1. SUBSTRUCTURE

Constant	Value	Explanation
Amount of spray mixture needed per square meter	**5 liters/m²**	Total volume of mixed anti-termite spray applied over each square meter of surface area.
Concentrate content in each liter of spray mixture	**0.01 liters/L**	Volume of anti-termite chemical concentrate in each liter of spray mixture. Equivalent to **0.1 liters per 10 liters** of mixture.
Coverage area of one roll of damp-proof membrane (DPM)	**56 m²**	Standard membrane roll size (width: 1 meter, length: 56 meters).
Waste allowance factor	**1.10**	Accounts for 10% extra material to cover wastage and overlaps.
Density of hardcore rock fill	**1500 kg/m³**	Bulk density used for weight calculations.
Density of murram or stone-dust filling	**1500 kg/m³**	Bulk density used for weight calculations.
Maximum thickness for hardcore area calculations	**0.30 meters (300 mm)**	Standard thickness limit when estimating volumes from area.

Calculation Procedures

1.1 Anti-Termite Treatment by Spraying

Termiticide Type	Formula for Concentrate (L)	Equivalent Simplified Formula	Notes
Premise	**(Area ÷ 156) × 1.1**	**0.00705 × Area**	**1 litre per 156 m², +10% waste allowance**
Termidor	**(5 × Area ÷ 400) × 1.1**	**0.01375 × Area**	**5× factor, divided by 400, +10% allowance**
Gladiator	**(9 × Area × 0.025) × 1.1**	**0.2475 × Area**	**9× factor × 2.5%, +10% allowance**
Andrex	**(Area ÷ 13) × 1.1**	**0.0846 × Area**	**1 litre per 13 m², +10% allowance**
Undertaker	**(Area ÷ 13) × 1.1**	**0.0846 × Area**	**Same as Andrex**
Other / Unspecified	**(5 × Area × 0.01)**	**0.05 × Area**	**Default fallback (1% of total mix)**

1.2 Damp-Proof Membrane (DPM) Sheets

Steps:

1. **Base Rolls (before waste)**
   Base Rolls = Area (m²) ÷ 56 m²/roll
2. **Total Rolls (including waste)**
   Total Rolls = Base Rolls × 1.10

1.3 Hardcore Rock Filling

Steps:

1. **If in CM,**
   Use the given volume directly in calculations.

2. **If in S.M, check the thickness**
3. Volume (m^3) = Area (m^2) × Thickness (m)
4. **Mass (kg):**
   Mass (kg) = Volume (m^3) × 1500 kg/m^3 × 1.10
5. **Convert to tons:**
   Tons = Mass (kg) ÷ 1000

1.4 Murram or Stone-Dust Filling

Steps:
Follow the same calculation steps as for hardcore filling (**Section 1.3**), but use the density value for murram or stone-dust (**1500 kg/m^3**).

CONCRETE WORKS

Constants and Reference Values

Constant	Value	Explanation
Density of cement	**1440 kg/m^3**	Used to calculate the mass of cement required.
Density of sand	**1600 kg/m^3**	Used to calculate the mass of sand required.
Density of ballast	**1800 kg/m^3**	Used to calculate the mass of ballast required.
Bulkage and shrinkage factor	**1.52**	Multiplier to account for the change in volume when converting dry materials to mixed concrete.
Waste allowance factor	**1.10**	Adds 10% extra material for wastage.

Weight of one cement bag	**50 kg**	Standard weight for bag count calculations.

Calculation Procedures

Determine the Volume of Concrete Required

1. **If volume is already in cubic meters:** Use directly.
2. **If given area and thickness:**
   Thickness (m) = Thickness (mm) ÷ 1000
   Volume (m^3) = Area (m^2) × Thickness (m)
3. **If given length and cross-section:**
   Convert dimensions to meters:
   Volume (m^3) = Length (m) × Width (m) × Depth (m)

Adjust for Bulkage, Shrinkage, and Waste

Adjusted Volume (m^3) = Volume × 1.52 × 1.10

Split into Cement, Sand, and Ballast Based on Mix Ratio

1. **Total Parts:**
   Total Parts = Cement Ratio + Sand Ratio + Ballast Ratio
2. **Material Volumes:**
   Cement Volume (m^3) = (Cement Ratio ÷ Total Parts) × Adjusted Volume
   Sand Volume (m^3) = (Sand Ratio ÷ Total Parts) × Adjusted Volume
   Ballast Volume (m^3) = (Ballast Ratio ÷ Total Parts) × Adjusted Volume

Convert Volumes to Mass or Bag Count

1. **Cement:**
   Mass (kg) = Cement Volume × 1440
   Bags = Mass (kg) ÷ 50
2. **Sand:**
   Mass (tonnes) = (Sand Volume × 1500) ÷ 1000
3. **Ballast:**
   Mass (tonnes) = (Ballast Volume × 1600) ÷ 1000

Summary Table of Formulas

Material	Formula	Notes
Adjusted Volume (m^3)	Volume × 1.52 × 1.10	Accounts for bulkage, shrinkage, and waste
Cement Volume (m^3)	(Cement Ratio ÷ Total Parts) × Adjusted Volume	Based on mix ratio
Sand Volume (m^3)	(Sand Ratio ÷ Total Parts) × Adjusted Volume	Based on mix ratio
Ballast Volume (m^3)	(Ballast Ratio ÷ Total Parts) × Adjusted Volume	Based on mix ratio
Cement Mass (kg)	Cement Volume × 1440	Converts volume to mass
Cement Bags	Cement Mass ÷ 50	Standard 50 kg bags
Sand Mass (tonnes)	(Sand Volume × 1500) ÷ 1000	Converts volume to tonnes
Ballast Mass (tonnes)	(Ballast Volume × 1600) ÷ 1000	Converts volume to tonnes

FORMWORK

Constants and Basic Measures

Constant / Conversion	Value	Explanation
1 metre in feet	**3.28084 ft**	Use to convert metres to feet where required.
Marine plywood sheet coverage	**2.97 m²** (8 ft × 4 ft)	Area covered by one standard marine plywood sheet.
Timber props required	**4 props per m²**	Rule of thumb for supporting formwork.
Nails requirement	**1 × 50 kg bag per 200 m²**	Quantity of nails per area before waste.
Waste allowance factor	**1.10**	Add 10% extra for wastage and overlaps.

Area Determination

- **If area is given in square metres (m²):** use the quantity directly.
- **If length (linear metres) and width (given in mm) are provided:**

1. Convert width to metres: Width (m) = Width (mm) ÷ 1000.
2. Calculate area: Area (m^2) = Length (m) × Width (m).

Calculation Procedures

A. Timber Props

- Props required = Area (m^2) × 4 props/m^2 × 1.10 (waste)

B. Nails

- Nail bags required = (Area (m^2) ÷ 200 m^2 per bag) × 1.10 (waste)
- Report the result as a decimal; when ordering from suppliers that sell only whole 50 kg bags, round up at the time of purchase.

C. Formwork (Sawn Timber) — using 6 in × 1 in boards (0.15 m width)

1. Board length (m) = Area (m^2) ÷ 0.15 m
   (This gives total linear metres of board required.)
2. Convert board length to feet if needed: Board length (ft) = Board length (m) × 3.28084.
3. Apply waste allowance: Board length with waste = Board length × 1.10.

D. Marine Plywood Sheets

- Number of sheets = (Area (m^2) ÷ 2.97 m^2 per sheet) × 1.10 (waste)
- Report the exact decimal number; when ordering, round up to the next whole sheet if supplier sells only whole sheets.

6.5 Example Calculations

Given: Area = 50.00 m^2; Use marine plywood formwork.

1. Props required = 50.00 × 4 × 1.10 = 220.00 props (report 220 props)
2. Nail bags required = (50.00 ÷ 200) × 1.10 = 0.275 bags (report 0.28 bags; **order 1 bag** if supplier sells whole 50 kg bags)
3. Number of plywood sheets = (50.00 ÷ 2.97) × 1.10 = 18.52 sheets (report 18.52 sheets; **order 19 sheets** when purchasing whole sheets)

Reinforcement and BRC

Rebars (Steel Bars)

Step 1: Calculate Total Length and Number of Bars

Determine Diameter – Identify the bar diameter (e.g., 8 mm, 16 mm) from specifications.

Density Table (kg/m):

Diameter (mm)	Density (kg/m)
8	0.395
10	0.617
12	0.889
16	1.580
20	2.470
25	3.858

32	**6.313**

Formulas:

- **Total Length (m) = Total Weight (kg) ÷ Density (kg/m)**
- **Number of Bars = (Total Length ÷ 12.192 m) × 1.10**
  (12.192 m = 40 ft standard bar length; 1.10 accounts for 10% waste)

Binding Wire:

- **Binding Wire (kg) = Total Weight (kg) × 0.012 × 1.10**

Example:

- **Weight = 5000 kg, Diameter = 16 mm**
- **Density = 1.580 kg/m**
- **Total Length = 5000 ÷ 1.580 ≈ 3164.56 m**
- **Bars = (3164.56 ÷ 12.192) × 1.10 ≈ 285 bars**
- **Binding Wire = 5000 × 0.012 × 1.10 = 66 kg**

BRC Mesh (British Reinforcement Concrete Mesh)

Dimension	Value
Width	**2.4 m**
Length	**48 m**
Area	**115.2 m²**

Step 3: Formula for Rolls

- **Number of Rolls = (Area to cover ÷ 115.2) × 1.10**
  (1.10 accounts for 10% waste due to overlaps, cuts, and errors)

Example:

- **Area = 500 m², Mesh = A142**
- **Rolls = (500 ÷ 115.2) × 1.10 ≈ 4.77 → order 5 rolls**
-

Final Summary Table

Item	Formula / Details	Example
Rebar Bars	**(Weight ÷ Density) ÷ 12.192 × 1.10**	**285 bars (16 mm, 40 ft)**
Binding Wire	**Weight × 0.012 × 1.10 (kg)**	**66 kg**
BRC Rolls	**(Area ÷ 115.2) × 1.10**	**5 rolls (A142)**

Walling

Constants

Material / Property	Value
Damp proof course roll coverage	7 m² per roll (1 m × 7 m)
Quarry stone	13.68 ft of stone per m²
Machine-cut stones	12 stones per m²
Hoop iron weight	0.6 kg per m²
Hoop iron roll weight	15 kg
Cement density	1440 kg/m³
Sand density	1600 kg/m³
Mortar volume per m² @ 100 mm	0.011 m³

Mortar volume per m² @ 150 mm 0.016 m³

Mortar volume per m² @ 200 mm 0.0213 m³

1. Damp Proof Course (DPC)

- **Formula**:
    - Area = length × width (in meters)
    - Rolls required = ((Area ÷ 7) × 1.10)

2. Quarry Stone Walling

- **Formulas**:
    - Stones = (Area × 13.68 × 1.10) feet of rough quarry stone (9"×9")
    - Mortar Volume = Area × 0.0213 m³
    - Cement Bags = ((Mortar Volume × (cement_ratio / total_ratio) × 1440 ÷ 50) × 1.10)
    - Sand (tonnes) = ((Mortar Volume × (sand_ratio / total_ratio) × 1600 ÷ 1000) × 1.10, 2)
    - Hoop Iron Rolls = ((Area × 0.6 ÷ 15) × 1.10)

3. Machine-Cut Stone Walling

- **Formulas**:
    - Stones = (Area × 14)
    - Mortar Volume = Area × Volume_Factor(thickness)
    - Cement & Sand: same formula as in Quarry Stone Walling (default ratio 1:3)
    - Hoop Iron Rolls = ((Area × 0.6 ÷ 80) × 1.10)

4. Eaves Filling

- **Formulas**:
    - Height (mm), default **400 mm**, convert to meters: Area = length × height
    - Thickness (mm), default **200 mm**
    - Stones = (Area × 12 × 1.10)
    - Mortar Volume, Cement, Sand: same as in Quarry Stone Walling
    - Hoop Iron Rolls = (Area × 0.6 ÷ 80)

ROOFING

Truss Materials Calculation Guide[i]

Constants and Conversion Factors:

1. **Metre to Feet**:
2. **Waste Allowance**: Always add **10% extra** to account for waste and cutting.
3. **Quantity Type**: Quantities must be given in **linear metres** (length only).

Timber Section Size Mapping (mm → inches)

Section (mm)	Size (inches)
250 × 50	10 × 2
250 × 25	10 × 1

225 × 50	9 × 2
225 × 25	9 × 1
200 × 50	8 × 2
200 × 25	8 × 1
175 × 50	7 × 2
175 × 25	7 × 1
150 × 50	6 × 2
150 × 25	6 × 1
100 × 50	4 × 2
100 × 25	4 × 1
75 × 75	3 × 3
75 × 50	3 × 2
75 × 25	3 × 1
50 × 50	2 × 2
50 × 25	2 × 1

Step-by-Step Calculation:

1. **Confirm quantity is in metres of timber length.**
2. **Read the timber section dimensions** in millimetres from the description.
3. **Match to inch sizes** using the table above (or calculate using mm ÷ 25.4).
4. **Convert length to feet**:
5. **Add waste allowance**:

Roof Covering

Constants and Typical Values

Description	Value	Notes
Waste factor (includes 10% extra)	**1.10**	Apply to all calculated quantities to cover waste and cuts.
Typical sheet length (metres)	**2.50 m**	Common length used for profile and metal sheets; confirm with supplier.
Tiles per square metre (typical)	**10 tiles/m²**	Typical for many clay and concrete tiles; confirm by tile type.
Bundle coverage (square metres)	**3 m² / bundle**	Typical bundle coverage for asphalt or some tile systems; confirm by product.
Nails per sheet (typical)	**12 nails / sheet**	Used for profile and similar sheets.
Nails per bag	**120 nails / bag**	Standard loose nail bag size (confirm locally).
Screws per square metre (typical)	**4 screws / m²**	Typical for some stone-coated systems; confirm by supplier.
Typical sheet width (metres)	**Varies by type**	**Use manufacturer specification for each profile.**

General Waste Rule

All calculated quantities below include a × Waste factor (1.10) step. Report the precise calculated result, then round up to the supplier unit (whole sheets, bundles, screws boxes, etc.) when ordering.

Ridgecaps & Valleys

Formula:

Number of pieces = (Length ÷ Sheet length) × Waste factor

- Length is the total linear length of ridge or valley to be covered (metres).
- Sheet length use the typical value (2.50 m) or the actual sheet length.

Clay Roof Tiles

Formula:

Number of tiles = (Area × Tiles per m^2) × Waste factor

- Tiles per m^2 use the typical value (10 tiles/m^2) or the manufacturer's figure.

Stone-Coated Steel Tiles

Typical base values used in these calculations:

- Tiles per m^2 = **10**
- Bundle coverage = **3 m^2**
- Nails per sheet = **12**
- Nails per bag = **120**
- Screws per m^2 = **4**
- Sheet width = **Varies by type**

Formula (tiles):

Number of tiles = (Area × Factor) × Waste factor

- Use **Factor = 2.2** for Decra products.
- Use **Factor = 2.0** for many other stone-coated profiles.

Notes: confirm exact factor and fixing schedule from the product datasheet.

Asphalt Shingles

Formula:

Number of bundles = (Area ÷ Bundle coverage) × Waste factor

- Bundle coverage typically **3 m^2 / bundle** but confirm with the manufacturer.

Profile Sheets (Box/IT4-6 and similar)

Formulas:

Number of sheets = (Area ÷ (Sheet width × Sheet length)) × Waste factor

Number of nails = (Number of sheets × Nails per sheet) × Waste factor

Number of nail bags = Number of nails ÷ Nails per bag

- Use actual Sheet width and Sheet length from the product specification when available.
- Report nail quantities as exact numbers, then round to whole bags for ordering.

Corrugated / Versatile / Roman Sheets

Use the same formulas as **Profile Sheets** above, substituting the appropriate sheet width and sheet length for each sheet type.

Polycarbonate Sheets

Formulas:

Number of sheets = (Area ÷ (Sheet width × Sheet length)) × Waste factor

Number of screws = (Area × Screws per m^2) × Waste factor

- Screws per m^2 should be taken from the supplier's fixing guide (typical values vary by panel profile and wind load).

Plaster & Render

Constants

- **Cement density**: 1440 kg/m³
- **Lime density**: 2210 kg/m³
- **Sand density**: 1500 kg/m³
- **Waste factor**: +10% on all materials
- **Bag sizes**:
    - Cement: 50 kg
    - Lime: 25 kg
- **Default thickness**: 15 mm (applied only to three-part mixes if not specified)

Unit Handling

1. **SM/SQM/M2**: Area = Qty

2. **LM**: Area = Qty × (upper width in mm / 1000)

Material Calculations

Two-Part Mix (cement : sand)

Total ratio = 1 + sand_ratio

Cement volume (m3) = Volume_m3 × (1 / Total ratio)

Sand volume (m3) = Volume_m3 × (sand_ratio / Total ratio)

Cement mass (kg) = Cement volume × 1440 × 1.10 (waste)

Sand mass (kg) = Sand volume × 1500 × 1.10 (waste)

Cement bags = ceil(Cement mass × 1.1 / 50)

Sand tonnes = (Sand mass × 1.1) / 1000

Three-Part Mix (cement : lime : sand)

Formulas:

- **Total ratio** = 1 + lime_ratio + sand_ratio
- **Cement volume (m^3)** = Volume_m3 × (1 / Total ratio)
- **Lime volume (m^3)** = Volume_m3 × (lime_ratio / Total ratio)
- **Sand volume (m^3)** = Volume_m3 × (sand_ratio / Total ratio)

Mass & Waste:

- Cement mass (kg) = Cement volume × 1440 × 1.10 (waste)
- Lime mass (kg) = Lime volume × 2210 × 1.10 (waste)
- Sand mass (kg) = Sand volume × 1500 × 1.10 (waste)

Final Quantities:

- Cement bags = **ceil**(Cement mass / 50)
- Lime bags = **ceil**(Lime mass / 25)
- Sand tonnes = Sand mass / 1000

Tiles

Tiles per Box

Size (mm)	Tiles/Box
200×300	25
250×400	15
300×300	17
400×400	12
300×600	7
450×450	6
600×600	4
450×900	3
250×750	6
265×800	11
300×1200	2
300×1500	3

Material Calculations

Steps:

1. **Total Tiles Needed:**
2. total_tiles = (Qty / tile_area_m2) × 1.10
3. **Boxes Needed:**
4. num_boxes = (total_tiles / tiles_per_box)
5. **Adhesive Required:**
6. adhesive_kg = (Qty × 10) × 1.10
7. **Grout Required:**
8. grout_kg = (Qty × 0.5) × 1.10

Painting Material Calculations Guide

Coverage Assumptions

- **Standard paint coverage**: 15 m² per litre per coat
- **Skim filler coverage**: 10 m² per 25 kg bag
- **Waste factor**: 10% extra added to all calculations

Varnish

Formulas:

- Base varnish (3 coats) = (Area ÷ 15) × 3
- Varnish litres = Base varnish × 1.10
- Thinner litres = (Base varnish × 0.10) × 1.10

Example:

- For 100 m²: 100 ÷ 15 ≈ 6.67 litres per coat

- Total (3 coats) = 20.01 litres base, ≈ 22 litres with waste
- Thinner = 2 litres base, ≈ 2.2 litres with waste

Final Output:

- **22 litres clear varnish**
- **2.2 litres spirit thinner**

Oil-Based Paint (Gloss)

Formulas:

- Primer (if specified) = (Area ÷ 15) × 1.10
- Undercoat = (Area ÷ 15) × 1.10
- Gloss paint (2 coats) = (Area ÷ 15) × 2 × 1.10
- Thinner = ((Area ÷ 15) × 2 × 0.10) × 1.10

Final Output:

- **17.6 litres gloss paint**
- **8 litres undercoat**
- **1.8 litres thinner**
- **Optional: 8 litres primer (acrylic)**

Interior Emulsion Paint

Formulas:

- Undercoat litres = (Area ÷ 15) × 1.10
- Topcoat litres (2 coats) = (Area ÷ 15) × 2 × 1.10
- Skim filler bags (25 kg) = Round up((Area ÷ 10) × 1.10)

Example:

- For 90 m²: Undercoat ≈ 6.6 litres, Topcoat ≈ 13.2 litres, Skim filler = 10 bags

Final Output:

- **6.6 litres undercoat**

- **13.2 litres silk vinyl paint**
- **10 bags skim filler (25 kg)**

Exterior Weather-Resistant Paint

Formulas:

- Undercoat litres = (Area ÷ 15) × 1.10
- Topcoat litres = (Area ÷ 15) × 1.10

Final Output:

- **11 litres undercoat**
- **11 litres weather-resistant paint**