



**Playgrounds**  
 518 South Main Street  
 Somerset, KY 42501  
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# RSP TEST RESULTS & CONCLUSIONS

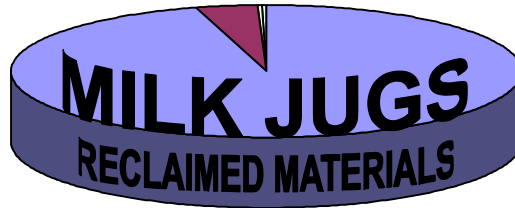
(RECYCLED STRUCTURAL PLASTICS)  
 MECHANICAL ENGINEERING TESTING LAB AT LEHIGH UNIVERSITY, BETHLEHEM, PA.  
 MAY 1998 C.J. COGLAN

## RSP COMPOSITION OF RECYCLED MATERIALS - 2001 WEIGHTS & QUANTITIES OF RECYCLED MATERIALS - 2001

RSP COMPOSITION - 99.5% RECYCLED MATERIALS	% BY WEIGHT	SOURCE
HDPE - HIGH DENSITY POLYETHYLENE	95.50	MILK JUGS
POLYPROPYLENE	4.00	LIDS
RECYCLOSTABILIZER - STABILIZES RECYCLED MATERIAL	0.25	ADDITIVE
UV PROTECTANT - PROTECTS AGAINST COLOR FADING	0.25	ADDITIVE
<b>TOTAL</b>	<b>100.00</b>	

### RSP MATERIAL COMPOSITION (BEFORE STEEL INSERTS-WHEN REQUIRED)

- 1
- 2
- 3
- 4



### RSP PLASTIC LUMBER RAW MATERIAL WEIGHTS & JUG QUANTITIES

MILK JUG WEIGHTS	3.66 OUNCES / JUG	
MILK JUG LID WEIGHTS	0.15 OUNCES / LID	
TOTAL WEIGHT	3.80 OUNCES / JUG & LID	<b>4.2 JUGS PER POUND</b>
SAMPLE BOARD : 2" X 4" X 12'	33.51 POUNDS / BOARD	<b>140.76 JUGS PER BOARD</b>
SAMPLE BOARD : 2" X 6" X 12'	50.02 POUNDS / BOARD	<b>210.09 JUGS PER BOARD</b>
SAMPLE BOARD : 5/4" X 6" X 12'	28.51 POUNDS / BOARD	<b>119.74 JUGS PER BOARD</b>
SAMPLE BOARD : 4" X 4" X 12'	52.92 POUNDS / BOARD	<b>222.26 JUGS PER BOARD</b>
SAMPLE BOARD : 4" X 6" X 12'	83.16 POUNDS / BOARD	<b>349.27 JUGS PER BOARD</b>
SAMPLE BOARD : 6" X 6" X 12'	124.81 POUNDS / BOARD	<b>524.20 JUGS PER BOARD</b>

### REPORT STATEMENTS: 1.4.1 ENVIRONMENTAL REASONS TO USE PLASTIC LUMBER

"Plastic Lumber is becoming an appealing material to use due to environmental concerns. .... Plastic does not decompose from contact with the soil. This was the problem with landfilling plastic. In this case, a previously detrimental property has become a beneficial property. Environmental regulations are also making plastic lumber a material of choice. Many parts of the country are enacting legislation making it illegal to place pressure treated lumber into water.....Plastic Lumber will not degrade and will not release any chemicals into the water.

**RSP Lumber is an environmentally friendly product."**

### REPORT STATEMENTS: 1.4.2 ECONOMIC REASONS TO USE PLASTIC LUMBER

"There are economic reasons to use plastic lumber. Plastic lumber does cost more than traditional wood lumber. ...This means that a customer will have a greater initial investment to make. However, when the cost of plastic lumber is calculated over its lifetime, it becomes more cost effective than wood. Plastic lumber requires less maintenance than wood. Once it is setup, it should not need to be painted at all. It will not need to be waterproofed on a yearly basis because it is waterproof by its physical nature. Plastic planks will not splinter or crack. **There will generally be no maintenance after construction is completed."**



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## RSP TEST RESULTS & CONCLUSIONS

(RECYCLED STRUCTURAL PLASTICS)  
 RHODES STRUCTURAL TESTING LABS LEXINGTON, KY  
 GEISLER, P.E. & J.M.P. CONSULTANT ENGINEERS,  
 J. M. POAGE- STRUCTURAL ENGINEER, MAY 1997

### RHODES TEST: PLASTIC (composite) LUMBER WITH STEEL INSERTS BENDING TESTS - (STRUCTURAL RESISTANCE TO BENDING)

MATERIAL & SIZE	MAXIMUM LOAD	MAXIMUM STRESS	BENDING MODULUS
RSP 4 X 6 (3.8" X 5.44" X 30" SPAN) & 1/8" X 4" X 30" STEEL	<b>WITH STEEL INSERT</b> 9,785.00 LBS.	2610.00 psi	not reported
RSP (2) 2 X 6 (3.12" X 5.44" X 30" SPAN)	(2) 2" X 6" boards <b>WITHOUT STEEL</b> 3,170.00 lbs each TOTAL 6,340.00 lbs	2050.00 psi each	not reported
STEEL INSERTS INCREASED LOAD CARRYING ABILITY	9,785 - 6,340 = 3,445 LBS EXTRA LOAD SUPPORT	not reported	not reported
<b>RSP WITH STEEL INSERT IS 54 % STRONGER THAN RSP WITHOUT STEEL in this test.</b>		<b>RSP with steel is more rigid than RSP without steel.</b>	

### CONCLUSION 1: RSP IS ULTIMATELY STRONGER WITH STEEL INSERTS IN MAXIMUM LOADING IN THESE TESTS BY 54% than an identical beam with no steel.

3.1.5 Conclusions: "The structural design is extremely safe to carry live load forces used for construction of "Play Mart Inc." playground equipment. **SAFETY FACTORS OF 2.0 TO 4.77 WERE FOUND FOR BENDING STRESS.** Compressive safety factor for the 6" x 6" post was 24.5" **I FOUND THE MATERIAL STRUCTURALLY SOUND TO BE USED FOR THE MANUFACTURE OF PLAYGROUND EQUIPMENT PER "PLAY MART, INC." SPECIFICATIONS AND USES."** - JOSEPH L. POAGE P.E. & L.S. REGISTERED PROFESSIONAL STRUCTURAL ENGINEER -STATE OF KY # 5257.

**RSP (W/ STEEL) BEAMS ARE 54% STRUCTURALLY STRONGER & SAFER, WITH APPROPRIATE DESIGN FOR RECYCLED MATERIALS.**



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MAY 1998 C.J. COGHLAN

**RSP 3.1 TEST: PLASTIC LUMBER BENDING TESTS - 1998**  
**RSP PMI IN-HOUSE TEST: MINI DECK LOADING TESTS - 2001**

### 3.1 TEST: PLASTIC LUMBER BENDING TESTS - (STRUCTURAL RESISTANCE TO BENDING)

MATERIAL & SIZE	MAXIMUM LOAD	MAXIMUM STRESS	BENDING MODULUS
WOOD 2 X 4	2834.75 LBS.	6106.92 psi.	10,689,413 psi
RSP 2 X 4	2128.23 LBS.	3691.15 psi	1,136,508 psi
WOOD 1 X 6	680.84 LBS.	6106.92 psi	6,455,095 psi
RSP 1 X 6	1178.06 LBS.	3583.11 psi	1,342,644.3 psi
WOOD 2 X 6	1980.26 LBS.	4440.57 psi	7,215,713 psi
RSP 2 X 6	2672.57 LBS.	3090.17 psi	1,084,108 psi
<b>RSP is stronger than wood in some tests.</b>		<b>RSP is more flexible than wood.</b>	

**CONCLUSION 1: RSP IS ULTIMATELY STRONGER THAN WOOD IN MAXIMUM LOADING IN TWO TESTS, BUT REMAINS MORE FLEXIBLE WITH LESS RESISTANCE TO BENDING. (SEE TESTS WITH STEEL INSERTS FOR HORIZONTAL BEAM APPLICATIONS.)**

3.1.5 Conclusions: "From these results, it is evident that RSP beams are more flexible and fail at lower stresses than their wooden counterparts."

### PMI IN-HOUSE TEST 2001: PLASTIC LUMBER BENDING TESTS - (STRUCTURAL RESISTANCE TO BENDING) CURRENT MINI DECK WITH NO STEEL INSERTS - LOADING TEST.

PMI MINI DECK 2001 DECK MATERIAL SIZE	MAXIMUM LOAD	MAXIMUM LOAD DURATION & TEMPERATURE	MAXIMUM DEFLECTION
RSP 5/4" X 6" FRAMES & TOPS	1000 LBS. LIVE & DEAD LOADS	100 HOURS	PASSED WITH 1/240 DEFLECTION
DECK SIZE 23" X 30" X 7"	200 PSF.	60 TO 100 DEG. F. FLUCTUATION	NO FAILURE
DECK SUPPORTS SIZE (4) - 3.5" X 3.5" X 10"			
HARDWARE SIZES	DECK TOP HARDWARE - (48) #10 X 2.5" SS SQUARE DRIVE DECK SCREWS.	DECK FRAME HARDWARE - (24) #10 X 3" SS SQUARE DRIVE DECK SCREWS.	POST & FRAME HARDWARE - (8) 3/8" X 4" SS HEX DRIVE LAG BOLTS.

**CONCLUSION 2: RSP IS STRONG IN MAXIMUM LOADING IN MINI DECK TESTS, DUE TO CLOSER JOIST SPACING IN THE DECK DESIGN, AND PASSED A 200 PSF LOADING TEST, DOUBLE THE CODE REQUIREMENT FOR MANY COMMERCIAL APPLICATIONS.**

**RSP STRUCTURE IS FLEXIBLE & SAFER, WITH  
APPROPRIATE DESIGN FOR RECYCLED  
MATERIALS.**



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**RSP 3.2 TEST: PLASTIC LUMBER HARDNESS TESTING - 1998**

**RSP 3.3 TEST: PLASTIC LUMBER IMPACT TESTING - 1998**

### 3.2 TEST: PLASTIC LUMBER HARDNESS TESTING - (SURFACE RESISTANCE TO MARRING)

A STEEL BALL OF .444" IN DIAMETER IS DRIVEN TO ONE-HALF ITS DIAMETER INTO THE SURFACE OF THE MATERIAL.

THE AVERAGE FORCE OF SIX TESTS FOR RSP PLASTIC LUMBER.	<b>2471.79 lbs.</b>	2471.79 / 448.46= <b>5.51</b> <b>RATIO</b>
THE AVERAGE FORCE OF SIX TESTS FOR WOOD.	<b>448.46 lbs.</b>	

#### CONCLUSION 1: RSP IS 5.51 TIMES MORE RESISTANT TO SURFACE MARRING THAN WOOD.

3.2.5 Conclusions: "It has been consistently shown that recycled lumber is not as strong in bending as is wood. RSP lumber is, however, almost six times as hard as is wood. In hardness testing, it was found that the orientation of the fiber in wood does allow it to be a factor in hardness. While this contributes to the fact that it is more difficult to cut, it also allows RSP recycled lumber to stand up to greater impact forces. This will enable RSP lumber to be handled more roughly than wood."  
**(RSP is defacing-proof.)**

**CONCLUSION 2: VANDALISM IS DIRECTED AT THE SURFACE OF ALL PRODUCTS FIRST. RSP IS MORE VANDAL RESISTANT TO SURFACE DEFACING. BECAUSE THE COLOR PENETRATES THE ENTIRE CROSS-SECTIONAL PROFILE, IT IS IMPOSSIBLE TO SCRATCH OFF THE COLOR OF THE MATERIAL.**

## RSP SURFACE IS VANDAL RESISTANT

### 3.3 TEST: PLASTIC LUMBER IMPACT TESTING - (STRUCTURAL RESISTANCE TO BREAKING)

3.3.1 "RSP Lumber appears to have a number of properties that give it advantages over wood in certain applications. One area that this may occur is in its resistivity to sudden impact. In order to quantify this theory, Charpy impact testing was conducted on specimens of both RSP Lumber and wood."

Material Tested	Breaking energy required @ room temperature	Breaking energy required @ 14 deg. F temperature
Four Identical RSP test samples	138.2 ft.lbs	137.8 ft.lbs
Four Identical wood test samples	126.8 ft.lbs	127.1 ft.lbs
RSP BREAKING STRENGTH / WOOD BREAKING STRENGTH	<b>ROOM TEMPERATURE RSP = 108.99% OF WOOD</b>	<b>FROZEN RSP = 108.42% OF WOOD</b>

3.3.7 Conclusions: "The Charpy Impact test is used to measure the impact resistivity of a given material. It measures the amount of energy necessary to break a standard sized specimen of the material. This test was used to measure the impact resistivity of RSP lumber and wood.

**In both cases, the breaking energy of RSP Lumber was greater than that of the wooden specimen used.** The difference between the two fracture energies at room temperature was 11.4 ft.-lbs. The difference between the two fracture energies at 14 deg. F. was 10.7 ft.-lbs. **From this it can be inferred that RSP Lumber will be able to resist greater impact forces than wood."**

## RSP IS IMPACT BREAK RESISTANT



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## RSP 3.4 TEST: PLASTIC LUMBER WATER ABSORPTION RATES - 1998

### 3.4 TEST: PLASTIC LUMBER WATER ABSORPTION RATES - 24 HOUR SUBMERSION

BEFORE SUBMERSION IN WATER FOR 24 HOURS: AVERAGE DIMENSIONS OF 4 SPECIMENS:  
6.031"L X 5.813"W X 1.938"TH.

AFTER SUBMERSION IN WATER FOR 24 HOURS: AVERAGE DIMENSIONS OF 4 SPECIMENS:  
6.031"L X 5.813"W X 1.938"TH.

**CONCLUSION 1: SIZE OF SPECIMENS WERE UNCHANGED AFTER 24 HOUR SUBMERSION.**

BEFORE SUBMERSION IN WATER FOR 24 HOURS: AVERAGE WEIGHT OF 4 SPECIMENS: 6.031"L X 5.813"W X 1.938"TH: 2.095 POUNDS

AFTER SUBMERSION IN WATER FOR 24 HOURS: AVERAGE WEIGHT OF 4 SPECIMENS: 6.031"L X 5.813"W X 1.938"TH: 2.099 POUNDS

**CONCLUSION 2: WEIGHT OF SPECIMENS INCREASED 0.2% AFTER 24 HOUR SUBMERSION.**

3.4.5 CONCLUSIONS: "The results of this experiment, while not surprising, are very favorable. It would be expected that the specimens of Recycled lumber would not absorb water during submersion in water. After all, the materials from which this recycled lumber is manufactured were once used to make liquid containers. ... The fact that recycled lumber does not absorb water will allow it to be used in situations where wood would not be suitable."

**RSP IS VIRTUALLY WATERPROOF**