

Which footing suits a Chiang Rai ground mount best?

STR-02 low ground mount · 45 × 650 W panels · 36 posts · acidic red laterite clay · monsoon wet season

Analysis of TN-20261019-STR-FTG01 / FTG02 / FTG03 · Private client

1 The answer

BEST FOOTING FOR THIS SITE



Helical pile (Rev03)

SF 4.6 even in soft, soaked clay

- Uplift held by soil above two deep plates, not by weight
- Every one of the 36 piles proof-tested
- No digging, concrete or curing
- Removable and reusable

BEST LOCAL BACK-UP



Augered concrete pier

Ø0.40 × 1.20 m · SF 4.2 soaked

- Tractor auger is easy to find locally
- Concrete does not corrode in acidic soil
- Cast against undisturbed soil, no backfill
- Use where a helical pile refuses

NOT ADVISED ON LOW GROUND



Weight-based pads and blocks

SF 1.58 dry → 0.91 waterlogged

- Uplift resistance is only the weight of concrete and soil
- Water buoyancy removes about 40% of that weight
- Cannot be tested after backfill

2 Scorecard

Footing	Uplift, wet season	Can be tested	Life in acidic soil	Easy to build locally	Speed, no curing	Uplift SF dry / firm	Uplift SF wet / soft	Overall
Helical pile Rev03 · Ø89 shaft, 2 × Ø250 helix, 2.2 m	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	9.0	4.6	4.4
Augered concrete pier Ø0.40 × 1.20 m, full-length rebar	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	8.1	4.2	4.2
Continuous-thread screw Rev02 · Ø76, 1.6 m	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	1.6–2.5	≈ 1.0–1.6	3.8
Plain block in hole Alt. A · 0.60 × 0.60 × 0.80 m	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	1.54	≈ 0.9	3.3
Contract pad + stem 0.80 × 0.80 × 0.15 m at 0.60 m	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	1.58	0.91	2.9
Surface ballast block Alt. B · 1.00 × 1.00 × 0.30 m	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	1.59	≈ 0.9	3.1

Solar ESS assessment, 5 = best. Uplift safety factor (SF) at an interior post under the 446 kgf design wind uplift (DPT 1311-50, Chiang Rai, V = 25 m/s); required SF ≥ 1.5 with dead load at 90%. "Wet / soft" = soil soaked in the rainy season (cu = 25 kPa) and, for weight-based footings, ground water at the surface.

3 Why the site conditions decide it

Low ground + monsoon = buoyancy

A pad resists uplift only by its weight plus the soil on it. When the ground is waterlogged, water pushes up on both:

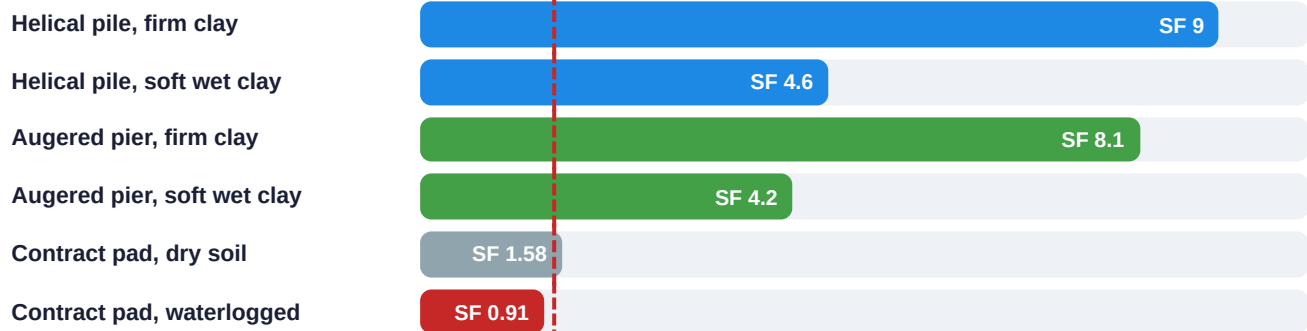
- Concrete: 2,400 → 1,400 kg/m³
- Backfill soil: 1,600 → about 800 kg/m³
- Pad + soil weight: 713 kg → 382 kg

$0.9 \times (382 + 70) \div 446 = \text{SF } 0.91$, below 1.0. The storm season is also the wet season, so the worst wind and the weakest footing arrive together.

Red laterite clay

- **Acidic** (often pH 4.5–5.5): zinc on steel wears faster, about 10–20 years. Rev03 adds $\geq 85 \mu\text{m}$ galvanizing, ground-line coating, a concrete collar and 1.5 mm spare steel.
- **Hard ironstone layers** at 0.5–1.5 m can stop a screw or pile. Rev03 allows a $\varnothing 60$ pilot hole through the hard layer only; if refusal is above 1.8 m, use the augered pier at that post.
- **Softens when soaked**: the helical pile trial tests are done after soaking the ground overnight, so the test reflects the wet season.

4 Uplift safety factor compared



Red dashed line = required SF 1.5. Helical pile: 2 plates $\times 9 \times \text{cu} \times 0.0429 \text{ m}^2$ + dead load. Augered pier: concrete weight (buoyant when wet) + side adhesion $0.5 \times \text{cu}$ over 1.0 m. Pad: weight only, as the contract design.

5 Check of the helical pile design (Rev03)

Item	Rev03 value	Our check	Result
Design uplift, interior post	446 kgf	$q = \frac{1}{2} \times 1.25 \times 25^2 = 390.6 \text{ N/m}^2 \times 1.8 \times 0.82 = 58.8 \text{ kgf/m}^2$; $41.2 \text{ m}^2 \times 92\% \div 5$	✓ agrees
Plate capacity, cu = 25 kPa	983 kgf per plate	$9 \times 25 \text{ kPa} \times 0.0429 \text{ m}^2 = 9.65 \text{ kN}$	✓ agrees
Lateral capacity	798 kgf (SF 12.9)	Rev03 uses the sand (Kp) formula; for clay, Broms short pile gives about 1,140 kgf at cu = 25 kPa	✓ even safer
Torque check	$1.5 \text{ kN}\cdot\text{m} \approx 3,500 \text{ kgf}$	$K_t \approx 23 \text{ m}^{-1}$ is typical for a 3.5" shaft	✓ reasonable
Helix plate bending	$\times 1.6$	Lowest margin in the design, but only reached if a plate carries its full soft-clay capacity	OK

6 Recommended footing plan for the 36 posts

1. Helical piles at all 36 posts (Rev03 specification), with soil pH and resistivity checked at 2–3 points and 4 soaked trial piles before ordering the rest.

2. Augered concrete pier where a pile refuses above 1.8 m: Ø0.40 × 1.20 m, 240 ksc concrete cast against the undisturbed hole the same day it is drilled (pump out any water), 4 × DB12 full length with the J-bolts tied in, accepted after one pull test.

3. Weight-based pad or block only on posts that never pond, and only if enlarged so that the waterlogged SF is at least 1.5 (about twice the contract concrete), or tied down with a ground anchor.

Drainage for every option: a gravel ring at each post and a shallow swale along the low side so rainwater does not stand under the array.

7 Quick comparison for the owner

Question	Helical pile	Augered pier	Pad / block
Holds in the rainy season?	✓ SF 4.6	✓ SF 4.2	✗ SF 0.9
Is every footing tested?	✓ all 36	Sample test	✗ cannot be
Concrete and digging	None (small collar)	5.4 m ³ , no backfill	4.5–10.8 m ³ , 23 m ³ dug
Ready for posts	Same day	After 7 days curing	After 7 days curing
Life in acidic soil	≥ 25 years (protected)	50+ years	50+ years
Can be removed later	✓	✗	✗
Special equipment	Drive head ≥ 6 kN·m + torque logger	Tractor auger	Hand tools

Basis: TN-20261019-STR-FTG01 Rev01 (contract pad), FTG02 Rev01 (alternative footings), FTG03 Rev03 (helical pile); DPT 1311-50 wind load for Chiang Rai. Soil strengths are typical values for red laterite clay and must be confirmed by the site trial and pull tests. The structure above the footings, purlin levels and the Contract Price are unchanged.