REPLAS
RECYCLED PLASTIC PRODUCTS

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RECYCLED PLASTIC

PRODUCT DATA

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1. Environmental Impact Statement.

- **Materials.**

The materials used are post-consumer and post-industrial mixed plastics collected and processed by Replas and other recyclers. Energy utilised in reprocessing is limited to heat generated by electricity, which is used to soften and reform the thermoplastic materials.
No additional environmental pollution is generated by this process and no waste results; all material is converted to finished product.
The thermoplastic materials processed are not regarded as toxic and no toxic substances are generated during manufacture of recycled plastic products.

- **Pollution and Health**

There are no known pollution or health problems associated with the use of recycled plastic.
However, it would be expected that users of recycled-plastic materials will employ the same personal safety items that are used when working with timber.

- **Installation.**

Installation procedures involved in the use of recycled plastic products are the same as for the materials they are intended to replace; the material can be machined and formed using the same techniques that are used for timber. Predrilling of nail and screw holes is recommended. The waste generated is more easily collected and less dusty than timber waste and could possibly be recycled, although this would not generally occur because of the small quantities involved. Material is usually supplied to the length required by the customer to minimise waste.
The minimal waste resulting would probably be disposed as general building residue.

In the case of concrete substitutes, the procedures for installation result in lower costs and energy usage because of the much lower weight to volume ratio of recycled plastic. This gives significant savings in labour and lifting machinery costs. In addition, the use of lightweight recycled-plastic products has significant Occupational Health and Safety advantages.

Site preparation costs are not affected by the use of recycled-plastic products, however structural changes to allow for the use of recycled plastic may be necessary. Any increase in costs incurred must be considered against the advantages of using recycled plastic; generally increased life expectancy.

Further information about installation guidelines can be found on our website – **www.replas.com.au**

- **Maintenance**

It is generally claimed that the life expectancy of recycled-plastic products of the type Replas usually produces (i.e. thick-section products) is 40 years plus.

Maintenance is normally not required, other than visual inspection for damage and general cleaning. Where damage has occurred to products such as tables, chairs and benches, the damaged parts can be replaced easily and cheaply. Painted surfaces are subject to the same cleaning and repainting requirements as any other material. Graffiti may be removed by using commercially available graffiti removing strippers, provided that action is taken promptly.

- **Disposal**

Undamaged items can be reused in other areas.
Unusable damaged items can be recycled where such facilities exist or returned to the manufacturer for disposal.
There is no potential hazard involved in disposal in landfill if that is the only disposal option.

- **Environmental Effects**

The use of recycled-plastic products does not involve any environmental damage: in fact, the reverse is the case. The use of timber substitute preserves timber for other uses and in the long term could result in the preservation of such species as Red Gum, Ironbark and other hardwoods.

The manufacture of products, likewise, does not harm the environment since no toxic substances are generated and all production waste is reused. The energy required to process waste plastic is 75% more effective than that required to produce the product from virgin materials, which in many instances is based on the consumption of non-renewable resources.

- **Design Criteria**

Plastic, particularly the types used in our recycling process, is not to be regarded as structural or load-bearing material. Careful compounding using reinforcing fillers can give adequate load-bearing characteristics in certain circumstances, provided the material spans minimal gaps. The span must be determined for each structure, taking into consideration expected loads and the dimensions of the materials being used.

2. Quality Statement

Replas manufactures moulded-plastic products using recycled post-industrial and post-consumer waste plastic.

Products are generally described as being of a non-critical nature, and the properties of the products are usually agreed upon during discussions with end users.

Users of products made from recycled plastic should recognise the limitations imposed, and in conjunction with the supplier agree on the necessary specification limits.

It is possible to select blends of raw material to suit most applications to ensure that the user will be confident that the product will achieve consistent conformance to a reasonably prepared specification.

In general, products made from recycled plastic conform to "Fit for Use" criteria and are consistent batch to batch.

A sample specification is along the following lines……

Material source:	Post-consumer and post-industrial waste plastic and other materials
Physical properties:	Sectional integrity
	Porosity to a maximum of 15% with void area not to exceed 15% of any cross section Maximum void diameter of 5mm with no more than 4 voids of this size in any one cross section
Surface finish:	The surface finish may contain polymer knots which will be no greater than 30mm at any given point

This is a general specification. Colors may vary from batch to batch due to the varied recycled plastic collected.

3. Material Specifications and Technical Data

a. Test results for reinforced material used in Repeat Plastic products: [2]

Test	Test Method	Result
Flexural Modulus (Mpa)	ASTM D 790M	696
Compressive Strength (Mpa)	ASTM D 695M	23.0
Tensile Strength (Mpa)	ASTM D 638	9.95
Coefficient of Thermal Expansion ($^0C^{-1}$)	ASTM D 696	1.1×10^{-4}

Reinforced material used in Enduroplank™: [3]

Performed on plank of "W" cross section, dimensions 190mm wide x 50mm thick at the thickest points.

Test Description: Enduroplank™ was supplied complete with a jig for three point bending test. Load was applied to the middle of the plank and increased until the plank failed.

Test Conditions – symmetric 3 point bend,
Ends bolted down to flat support platform at each end, inner edges of support (span) 1.0m.
Bolt hole separation 112mm at each end.
Load applied across breadth of plank with a 50mm. wide block of timber (190mm. x 50mm.).
Displacement rate 10mm/min.
Temperature: ambient.

Results:

Specimen No.	Load at Failure	Displacement at Failure	Stiffness at Failure
1	4.8kN	57mm	83.6 N/mm
2	6.2kN	74mm	84.7 N/mm
3	3.6kN	52mm	68.1 N/mm
4	6.4kN	79mm	81.7 N/mm

It should be recognised that the above tests were carried out on a selected mixture of polymers from the waste stream and are nominal figures only. The results are intended for guidance only.

4. Combustion Data

Tests performed on Freeway Soundwall panel of nominal composition
50% polypropylene and 50% low density polyethylene. [4]

Test method: AS 1530.3.1989 AMDT No 1 April 92

Title: *Simultaneous determination of ignitability, flame propagation, heat release and smoke release*

Results:	Mean		Std. Error
Ignition Time	7.83	min.	0.23
Flame Propagation Time	95.6	s	3.4
Heat Release Integral	113.8	kJ/m^2	3.6
Smoke release, Log D	-1.0342		0.0611
Optical Density, D	0.0974	/m	

Number of specimens ignited: 6

Number of specimens tested: 6

Regulatory indices:

Ignitability Index	12	Range 0-20
Spread of Flame Index	5	Range 0-10
Heat Evolved Index	4	Range 0-10
Smoke Developed Index	4	Range 0-10

Comments:

The results of this test may be used to directly assess fire hazard, but it should be recognised that a single-test method will not provide a full assessment of fire hazard under all conditions.

Each test specimen had an unattached backing of 4.5 mm thick fibre reinforced cement board.

Each test specimen was restrained on the exposed face by a layer of galvanised welded square mesh made from wire of nominal diameter 0.8 mm and nominal spacing 12 mm in both directions and the assembly clamped in four places.

The specimens melted away from the area of maximum heat and produced flaming droplets during the test. Due to this phenomenon it should be recognised that this test result may not be a true indication of the product's fire hazard properties.

5. Combustion Toxicity Data

Inhalation toxicity of smoke produced by combustion of plastic lumber

Introduction

Plastic lumber is produced from thermoplastics that are formed into profiles and shapes via extrusion, intrusion, casting or moulding processes. [6] The main thermoplastic used for the fabrication of plastic lumber is polyethylene which is often derived from post-industrial or post-consumer sources.

Plastic lumber is being used to replace wooden lumber in some construction applications, especially in outdoor applications where the plastic lumber has better resistance to weathering than the wood. [7-9]

Unlike wood, plastic lumber is resistant to rotting in wet soil, impervious to insect attack and requires essentially no maintenance. [6]

Plastic lumber manufactured using post-consumer and/or post industrial waste plastic has been proposed as an excellent material for use in the construction of docks, piers and bulkheads and is touted to outlast conventional wood products due to its strength, durability and resistance to rot. [10]

A major advantage of plastic lumber compared to treated lumber is that plastic contains no leachable toxic metals such as arsenic and copper. In contrast, treated wood contains chromated copper arsenate (CCA) which can leach toxic metals into the environment.

Fire studies

Full-scale fire studies indicate that polyethylene, when under combustion, is less hazardous from the standpoint of toxicity than cellulosic material, i.e. burning wood. A joint study by the Dow Chemical Company and the Fire and Safety Research Institute in Chicago showed that there is:

"no substantial difference in toxicity between burning cellulosic materials and burning polyethylene materials and this is sufficient basis to conclude that fires involving polyethylene present no more of an inhalation toxicity risk than wood" [5]

When comparisons are made on a volume basis, then the smoke from wood is the more toxic material. The study found that the main hazards in a large-scale fire situation involving polyethylene or wood are carbon monoxide and temperature.

6. Effect of U.V. Exposure

The UV deterioration rate for plastics is between 2 to 5 thousandths of an inch per year. The deterioration test was done on a white pigmented body. Any pigment darker than white reduces the deterioration and a black body has almost no UV degradation. (11)

Another report (12) reaches the conclusion that:

"Outdoor exposure of recycled plastic lumber results in some weathering effects. Surface whitening is due to UV degradation on the sample surface. UV light may cause some miniscule surface degradation on high density polyethylene of up to 0.003 inches/year. (13) The surface whitens but this does not affect the overall mechanical properties of the bulk material. Therefore, UV degradation is not much of a threat. However the seasonal temperature changes occurring year after year, analogous to annealing a sample, induce a moderate increase in the mechanical properties. The increase in modulus and strength that occurred with the samples after weathering is likely the result of annealing. (14).
The improved flexural properties of the samples after weathering over a period of eleven years offers promising results concerning recycled plastic lumber. The lack of material property degradation in conjunction with life cycle cost benefits catapults the industry into the twenty-first century."

7. Coefficient Of Linear Expansion

The coefficient for RPA material is applicable to jetty plank, profiles and wharf fenders. The value of 1.1X 10_4 (1.1 x 10 to the minus 4) applies. This means that each one-metre length will expand by 0.0001m for each degree Celsius change in temperature, or 0.11mm per degree change in temperature.

A one-metre length will expand (or contract) 2.2mm for a 20 degree change in temperature.

To accurately recommend the gap between planks depends on the temperature of installation and the maximum temperature to be expected at that site.

Installers who do not wish to use the above calculation may choose to use the below rule of thumb to cover the majority of situations. Using the following chart should cover this.

Length of profile - LOP   Gap to be provided - GTBP

LOP -	1 metre	2 metres	3 metres	4 metres	5 metres	6 metres	7 metres	8 metres
GTBP -	3.0mm	6.0mm	9.0mm	12.0mm	15.0mm	18.0mm	21.0mm	24.0mm.

This assumes a 20 degree difference between the installation temperature and the maximum expected temperature.

The above chart is only a suggestion regarding recommendations to installers.

Copy as at 12/3/09 – We reserve the right to update and modify this document as more information comes to hand

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Full copies of above test reports will be made available on request

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