

Bitumen Calculation Formula Reference Guide

Comprehensive Engineering Handbook for Road Paving, Density Values & Prime/Tack Coat Quantities

1. Essential Reference Values for Bitumen

Bitumen (asphalt binder) volume-to-weight calculations depend on standard temperature and density parameters:

Property Parameter	Standard Engineering Value	Typical Operational Range
Bitumen Density (ρ)	1,020 kg/m ³ (1.02 t/m ³)	1,010 kg/m ³ – 1,050 kg/m ³
Mass of 1 m ³ Bitumen	1.02 Metric Tons (1,020 kg)	1.01 – 1.05 Metric Tons
Specific Gravity (SG)	1.02 (at 15.6°C / 60°F)	1.01 – 1.05
Weight of 1 Liter	1.02 kg	1.01 kg – 1.05 kg

2. Fundamental Bitumen Calculation Formulas

Formula 1: Total Bitumen Weight from Layer Volume & Percentage

$$W_{bitumen} = V_{asphalt} \times \rho_{asphalt} \times (\%_{bitumen} / 100)$$

Where: $V_{asphalt}$ = Length × Width × Thickness (m³), $\rho_{asphalt}$ = Asphalt Mix Density (~2,350 kg/m³), $\%_{bitumen}$ = Binder content by weight (typically 4.5% to 6.0%).

Formula 2: Spray Rate Calculation (Tack Coat / Prime Coat)

$$Q_{liters} = Area (m^2) \times Application Rate (kg/m^2) / Bitumen Density (kg/L)$$

Where standard Prime Coat rate = 0.9 to 1.4 kg/m² and Tack Coat rate = 0.25 to 0.50 kg/m².

3. Application Rate & Coverage Quick Reference

Application Type	Recommended Rate (kg/m ²)	Recommended Rate (L/m ²)	Primary Material Used
Prime Coat (Granular Base)	0.90 – 1.40 kg/m ²	0.88 – 1.37 L/m ²	Cutback Bitumen (MC-30 / MC-70)
Tack Coat (Existing Asphalt/ Concrete)	0.25 – 0.50 kg/m ²	0.24 – 0.49 L/m ²	Bitumen Emulsion (RS-1 / CRS-1)
Seal Coat (Surface Maintenance)	0.60 – 1.00 kg/m ²	0.59 – 0.98 L/m ²	Rapid Curing Emulsion / Rubberised

4. Practical Step-by-Step Example

Scenario: Calculate bitumen required for a road stretch of **500 meters length**, **6 meters width**, with a **50mm (0.05m) asphalt layer** containing **5% bitumen binder**.

- **Step 1: Calculate Volume (V)** = $500 \text{ m} \times 6 \text{ m} \times 0.05 \text{ m} = 150 \text{ m}^3$
- **Step 2: Calculate Total Asphalt Mass** = $150 \text{ m}^3 \times 2,350 \text{ kg/m}^3 = 352,500 \text{ kg}$ (352.5 Metric Tons)
- **Step 3: Calculate Bitumen Mass** = $352,500 \text{ kg} \times 5\% = 17,625 \text{ kg}$ (17.625 Metric Tons)
- **Step 4: Convert to Liters** = $17,625 \text{ kg} / 1.02 \text{ kg/L} \approx 17,279 \text{ Liters}$