

Embodied Energy in Construction Materials

MATERIAL	MJ/kg	MJ/m3	BTU/lb	BTU/ft3
Aggregate, general	0.10	150	43	4,026
virgin rock	0.04	63	17	1,691
river	0.02	36	9	966
Aluminium, virgin	191.00	515,700	82,115	13,840,971
extruded	201.00	542,700	86,414	14,565,629
extruded, anodised	227.00	612,900	97,592	16,449,741
extruded, factory painted	218.00	588,600	93,723	15,797,548
foil	204.00	550,800	87,704	14,783,027
sheet	199.00	537,300	85,555	14,420,698
Aluminium, recycled	8.10	21,870	3,482	586,973
extruded	17.30	46,710	7,438	1,253,659
extruded, anodised	42.90	115,830	18,444	3,108,784
extruded, factory painted	34.30	92,610	14,746	2,485,578
foil	20.10	54,270	8,641	1,456,563
sheet	14.80	39,960	6,363	1,072,494
Asphalt (paving)	3.40	7,140	1,462	191,632
Bitumen	44.10	45,420	18,960	1,219,036
Brass	62.00	519,560	26,655	13,944,571
Carpet	72.40		31,126	
felt underlay	18.60		7,997	
nylon	148.00		63,629	
polyester	53.70		23,087	
polyethylerphthalate (PET)	107.00		46,002	
polypropylene	95.40		41,015	
wool	106.00		45,572	
Cement	7.80	15,210	3,353	408,224
cement mortar	2.00	3,200	860	85,885
fibre cement board	9.50	13,550	4,084	363,671
soil-cement	0.42	819	181	21,981
Ceramic				
brick	2.50	5,170	1,075	138,759
brick, glazed	7.20	14,760	3,095	396,146
pipe	6.30		2,709	
tile	2.50	5,250	1,075	140,906
Concrete				
block	0.94		404	
brick	0.97		417	
GRC	7.60	14,820	3,267	397,757
paver	1.20		516	
pre-cast	2.00		860	
ready mix, 17.5 Mpa (2500 psi)	1.00	2,350	430	63,072
ready mix, 30 Mpa (4500 psi)	1.30	3,180	559	85,349
ready mix, 40 Mpa (5800 psi)	1.60	3,890	688	104,404
roofing tile	0.81		348	

Copper	70.60	631,160	30,353	16,939,824
Earth, raw				
adobe block, straw stabilised	0.47	750	202	20,129
adobe, bitumen stabilised	0.29		125	
adobe, cement stabilised	0.42		181	
rammed soil cement	0.80		344	
pressed block	0.42		181	
Fabric				
cotton	143.00		61,479	
polyester	53.70		23,087	
Glass				
float	15.90	40,060	6,836	1,075,178
toughened	26.20	66,020	11,264	1,771,923
laminated	16.30	41,080	7,008	1,102,554
tinted	14.90	375,450	6,406	10,076,775
Insulation				
cellulose	3.30	112	1,419	3,006
fibreglass	30.30	970	13,027	26,034
polyester	53.70	430	23,087	11,541
polystyrene	117.00	2,340	50,301	62,804
wool (recycled)	14.60	139	6,277	3,731
Lead	35.10	398,030	15,090	10,682,804
Linoleum	116.00	150,930	49,871	4,050,839
Paint	90.40		38,865	0
solvent based	98.10		42,175	0
water based	88.50		38,048	0
Paper	36.40	33,670	15,649	903,676
building	25.50		10,963	
kraft	12.60		5,417	
recycled	23.40		10,060	
wall	36.40		15,649	
Plaster, gypsum	4.50	6,460	1,935	173,381
Plaster board (GWB)	6.10	5,890	2,623	158,083
Plastics				
ABS	111.00		47,721	
high density polyethelene (HDPE)	103.00	97,340	44,282	2,612,527
low density polyethelene (LDPE)	103.00	91,800	44,282	2,463,838
polyester	53.70	7,710	23,087	206,930
polypropylene	64.00	57,600	27,515	1,545,937
polystyrene, expanded	117.00	2,340	50,301	62,804
polyurethane	74.00	44,400	31,814	1,191,660
PVC	70.00	93,620	30,095	2,512,685
Rubber				
natural latex	67.50	62,100	29,020	1,666,714
synthetic	110.00		47,291	
Sand	0.10	232	43	6,227
Sealants and adhesives				

phenol formaldehyde	87.00		37,403	
urea formaldehyde	78.20		33,620	
Steel, recycled	10.10	37,210	4,342	998,686
reinforcing, sections	8.90		3,826	
wire rod	12.50		5,374	
Steel, virgin, general	32.00	251,200	13,758	6,742,005
galvanised	34.80	273,180	14,961	7,331,930
imported, structural	35.00	274,570	15,047	7,369,237
Stone, dimension				
local	0.79	1,890	340	50,726
imported	6.80	1,890	2,923	50,726
Straw, baled	0.24	31	103	819
Timber, softwood				
air dried, roughsawn	0.30	165	129	4,428
kiln dried, roughsawn	1.60	880	688	23,618
air dried, dressed	1.16	638	499	17,123
kiln dried, dressed	2.50	1,380	1,075	37,038
mouldings, etc	3.10	1,710	1,333	45,895
hardboard	24.20	13,310	10,404	357,230
MDF	11.90	8,330	5,116	223,570
glulam	4.60	2,530	1,978	67,903
particle bd	8.00		3,439	
plywood	10.40		4,471	
shingles	9.00		3,869	
Timber, hardwood				
air dried, roughsawn	0.50	388	215	10,414
kiln dried, roughsawn	2.00	1,550	860	41,601
Vinyl flooring	79.10	105,990	34,007	2,844,686
Zinc	51.00	364,140	21,926	9,773,223
galvanising, per kg steel	2.80		1,204	

Source: <http://www.victoria.ac.nz/cbpr/documents/pdfs/ee-coefficients.pdf>