

Appendix 2. Conversion Factors for Wood Products

The conversion factors in this appendix are those used in the USFS publication, *An Analysis of the Timber Situation in the United States: 1989-2040* (Haynes 1990). They are a weighted average of the following influences: (1) mix of species used, (2) various states of manufactured products as they enter commerce, (3) regional differences in production quantity, and (4) various manufacturing technologies.

A. Average product weights.

Product	Standard unit	Weight of wood per standard unit (short tons)
Roundwood products ^a		
Softwood ^b	Thousand cubic feet	15.500
Hardwood ^c	Thousand cubic feet	20.000
Softwood ^b	Cord (80 cubic feet)	1.400
Hardwood ^c	Cord (80 cubic feet)	1.600
Lumber		
Softwood	Thousand board feet	0.974
Hardwood	Thousand board feet	1.680
Structural panels		
Softwood plywood	Thousand square feet, 3/8 inch basis	0.544
Waferboard and OSB	Thousand square feet, 3/8 inch basis	0.866
Nonstructural panels		
Hardboard	Thousand square feet, 3/8 inch basis	1.140
Insulation board	Thousand square feet, 3/8 inch basis	0.275
Particleboard	Thousand square feet, 3/8 inch basis	0.289
Hardwood plywood	Thousand square feet, 3/8 inch basis	0.657

Source: Haynes (1990, Table B-7).

Note: Lumber weights are weighted averages for the species and volumes of production as reported by the Bureau of the Census for 1986. Average weights per thousand board feet, at 15% moisture content (USFS 1987), were used to convert volumes, by species, to tons. The weight of dressed lumber was used for softwoods because the product is ordinarily sold as surfaced-dry, while rough-dry hardwood lumber weights were used because this product is ordinarily marketed in that form.

Plywood weights are averages for the species and volumes of production for 1986. Average weights per cubic foot (15% moisture content) were used to convert volume, by species, to tons at 31.25 cubic feet per thousand square feet, 3/8 inch basis. The weight of hardwood plywood was adjusted for a raw material mix of 62% hardwood and 38% softwood (Haynes, 1990, Table B-6).

Particleboard weight is based on a bone-dry weight of 46 pounds per cubic foot of product, and is adjusted to air-dry moisture content and to delete the weight of resins, waxes, and additives (8.5% of bone-dry weight). Hardboard and insulating board weights are those reported by the Bureau of the Census in 1986, with the weights of resins, waxes, and other additives deleted.

^aLogs, bolts, pulpwood, fuelwood, and miscellaneous industrial roundwood.

^bAt 35 pounds per cubic foot, air dry.

^cAt 40 pounds per cubic foot, air dry.

B. Volume per product unit factors.

Product	Units	Value
Cord	ft ³ solid per cord	79.2
	Cord of pulpwood per ton pulp	1.50
Rail crosstie	Board feet per tie	40
	ft ³ per tie	3.5
	m ³ per tie	0.10
Rail bridge/switch tie	board feet per tie	63
	ft ³ per tie	5.25
	m ³ per tie	0.15
Pallet	Board feet lumber per pallet	17
	ft ² (3/8 basis) structural panel per pallet	0.86
	ft ² (3/8 basis) nonstructural panel per pallet	0.50
Pulp	Ton of wood pulp per ton of paper and paperboard	1.02
	Cord of pulpwood per ton of wood pulp	1.50

C. Use of wood products in new U.S. housing by product and type of unit, 1986.

Type of unit	Average area (ft ²)	Lumber use, BF per Unit	Lumber use, BF per ft ²	Structural panel use, ^a		Nonstructural panel use, ^b	
				ft ² 3/8 per Unit	ft ²	ft ² 3/8 per Unit	ft ²
Single family	1,825	12,975	7.11	6,770	3.71	2,755	1.51
Multifamily	911	4,720	5.18	2,505	2.75	850	0.93
Mobile home	1,110	4,340	3.91	1,610	1.45	3,805	3.43
Combined	1,460	9,419	6.45	4,851	3.32	2,296	1.57

Source: Haynes (1990, Tables 1, 2, and calculated from data on pp. 9-10).

Note: Volumes include allowances for on-site and manufacturing waste.

^aSoftwood plywood, waferboard, OSB, composite board.

^bHardwood plywood, hardboard, insulation board, particleboard, MDF.

D. Lumber factors:

1. Composite national averages

Lumber	BFFR	LRF	CRR	ft ³ lumber per MBF lumber	ft ³ log per MBF lumber	ft ³ log per ft ³ lumber
Softwood	16.67	6.44	0.362	60.00	155.1	2.76
Hardwood	12.00	5.26	0.499	83.33	189.9	2.00

See Chapter 4 for definition of BFFR, LRF, and CRR.

Note: The softwood CRR is lower than that for hardwood since most softwood lumber leaves the sawmill surfaced, dried, or both whereas most hardwood lumber leaves the sawmill rough green.

2. Lumber recovery factor (LRF) by region, 1985

Region	BF lumber per ft ³ log input	
	Softwood	Hardwood
North	NA	NA
South	6.02	NA
Rocky Mountains	6.80	NA
Pacific Coast: West	7.87	NA
East	6.33	NA
Pacific Southwest	6.80	NA

E. Plywood factors:

1. Composite national averages

Lumber	ft ³ panel per MSF 3/8	MSF 3/8 per ft ³ panel	Log ft ³ per MSF 3/8	SF 3/8 per log ft ³ VRF	Log ft ³ per panel ft ³	CRR % ^a
Softwood	31.25	32	71.1	14.1	2.25	44.5
Hardwood	31.25	32	64.2	15.6	2.06	48.6

^aFinished panel. See Chapter 5 for discussion of plywood terminology.

2. Veneer recovery factor (VRF) by region, 1985

Region	ft ² 3/8 plywood per ft ³ log input	
	Softwood	Hardwood
North	NA	NA
South	13.9	NA
Rocky Mountains	14.3	NA
Pacific Coast: West	14.5	NA
East	17.2	NA
Pacific Southwest	14.3	NA

F. Nonveneer panel factors:

1. Composite national averages

Panel	ft ³ per MSF 3/8	MSF 3/8 per ft ³	log ft ³ per MSF 3/8	SF 3/8 per log ft ³	log ft ³ per panel ft ³	CRR % ^a
OSB/waferboard	31.25	32	62.3	16.0	1.99	50.1
Particleboard	31.25	32	45.6	21.92	1.46	NA ^c
Insulation board	31.25	32	14.3	69.93	0.46 ^b	NA ^c
Hardboard	31.25	32	45.9	21.79	1.47	NA ^c

Note: While the term "log ft³" is used in the table to indicate that these factors reflect roundwood equivalent, in fact much of the raw material used by these processes is by-product residues from other wood industries, not roundwood logs.

^aFinished panel.

^bThat is, 0.46 ft³ of log is *expanded* to 1 ft³ of panel.

^cCannot be expressed due to panel densification.

2. OSB/Waferboard recovery factors by region, 1985

Region	ft ³ 3/8 product per ft ³ log input
North	17.9
South	16.9

G. Wood pulp factors:

1. Wood pulp conversion factors in the United States, by species, pulpwood consumption, and pulping process, 1986

Pulping process	Species composition of pulpwood		Pulpwood consumption				Production %			
	Softwood %	Hardwood %	Per short ton of pulp produced:		Per metric ton of pulp produced:					
			Cords	ft ³	m ³	Cords		ft ³	m ³	
Chemical Sulfite	72.0	28.0	1.615	127.62	3.614	1.781	140.68	3.984	81.8	
Bleached Unbleached	53.9	46.1	1.950	154.07	4.363	2.150	169.83	4.809		(2.7)
Sulfate and semibleached	53.9	46.1	1.950	154.07	4.363	2.150	169.83	4.809		—
Unbleached	53.9	46.1	1.950	154.07	4.363	2.150	169.83	4.809		—
Bleached	72.8	27.2	1.585	125.20	3.545	1.747	138.01	3.908		(74.7)
Unbleached	58.6	41.4	1.529	120.80	3.421	1.686	133.16	3.771		(39.4)
Dissolving	87.5	12.5	1.480	116.95	3.312	1.632	128.92	3.650		(35.3)
	71.6	28.4	2.294	181.26	5.133	2.529	199.80	5.658		(4.4)
Groundwood	90.8	9.2	0.986	77.92	2.206	1.087	85.89	2.432		9.2
Semichemical	4.7	95.3	0.968	76.50	2.166	1.067	84.33	2.388		6.9
Defibrated or exploded	52.3	47.7	1.008	79.66	2.256	1.111	87.81	2.486		2.1
All processes	69.5	30.5	1.486	117.40	3.324	1.638	129.41	3.664		100.0

2. Fiber consumption per ton paper and board, 1986

	Ton per Ton
Wood pulp	0.810
Wastepaper	0.209
Other fiber	0.005
	1.025

3. Pulpwood Consumption per ton of wood pulp produced, 1986

1.504 of which 69.2% softwood, 30.8% hardwood
of which 39% is mill residue, 61% from roundwood.

