understand the recycling issues for the US marketplace. It is our hopes that there will be a concerted effort to stop the pigmentation of HDPE dairy bottles so the recycled plastic lumber industry can continue its goal to help reduce and eliminate the disposal of recyclable materials to landfills. Your active attention to this matter is important to the long term success of the RPL industry.

The Plastic Lumber Industry in Competitive Markets?

This is a very interesting business question, especially as larger players begin their entry into the markets. In many ways the RPL industry is quite young in the business cycle development, marketplace fundamentals and technology understanding. The consuming public is becoming more knowledgeable about the differences within the various materials systems and how they factor into making the appropriate choice for their projects needs. RPL most certainly has a place within these markets. The following probing business questions center around business basics:

- What unknown business factors will affect the ability of manufacturers to produce and market within the fractional aspects of building materials distribution and marketplace?
- The US building products marketplace shows great swings in seasonal business activities. Can the required capitalization for large scale production facilities be supported by a seasonal marketplace?
- Will there be the need for large, high production facilities? Or will there be a need for small efficient regional facilities to reduce transportation costs?
- Will the building products distribution markets be able to distinguish the various new materials as they enter the marketplace and understand each market segment that the material fills?
- Will the building products distribution systems have the working capital and/or the desire necessary to efficiently distribute these new material systems within a seasonal marketplace?
- Will the industry manufacturers consolidate further?
- Will raw material pricing significantly damage profit margins or efficient selling prices?

The buyers continue to be vocal about the needs for material consistency, quality standards and timely delivery. The Recycled Plastic Lumber Industry needs to 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. The core strengths of the PLTA are our work with the ASTM and to provide a forum where old and new members can discuss industry issues. We look forward to that continued work in the year 2003 and beyond.

Membership Applications may be down load from our website www.plasticlumber.org.

Respectfully Submitted,

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