

Passive Design Checklist for Tropical Homes

A Practical Workbook for Homeowners, Builders and Architects

What's inside this workbook:

- ✓ Climate Type Identifier & Strategy Matrix
- ✓ House Orientation Scoring Tool
- ✓ Natural Ventilation Planner
- ✓ Shading Selection Chart & Calculator
- ✓ Materials Reference Matrix
- ✓ Landscaping Planner
- ✓ 30-Day Action Calendar & Resources

Climate Type Identifier

Answer these five questions to identify your climate type. Circle or tick your answer for each question. Count your scores at the bottom.

No	Question	Answer A — Score 1	Answer B — Score 2
1	What is the average humidity in your city during the hottest months?	Below 50% (dry)	Above 60% (humid)
2	What is the typical night temperature during summer?	Drops by 10°C or more (cool nights)	Stays above 25°C (warm nights)
3	Which best describes your monsoon season?	Short or no rain season; dry most of year	Long rain season; humid year-round
4	Which city is closest to your location?	Jodhpur, Dubai, Cairo, Phoenix	Mumbai, Singapore, Bangkok, Manila
5	How does it feel outside at 6 am on a summer morning?	Dry and relatively fresh	Already hot and sticky

Your Score: 5–7 = Hot-Dry Climate · 8–10 = Hot-Humid Climate · Mixed Score = Hybrid Climate

Climate Strategy Matrix

Use the matrix below to identify which passive design strategies apply to your climate type. Prioritise strategies marked with ★★★ first.

Strategy	Hot-Humid	Hot-Dry	Mixed / Hybrid	Notes
Natural cross ventilation	★★★ Essential	★★ Useful	★★★ Essential	Primary comfort tool in humid climates
Thermal mass walls	★ Use with care	★★★ Essential	★★ Moderate	Heavy mass traps heat in humid nights

Deep roof overhangs	★★★★ Essential	★★★★ Essential	★★★★ Essential	Protects all window types on all facades
Night-flush ventilation	★★ Useful	★★★★ Essential	★★★★ Essential	Open windows at night to purge stored heat
Courtyard / light court	★★ Useful	★★★★ Essential	★★ Useful	Deeper proportions for hot-dry; shallower for humid
Roof insulation / cool coat	★★★★ Essential	★★★★ Essential	★★★★ Essential	Highest single-impact intervention for all climates
Ceiling fans	★★★★ Essential	★★ Useful	★★★★ Essential	Dramatically reduces perceived temperature
West-boundary tree planting	★★★★ Essential	★★★★ Essential	★★★★ Essential	Effective in 3–5 years for all climate types
Green / planted roof	★★ Useful	★★ Useful	★★ Useful	Excellent insulation; check structural load capacity
Water feature / courtyard pool	★ Use with care	★★★★ Essential	★★ Useful	Adds humidity in dry; avoid in already humid climates
Permeable ground paving	★★★★ Essential	★★ Useful	★★★★ Essential	Reduces heat island effect and improves drainage
External louvre screens	★★★★ Essential	★★★★ Essential	★★★★ Essential	East and west facades — replaces curtains effectively

 TIP: Record Your Climate Type Here

My climate type: _____ My city: _____
 Dominant wind direction: _____ Average summer temperature: _____
 _____ °C Average summer humidity: _____ %

House Orientation Scoring Tool

Use this tool to score your current or planned home orientation. Complete each item and total your score. A score of 16–20 is excellent. Below 10 requires significant shading and ventilation compensation.

Step 1 — Identify Your Sun Path

Hemisphere: ☐ Northern ☐ Southern

Latitude (degrees): _____

Summer solstice noon sun angle: _____ degrees

Hottest sun direction (noon): ☐ South ☐ North ☐ Varies

Prevailing summer breeze direction: _____

Step 2 — Orientation Scoring

Orientation Criterion	Your Score (0–2)	Notes / Observations
Long axis runs east-west (not north-south)	____ / 2	Ideal: long axis within 15° of true east-west
Living areas face north (N. hemisphere) or south (S. hemisphere)	____ / 2	Living, dining and family rooms on cooler face
No bedrooms on west-facing wall	____ / 2	West rooms overheat every afternoon
Primary openings aligned with prevailing breeze	____ / 2	Inlet on windward side; outlet on leeward side
Minimum east and west glazing	____ / 2	East and west windows kept small or well-screened
West boundary has or will have shade trees	____ / 2	Fast-growing species: neem, moringa, rain tree
No large heat-reflective surfaces facing primary openings	____ / 2	Avoid white walls or paving directing heat into windows
Service areas (kitchen, bathrooms, laundry) placed on leeward side	____ / 2	Keeps heat and moisture out of main airflow path

Building footprint allows for cross ventilation room-to-room	____ / 2	No sealed corridors blocking air path between sides
Site analysis conducted before design was finalised	____ / 2	Sun path, wind rose, neighbour shading all reviewed

Total Orientation Score: ____ / 20

Rating: 16–20 = Excellent · 11–15 = Good, minor compensation needed · 6–10 = Fair, invest heavily in shading and ventilation · 0–5 = Poor, seek architectural advice

Step 3 — If Orientation Is Constrained

Urban plots often prevent ideal orientation. Use the table below to plan your compensation strategy:

Problem	Compensation Strategy	Priority
West-facing bedrooms	External roller shutters or deep louvres + ceiling fans + west tree planting	HIGH
North-south long axis	Maximise roof overhangs on east and west; use vertical fins	HIGH
Openings away from breeze	Install clerestory windows for stack effect; use ceiling fans to supplement	MEDIUM
Large east-facing glazing	External louvre screens angled to block low morning sun; tinted glass as backup	MEDIUM
No west-boundary planting space	Green wall system on west facade; external roller shutters; cool roof coating	HIGH

CAUTION: Orientation Cannot Be Fixed Later

Unlike shading or ventilation, orientation is set at the design stage. If your plot forces a poor orientation, document it now and budget for enhanced shading on all affected facades before construction begins.

Natural Ventilation Planner

Use this page to plan and verify the ventilation strategy for every room in your home. Complete each table and the floor plan sketch grid before your design review meeting.

Section A — Cross Ventilation Checklist

Cross Ventilation — Room-by-Room Verification	
Main living area has openable windows on at least two opposite or adjacent walls	☐
Dining area has openings on windward and leeward sides	☐
Master bedroom has openings on two sides; no dead-end corridor blocking airflow	☐
All secondary bedrooms have openings on at least two sides	☐
Kitchen positioned on leeward side with dedicated exhaust ventilation	☐
Bathrooms have openable windows or mechanical exhaust on leeward side	☐
Home office / study has cross ventilation or stack-effect outlet	☐
Internal partitions have high-level transfer grilles above 2.4 m where needed	☐
No open-plan room has a depth greater than 2.5× its ceiling height	☐
All ceiling fans specified for habitable rooms (min. 1200 mm blade diameter in bedrooms)	☐

Section B — Opening Area Calculator

Use the reference table to verify that each room meets the minimum opening area ratios:

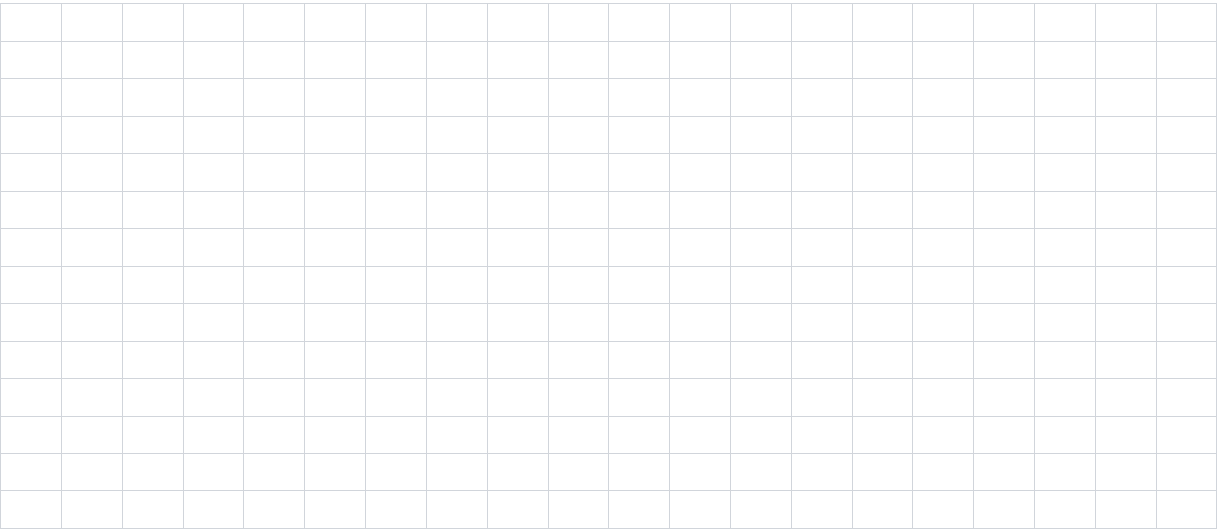
Room	Floor Area (m ²)	Inlet Opening Area Needed (min 15%)	Outlet Opening Area Needed (min 20%)	Actual Inlet Area	Actual Outlet Area	✓ / ✗
Living Room		÷ 6.7 = ____ m ²	÷ 5 = ____ m ²			
Dining Room		÷ 6.7 = ____ m ²	÷ 5 = ____ m ²			
Master Bedroom		÷ 6.7 = ____ m ²	÷ 5 = ____ m ²			
Bedroom 2		÷ 6.7 = ____ m ²	÷ 5 = ____ m ²			
Bedroom 3		÷ 6.7 = ____ m ²	÷ 5 = ____ m ²			
Kitchen		÷ 6.7 = ____ m ²	÷ 5 = ____ m ²			
Study / Home Office		÷ 6.7 = ____ m ²	÷ 5 = ____ m ²			

Section C — Stack Effect Checklist

Stack Effect Ventilation	
At least one room has a high-level outlet (clerestory window, roof vent or ridge monitor)	☐
Central hall or stairwell has operable high-level window to exhaust hot air	☐
Roof void is ventilated through gable vents or ventilated ridge tile	☐
No false ceiling completely seals the roof void from upper-room air	☐
Solar chimney or ventilated skylight considered for deep-plan rooms with no side openings	☐

Section D — Ventilation Planning Diagram Notes

Use the grid below to sketch your floor plan and mark airflow paths. Mark: inlet openings (→ arrows in), outlet openings (→ arrows out), ceiling fan locations (⊙), high-level stack vents (↑).



Scale: 1 grid square = ____ m · North direction: ____ · Prevailing breeze direction: ____

Shading Selection Chart

Shading is most effective when it is external — placed before solar radiation reaches the glass. Use this page to specify the right shading device for every facade and window in your home.

Section A — Overhang Depth Calculator

Formula: Required Overhang Depth (D) = Window Height (H) × Overhang Factor (F)

Latitude	Overhang Factor (F)	Example: 1.2 m Window	Notes
8°N / 8°S (e.g. Colombo, Kuala Lumpur)	0.35	$D = 0.35 \times 1.2 = 0.42 \text{ m}$	Sun is very high; smaller overhangs sufficient
12°N / 12°S (e.g. Chennai, Bangalore)	0.40	$D = 0.40 \times 1.2 = 0.48 \text{ m}$	Standard South Indian climate zone
15°N / 15°S (e.g. Mumbai, Hyderabad)	0.45	$D = 0.45 \times 1.2 = 0.54 \text{ m}$	Recommended minimum 600 mm for this zone
20°N / 20°S (e.g. Delhi, Kolkata)	0.50	$D = 0.50 \times 1.2 = 0.60 \text{ m}$	600–750 mm overhangs typical
25°N / 25°S (e.g. Ahmedabad, Riyadh)	0.55	$D = 0.55 \times 1.2 = 0.66 \text{ m}$	750–900 mm recommended; hot-dry factor applies
30°N / 30°S (e.g. Cairo, Sydney suburbs)	0.65	$D = 0.65 \times 1.2 = 0.78 \text{ m}$	Larger overhangs also allow winter solar gain

My latitude: ____° · Overhang factor for my location: ____ · My typical window height: ____ m
· My required overhang depth: ____ m

Section B — Shading Device Selection by Facade

Facade	Sun Angle	Best Shading Device	Second Choice	Avoid
South face (N. hemisphere)	High arc, predictable	Horizontal overhang — fixed, concrete or steel	Adjustable aluminium louvres angled downward	Internal blinds — ineffective against high sun
North face (N. hemisphere)	Low, indirect light	Minimal shading needed; use light diffusing screens	Planting or pergola for aesthetics only	Heavy fixed overhangs that block useful daylight
East face	Low morning angle	Vertical fins 200–400 mm deep at 600 mm spacing	External roller shutters; retract in afternoon	Horizontal overhangs — cannot block low-angle sun
West face	Low afternoon angle	External roller shutters or sliding screens	Vertical fins + deciduous tree planting	Fixed horizontal overhangs — entirely ineffective
Roof / skylights	Direct overhead	Fixed external horizontal louvre panels 300 mm deep	Double-glazed unit with integrated venetian blind	Clear unshaded skylights — worst heat gain source
North face (S. hemisphere)	High arc, predictable	Horizontal overhang — same calculation as S. above	Adjustable louvres angled downward	Internal blinds — allow solar heat entry before blocking

Section C — Window-by-Window Shading Planner

Window / Room	Facade	Current Shading	Proposed Upgrade	Priority
Living — main window				
Living — secondary				
Master bedroom				
Bedroom 2				
Bedroom 3				
Kitchen window				
Study / home office				
Front door / entry				
Bathroom				
Any skylight				

 NOTE: External Shading Always First

External shading blocks up to 80% of solar heat gain. Internal blinds block only 30–40%. Always specify and install external shading before purchasing curtains or blinds.

Materials Reference Matrix

Use this matrix to evaluate and compare materials for your home's walls, roof and floor. Select materials suited to your climate type identified on Page 2.

Section A — Roof Materials Comparison

Roof Material	Thermal Performance	Hot-Humid	Hot-Dry	Relative Cost	Notes
Dark metal sheet (bare)	Poor — heats to 70–80°C	X Avoid	X Avoid	Low	Requires full ceiling insulation if used
Light / white metal sheet	Moderate — reflects 60–70% radiation	★★ Acceptable	★★ Acceptable	Low–Med	Add ventilated air gap beneath for best results
Terracotta / clay tile (ventilated)	Good — ventilated structure reduces heat gain 30–40%	★★★★ Recommended	★★★★ Recommended	Medium	Traditional and effective; requires good roof structure
Concrete (flat, bare)	Poor — high thermal mass absorbs and retains heat	X Avoid	★ With insulation only	Medium	Must have waterproofing + cool coat in all climates
Concrete + cool roof coating	Good — coating reduces surface temp 20–30°C	★★★★ Recommended	★★★★ Recommended	Med (coating extra)	Best retrofit option for existing flat roofs
Green / planted roof (200 mm medium)	Excellent — evapotranspiration + insulation	★★★★ Recommended	★★ Useful	High	Requires structural allowance: 250–350 kg / m ²

Ventilated double-skin roof	Excellent — air gap prevents conducted heat	★★★ Recommended	★★★ Recommended	Med–High	Most effective new-build roof system for tropics
Thatch / attap palm leaf	Good — very low thermal conductance	★★ Traditional	★ Limited use	Low	Excellent natural performance; fire and maintenance risk

Section B — Wall Materials Comparison

Wall Material	Thermal Mass	Hot-Humid	Hot-Dry	Relative Cost	Notes
Hollow clay / AAC block (lightweight)	Low	★★★ Recommended	★ Supplement with mass	Low–Med	Good moisture management; widely available in India
Solid brick (220 mm)	Medium-High	★ Use with care	★★★ Recommended	Medium	High mass — good for hot-dry; traps heat in humid nights
Rammed earth (300 mm+)	Very High	X Poor moisture control	★★★ Excellent	Low–Med (labour high)	Ideal in hot-dry; requires good drainage at base
Laterite stone (Kerala)	Medium	★★★ Excellent	★★ Suitable	Low–Med	Natural material; excellent moisture management in humid climates

Compressed earth block	High	★ Limited use	★★★ Recommended	Low	Similar to rammed earth; better quality control
Concrete block (standard)	Medium	★★ Acceptable	★★ Acceptable	Low	Needs external insulation or render for best performance
Timber frame + insulation	Very Low	★★★ Recommended	★ Limited in very hot-dry	Med–High	Excellent for humid tropics; fast construction; ventilates well
Steel frame + insulated panel	Very Low	★★ Acceptable	★★ Acceptable	Medium	Fast; requires good thermal breaks at frame connections

Section C — Floor and Ground Surface Materials

Material	Thermal Feel	Moisture	Maintenance	Recommendation
Natural stone (granite, marble, basalt)	Cool underfoot — excellent	Good drainage	Medium	★★★ Best choice for tropical homes
Terracotta / clay tile	Cool — good thermal mass	Moderate	Low	★★★ Traditional, effective and beautiful
Polished concrete	Cool — good mass	Good if sealed	Low	★★★ Cost-effective and contemporary
Ceramic / vitrified tile	Cool — low mass	Excellent	Very Low	★★★ Widely used; choose light colours
Wall-to-wall carpet	Warm — insulating	Poor — mould risk	High	X Avoid in all tropical climates
Engineered timber / bamboo flooring	Neutral	Moderate	Medium	★★ Acceptable in well-ventilated dry areas
Bare concrete (unsealed)	Moderate	Poor — stains, dust	High	★ Acceptable for covered outdoor areas only

CAUTION: Avoid These Combinations

Dark metal roof + no insulation + west-facing bedrooms = extreme overheating. Heavy concrete walls + hot-humid climate + no ventilation = heat trap. Wall-to-wall carpet + high humidity = mould and dust mite breeding ground.

Landscaping for Cooling — Planner

The landscape around your home is part of its passive cooling system. A well-planted site can reduce ambient temperature by 2–5°C and dramatically reduce the heat load on west-facing walls.

Section A — Tree Placement Guide

Planting Zone	Goal	Best Species (India & SE Asia)	Minimum Distance from Building	Notes
West boundary	Block afternoon sun on west wall and roof	Neem, Rain Tree, Moringa, Mango, Teak	Equal to mature canopy radius (8–12 m for large species)	Plant as soon as possible — takes 3–5 years to be effective
East boundary	Break low morning sun; do not block southeast breeze	Coconut palm, Areca palm, Bamboo	3–6 m from building	Use open-crown or vertical species that filter not block
South of building (N. hemisphere)	Allow diffuse light; block reflected ground heat	Frangipani, Hibiscus, Bougainvillea, low shrubs	1–3 m from building	Keep below roofline; avoid blocking south breeze inlet
North of building (N. hemisphere)	Preserve breeze pathway — minimal obstruction	Low ground cover, grass, decomposed granite	Keep clear of building	Dense north planting can block the primary breeze inlet

Section C — Ground Surface Coverage Planner

Surface Type	Current Area (m²)	Target Area (m²)	Action Required
Natural turf / lawn		70% of garden (target)	
Planted ground cover (not lawn)			
Decomposed granite / gravel with mulch			
Permeable paving blocks			
Hard concrete or ceramic paving		Reduce to max 30%	
Dark asphalt or bitumen (near building)		Eliminate within 5 m	Replace with light permeable surface
Water feature surface area		1–5% of site area ideal	

 TIP: Plant the West Boundary This Month

You do not need a landscaping plan to start. Buy one fast-growing shade tree today — neem, moringa or a local equivalent — and plant it at the west boundary. The cooling benefit begins within two to three growing seasons.

30-Day Action Calendar

This page gives you a daily action plan for the next 30 days. Tick each item as you complete it. The goal is one meaningful action per day — not a full renovation sprint.

WEEK 1 — STUDY YOUR SUN PATH

Day	Action	☐ Done
Day 1	Download Climate Consultant from UCLA (free). Find and load the EPW weather file for your nearest city.	☐
Day 2	Run Climate Consultant analysis. Screenshot the 'Passive Cooling' strategy ranking for your city.	☐
Day 3	Go to SunCalc.org. Set your location and observe the sun arc at summer and winter solstice. Note the noon sun angle.	☐
Day 4	Find the prevailing wind rose for your city from the meteorological department or the EPW file. Note primary summer wind direction.	☐
Day 5	Walk your site or stand in your home at 8 am. Note which rooms and windows get direct morning sun.	☐
Day 6	Repeat the walk-through at 12 pm. Note which rooms are hottest. Write down three rooms that need urgent improvement.	☐
Day 7	Repeat at 4 pm. Note which rooms face west. Complete the Orientation Scoring Tool on Page 3. Calculate your total score.	☐

WEEK 2 — IMPROVE SHADING

Day	Action	☐ Done
Day 8	List every east and west-facing window in your home. Note which have no external shading.	☐
Day 9	Use the Overhang Depth Calculator on Page 5 to calculate required overhang depth for your latitude.	☐
Day 10	Research external louvre or roller shutter suppliers in your area. Collect three quotes for your most problematic windows.	☐
Day 11	Check your roof surface material and colour. Measure and note the area. Get a quote for cool roof coating if roof is dark.	☐

Day 12	Identify the best species for west-boundary tree planting in your region. Visit a nursery or check online availability.	☐
Day 13	Apply cool roof coating to your roof if currently dark and unsealed (or schedule with a contractor).	☐
Day 14	Complete the Window-by-Window Shading Planner on Page 5. Identify your top three shading investments.	☐

WEEK 3 — IMPROVE AIRFLOW

Day	Action	☐ Done
Day 15	Draw your floor plan freehand and trace the airflow path from your prevailing breeze through each room.	☐
Day 16	Identify every point where airflow is blocked: walls, furniture, closed doors, sealed partitions. List them.	☐
Day 17	Move furniture away from primary window inlets on windward walls. Test airflow improvement on a breezy afternoon.	☐
Day 18	Install or upgrade ceiling fans in all bedrooms. Ensure blade diameter matches room size (see Page 4 calculator).	☐
Day 19	Identify rooms with no cross ventilation. Investigate stack-effect options: operable high-level window, roof vent or clerestory.	☐
Day 20	Get a quote for high-level transfer grilles in internal partitions between bedrooms and corridor.	☐
Day 21	Complete the Cross Ventilation Checklist on Page 4. Tick off achieved items. Plan remaining gaps.	☐

WEEK 4 — REDUCE HEAT GAIN

Day	Action	☐ Done
Day 22	Purchase and plant one fast-growing shade tree at the west boundary of your property.	☐
Day 23	Replace the darkest hard paving surface immediately adjacent to your home with gravel, mulch or planting.	☐
Day 24	Install at least one climbing plant on the east or west wall. Use a timber trellis as support.	☐

Day 25	Complete the Ground Surface Coverage Planner on Page 7. Set a target for soft vs hard surface ratio.	☐
Day 26	Seal any gaps around ceiling penetrations (light fittings, pipes) that may allow hot roof-void air into habitable rooms.	☐
Day 27	Complete the Materials Reference Matrix on Page 6. Identify one material upgrade for your next renovation phase.	☐
Day 28	Review all completed checklist pages. Count your ticks. List the three highest-priority items still outstanding.	☐
Day 29	Share your three priority items with your architect, builder or a trusted advisor. Set a timeline for each.	☐
Day 30	Set a 6-month review date. On that date, revisit this workbook, walk through the home and measure any changes.	☐

Recommended Free Tools & Resources

Tool / Resource	What It Does	Where to Find It
Climate Consultant (UCLA)	Full climate analysis + passive strategy ranking for your city	energy-design-tools.aud.ucla.edu
EnergyPlus Weather Files	EPW climate data files for 2,000+ cities worldwide	energyplus.net/weather
SunCalc.org	Interactive sun path tool — any date, any location	suncalc.org
WeatherSpark	Visual monthly climate summaries with temperature, humidity and wind	weatherspark.com
Sun Seeker (iOS / Android)	Augmented reality sun path on your actual site	Available on App Store / Google Play
Overhang Depth Calculator	Calculate overhang depth by latitude and window height	greenbuildingadvisor.com
ARCNET Pillar Article	Full written guide to passive design for tropical homes	arcnet.studio.com/passive-design-tropical-homes