12

MATERIALS

Sustainable Materials

[AI IMAGE: Sustainable home exterior at golden hour]

Rammed earth walls · Bamboo screens · Terracotta tiles

ALT: Contemporary sustainable home exterior with natural materials at golden hour

6	12	4	30
Pages	Materials	Climates	Day Plan

02 Embodied Carbon Quick Reference

Embodied carbon is the total greenhouse gas emissions from extracting, manufacturing, transporting, and installing building materials — locked in before you move in. The table below gives verified carbon intensity figures for the most common materials in residential construction.

Embodied Carbon	CO2 emitted to produce and install a material. Measured in kgCO2e per kg of material.
EPD	Environmental Product Declaration — a verified, third-party lifecycle assessment of a material's environmental impact.
Net-Zero Material	A material whose carbon sequestration during growth offsets the carbon cost of production. Bamboo and hempcrete are examples.

Material	kgCO2e / kg	Rating	Category	Notes
Aluminium — Virgin	8.24	■ Very High	Metal	Highest carbon of common materials
Structural Steel	2.89	■ Very High	Metal	Reduce via recycled content spec
Portland Cement	0.83	■ High	Binder	Replace 30–70% with GGBS / fly ash
Fired Clay Brick	0.22	■ Medium	Masonry	Swap for fly ash brick in India
Concrete (30 MPa)	0.13	■ Medium	Composite	Specify GGBS or SCM blend
Recycled Steel	0.43	■ Low	Metal	85%+ of structural steel is recyclable
CLT Timber	−0.8 (stored)	■ Carbon Store	Engineered Timber	Sequesters carbon for building life
Hempcrete	−0.7 (stored)	■ Net Zero	Bio-composite	Lime re-absorbs CO2 as it cures
Rammed Earth	0.02	■ Very Low	Earth	Near-zero when soil is on-site
Bamboo (engineered)	−1.5 (stored)	■ Best in Class	Grass / Timber	Fastest-growing renewable material

■ **NOTE** Source: ICE Database v3.0 (University of Bath) and EC3 Calculator. Negative values indicate carbon stored within the material during growth. Values are approximate and vary by production method and geography.

■ **TIP** Always request an Environmental Product Declaration (EPD) from your supplier. EPDs are verified third-party lifecycle assessments — far more reliable than marketing claims alone.

03 Full Material Comparison Table — 12 Key Materials

Compare all 12 materials across seven critical dimensions. Use this table as your primary reference when shortlisting materials for any project.

■ Best / Very Good ■ Good / Acceptable ■ Fair / Use with caution ■ Avoid / High impact

Material	Embodied Carbon	Durability	Cost	Best Climate	Lifespan	Recyclability	VOC Risk
Bamboo	■ Very Low	■ High	■ Low–Med	Tropical / Humid	25–50 yrs	■ High	■ Low
Hempcrete	■ Net Zero	■ High	■ Medium	Temperate / Dry	100+ yrs	■ High	■ Very Low
Rammed Earth	■ Very Low	■ Very High	■ Low–Med	Hot-Dry / Arid	500+ yrs	■ V.High	■ Zero
Reclaimed Timber	■ Very Low	■ High	■ Variable	All Climates	50–100 yrs	■ High	■ Low
Cork	■ Negative	■ Medium	■ Medium	Temperate / Med.	25–40 yrs	■ High	■ Very Low
Mycelium	■ Very Low	■ Low–Med	■ Low	All (Interior)	10–30 yrs	■ V.High	■ Zero
Recycled Steel	■ Low	■ Very High	■ Medium	All Climates	100+ yrs	■ V.High	■ Low
Fly Ash Brick	■ Low	■ High	■ Low	Hot-Humid / Dry	50–75 yrs	■ Medium	■ Low
CLT Timber	■ Stores C	■ High	■ Med–High	Temperate / Cold	75–150 yrs	■ High	■ Low
Adobe / Mud Brick	■ Very Low	■ Medium	■ Very Low	Hot-Dry	100+ yrs	■ V.High	■ Zero
Recycled Glass	■ Low	■ High	■ Med–High	All (Interior/Ext.)	50–100 yrs	■ High	■ Very Low
Lime Plaster	■ Low	■ High	■ Low	All Climates	50–100 yrs	■ High	■ Zero

■ **NOTE** This table is a decision-making reference, not a definitive specification. Always verify specific material performance with suppliers and local building professionals before committing to a specification.

Supporting Articles from ARCNET:

- ■ **Hempcrete vs Traditional Concrete** — arcnet.media/hempcrete-vs-concrete
- ■ **Bamboo as a Modern Building Material** — arcnet.media/bamboo-architecture
- ■ **Recycled Materials Architects Should Consider** — arcnet.media/recycled-materials

04 Climate–Material Matching Chart

Match materials to your climate zone before you specify. A material ideal in one climate can fail in another. Use ■ = Recommended | ■ = Conditional | ■ = Avoid | — = Not applicable.

Material	Hot-Dry (Rajasthan, Middle East)	Hot-Humid (Kerala, Bangladesh)	Temperate (UK, NZ, N.India)	Cold (Himalaya, Scandinavia)
Bamboo	■ With treatment	■ Ideal	■ Good	■ Not ideal
Hempcrete	■ Excellent	■ Needs render	■ Ideal	■ + extra insul.
Rammed Earth	■ Best choice	■ Avoid	■ + insulation	■ Avoid
Reclaimed Timber	■ With shading	■ With treatment	■ Excellent	■ Good
Cork	■ Interior only	■ Good	■ Excellent	■ Good
Recycled Steel	■ Structural	■ Structural	■ Structural	■ Structural
Fly Ash Brick	■ Good	■ Excellent	■ Good	■ + insulation
CLT Timber	■ With shading	■ With sealing	■ Ideal	■ Best choice
Adobe / Mud Brick	■ Traditional	■ Avoid	■ Needs render	■ Avoid
Lime Plaster	■ Excellent	■ Excellent	■ Excellent	■ Good
Recycled Glass	■ Interior/Ext.	■ Interior/Ext.	■ Interior/Ext.	■ Interior/Ext.
Mycelium	■ Interior only	■ Interior only	■ Interior only	■ Interior only

India Climate Zone Quick Reference

■ **Hot-Dry (BWh/BSh)**	Rajasthan, Gujarat, western Maharashtra, parts of Andhra Pradesh & Telangana	Rammed earth, adobe, CSEB, thick masonry, whitewashed lime
■ **Hot-Humid (Aw/Cwa)**	Kerala, coastal Karnataka, coastal Tamil Nadu, coastal Andhra, Goa, Bengal coast	Bamboo, timber, terracotta, lime render, porous materials
■ **Humid Sub-tropical (Cwa)**	Delhi, UP, Bihar, MP, Odisha, North-East India	Fly ash brick, lime, bamboo, shaded masonry
■ **Highland (H)**	Himachal Pradesh, Uttarakhand, Ladakh, Sikkim, Arunachal	CLT, hempcrete, stone, sheep wool insulation

■■ **WARNING** Never apply hot-dry material logic to hot-humid climates. Thick thermal mass walls that perform beautifully in Rajasthan trap daytime heat in Kerala, leading to uncomfortable, humid interiors. Climate-match every material.

05 Material Selection Checklist + Material Passport

Run every material through this checklist before finalising your specification. Print this page and check off each item for each material you are considering.

	Criterion	What to Check	Done?
1	**Climate Match**	Is this material appropriate for my specific climate zone?	■
2	**Embodied Carbon**	Do I have documented carbon data — an EPD or ICE database reference?	■
3	**Local Sourcing**	Can this material be sourced within 500 km of my project?	■
4	**Third-Party Cert.**	Is there FSC, BIS, GRIHA, or EPD certification backing the sustainability claim?	■
5	**Lifespan**	What is the realistic lifespan under my climate and use conditions?	■
6	**Maintenance**	Do I know the maintenance schedule and estimated annual maintenance cost?	■
7	**Indoor Air Quality**	Is this material low-VOC, breathable, and free of formaldehyde and heavy metals?	■
8	**End of Life**	Can this material be recycled, reused, or composted at end of life?	■
9	**Track Record**	Has this material been used successfully in similar climates and applications?	■
10	**Installer Experience**	Do I have access to a contractor with proven experience installing this material?	■

Material Passport Template

Maintain one record card per significant material used in your project. This passport is invaluable for future maintenance, insurance claims, and resale.

Material Name:	Material 1
Manufacturer / Source:	_____
Batch / Order Ref.:	_____
Installation Date:	_____
Location in Home:	_____
Maintenance Schedule:	_____
EPD / Cert. Ref.:	_____
Notes:	_____

Material Name:	Material 2
Manufacturer / Source:	_____
Batch / Order Ref.:	_____
Installation Date:	_____
Location in Home:	_____
Maintenance Schedule:	_____
EPD / Cert. Ref.:	_____
Notes:	_____

■ **TIP** Keep your material passports in a dedicated folder — physical or digital. Include supplier invoices, EPD PDFs, and photos of the material as installed. This folder is your home's sustainability documentation and is increasingly requested by home buyers and valuers.

06 Maintenance Matrix, Resources & Next Steps

Plan your long-term maintenance using this matrix. Factor maintenance costs and time into every material selection decision — the lowest-upfront-cost material is not always the lowest-total-cost material.

Material	Check Frequency	What to Inspect	DIY Friendly?	Est. Annual Cost
Bamboo (Engineered)	Annually	Seal coat, joint integrity, insect signs	Yes	INR 3,000–8,000
Hempcrete	Every 5 years	Lime render cracks, moisture ingress	Partially	INR 5,000–12,000
Rammed Earth	Every 5 years	Surface erosion, base moisture, seal condition	Yes	INR 2,000–6,000
Reclaimed Timber	Every 2 years	Finish coat, warping, pest evidence	Yes	INR 4,000–15,000
Recycled Steel	Every 3–5 years	Rust spots, paint coat, fastener corrosion	Partially	INR 3,000–10,000
CLT Timber	Every 3 years	Moisture content, finish layer, joint seals	Partially	INR 5,000–12,000
Fly Ash Brick	Every 5 years	Mortar joints, efflorescence, dampness	Yes	INR 2,000–5,000
Adobe / Mud Brick	Every 2–3 years	Surface cracks, base erosion, render adhesion	Yes	INR 1,000–4,000
Lime Plaster	Every 5–7 years	Cracks, delamination, moisture staining	Yes	INR 2,000–8,000
Cork (Flooring)	Every 3–5 years	Seal coat, UV fading, edge lift	Yes	INR 2,000–6,000

Supplier Directory — Categories by Region

■■ **India**	Fly Ash Bricks: ACC Eco+, NUVOCO Artiste · Bamboo: Bamboosa, Eco Bamboo India · Lime / Earth: Auroville Earth Institute, Mitti Cool · Salvage: Natesan's Antiqin (Chennai), Indian Salvage (Delhi) · Low-VOC Paints: Fresco, Asian Paints Royale Atmos
■■ **Australia**	CLT: XLam Australia, Hess Timber · Hempcrete: Hempcrete Australia · Reclaimed Timber: Recycled Timber Melbourne · Cork: Wicanders · Natural Insulation: Australian Wool Innovation (Woolmark)
■■ **Europe**	Hempcrete: Tradical, Lime Technology (UK) · CLT: Binderholz, Stora Enso · Natural Paint: Earthborn, Auro, Livos · Cork: Amorim (Portugal) · Sheep Wool Insulation: Thermafleece, Isolena
■ **N. America**	Bamboo Flooring: Cali Bamboo, US Floors · CLT: Structurlam, Nordic Structures · Mycelium: Ecovative Design · Recycled Glass: Vetrazzo, IceStone · Low-VOC Paint: AFM Safecoat, Benjamin Moore Natura

■ Read the Full Guide + Continue Learning

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