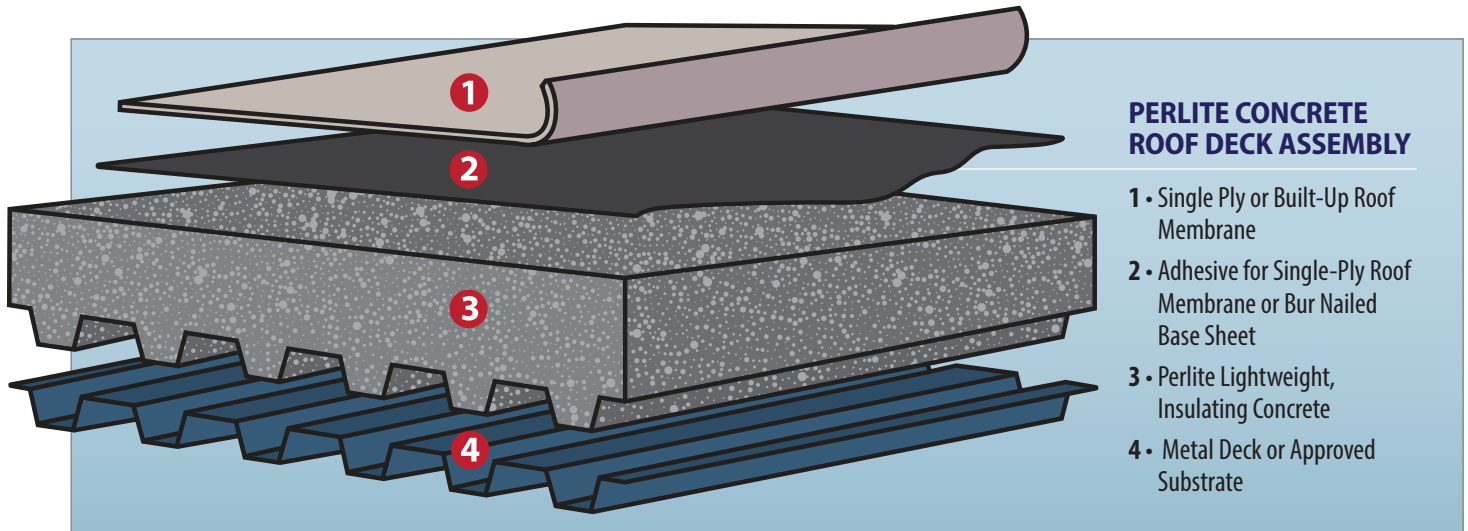


Perlite Lightweight Insulating Concrete Roofing

Sustainable and long-lasting thermal insulation with the strength and durability of concrete



Perlite Lightweight Insulating Concrete is a mix of perlite lightweight construction aggregate (ASTM C 332, Type 1), cement (OPC, Type 1, ASTM C150), air entraining agent admixture (ASTM C260) and water. Perlite lightweight insulating concrete roof decks offer unique sustainable thermal insulation, ultra-lightweight, and fire-resistance while replacing plastic/synthetic insulators (such as polystyrene, polyurethane and others) and a sloped-to-drain topping screed, all in a one-phase application. This versatile design reduces the roof buildup thickness and construction time and cost. Among their useful properties, perlite

A poured-to-fit perlite lightweight concrete roof deck is widely functional—providing durability, lightweight strength, insulative value, superior wind uplift- and fire-resistance—and impressively versatile, suiting the design demands of almost any roofing profile.

lightweight concrete roof decks offer consultants, contractors, and clients the following benefits:

Superior Thermal Insulation

With a thermal conductivity of 0.07 W/mK – 0.12 W/mK (0.040 – 0.069 Btu/ h•ft²•F). Perlite lightweight concrete roof deck is one of the world's most advanced thermally insulating cementitious mixtures available offering 20x more protection from heat gain or loss than ordinary concrete. U-values of 0.30

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PERLITE LW INSULATING CONCRETE MIX DESIGN AND TECHNICAL PROPERTIES									
MIX DESIGNS					TECHNICAL PROPERTIES			THERMAL INSULATION	
Cement to Aggregate Ratio (by volume)	Cement (kg) [lb]	Expanded Perlite Aggregate (100 L bags) [4ft ³ /110 L bags]	Potable Water (Liters) [US Gallons]	Air Entraining Agent ⁽¹⁾ (Liters) [US Gallons]	Wet Density Range (kg/m ³) [lb/ft ³]	Oven-Dry Density Range (kg/m ³) [lb/ft ³]	Compressive Strength (MPa) [psi]	Thermal Conductivity (W/mK) [Btu/h-ft ² F]	Thermal Resistance per [4 in.] (102mm) Thickness (m ² K/W) [Btu/h-ft ² F]
1/4	412 [907]	10 [11]	308–330 [81–88]	0.2 [0.05]	808 ± 48 [50.5±3]	544–640 [34–40]	2.413–3.447 [350–500]	0.10–0.12 [0.058–0.069]	1.016 [5.75]
1/5	330 [726]	10 [11]	297–319 [77–83]	0.2 [0.05]	728 ± 48 [45.5±3]	448–544 [28–34]	1.585–2.344 [230–340]	0.09–0.10 [0.052–0.058]	1.128 [6.41]
1/6 ⁽²⁾	275 [605]	10 [11]	275–297 [72–77]	0.2 [0.05]	648 ± 48 [45.5±3]	384–448 [24–28]	0.965–1.378 [230–340]	0.08–0.09 [0.052–0.058]	1.270 [7.25]
1/8	209 [462]	10 [11]	295–297 [77–83]	0.2 [0.05]	584 ± 48 [36.5±3]	320–384 [20–24]	0.552–0.861 [80–125]	0.07–0.08 [0.040–0.046]	1.451 [8.33]
ANSI/ASTM	C150	C332	–	C260	C138	C495	C495	C518	–

1 • For air entraining agent dosage, follow manufacturer's recommendations. Conduct a trial mix and check the wet density in accordance to the table range: 1) mix cement, water and air entraining agent well until a homogenous slurry is formed, 2) add lightweight perlite construction aggregate and mix for 5 more minutes, 3) check the wet density. Adjust air entraining agent dosage until wet density is achieved. Use an ordinary rotary concrete mixer with a large mixer capacity and fast mixing (rpms).

2 • 1/6 Mix Design is the most often used ratio for roofing applications as it provides an optimum balance between strength, insulation and lightweight.

Table 1 • Mix Designs, Technical Properties and Thermal Resistance of Perlite Lightweight Insulating Concrete Roofing.



Figure 1 • Abu Dhabi Airport Terminal roofing with perlite lightweight insulating concrete stand-alone insulation.

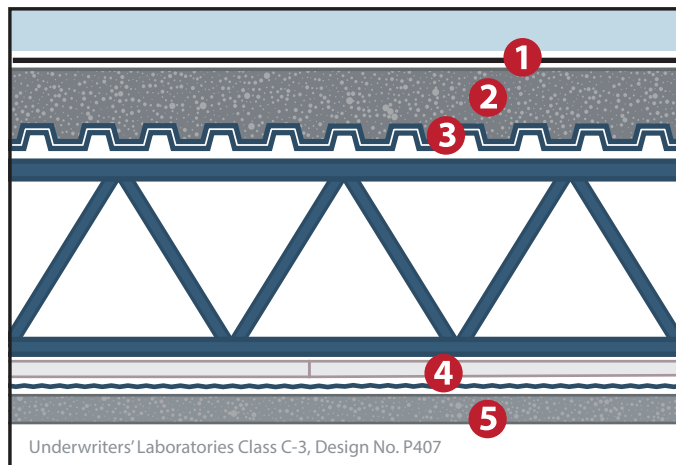
W/m²K for standalone applications are commonly achieved, and are as low as 0.12 W/m²K when applied in combination with insulation board.

Different performance measures can be achieved by varying the density and/or thickness of the final application. Typical U-values for a 4 inch (101.6 mm) thick roof deck start at 0.12 Btu/h•ft²F (0.6 W/m²K) and decreases with each additional measure of thickness. Table 1 provides a range of typical thermal resistance (R) insulating values per 4-inch thickness for various mix designs, useful in determining the desired thermal performance (R-value & U-value) and structural requirements for a given roof design. Note: The average thickness of the sloped-to-drain perlite lightweight concrete roof deck is considered to calculate the average U-value on the roof.

Excellent Fire Ratings

There are several perlite lightweight concrete roof deck designs available offering the benefit of between 1- and 3-hour fire ratings. A typical 3-hour rated roof deck design consists of a 2 inch (50.8 mm) minimum thickness of perlite lightweight insulating concrete applied over 28 gauge galvanized corrugated steel supported by steel joists 4 feet (1.22 m) on-center.

Perlite Lightweight Insulating Concrete Roofing



TYPICAL LIGHTWEIGHT PERLITE INSULATING CONCRETE ROOF DECK DESIGN WITH 3-HOUR FIRE RATING

- 1 • Reflective, waterproofing membrane
- 2 • 2 inches (50.8 mm) minimum perlite concrete
- 3 • 28 gauge galvanized steel decking
- 4 • Metal lath attached to furring channels
- 5 • 7/8 inch (22.2 mm) perlite-gypsum plaster

A ceiling constructed of 7/8 inch (22.2 mm) perlite gypsum plaster applied to expanded metal lath that is attached to 3/4 inch (19.1 mm) furring channels, and wire-tied to the lower chord of the joists completes the detail (see Figure 2).

Ultra-Lightweight

At Dry Density ranges between 20–40 lb/ft³ (340–640 Kg/m³), perlite lightweight concrete is among the lightest concrete mixtures available, helping to reduce dead loads on buildings and the overall strength needed to support a building in the event of an earthquake. The typical density of a perlite lightweight concrete roof design averages 27 lb/ft³ (432 kg/m³).

Slope-to-Drain

Perlite lightweight insulating concrete roof decks offer a smooth, monolithic, sloped-to-drain surface, ideal for receiving any kind of waterproofing solution (e.g., membrane, bituminous, PVC, cementitious, etc.). Perlite lightweight insulating concrete is highly workable and easy-to-screed and slope to internal drains or

Figure 2 (left) • Cross-section of 3-hour fire-rated roof deck with application of perlite lightweight concrete.



Photo courtesy Gulf Perlite LLC



Photo courtesy Gulf Perlite LLC

Top: Placing and screeding a perlite lightweight concrete roof deck. Above: Strong, smooth, monolithic surface of a perlite lightweight concrete roof deck installation.

to the roof edge. Perlite concrete is delivered by transit mixer or it can be mixed on-site at the roof level. Once dispensed, it is simply screeded to the desired thickness and slope.

Sustainable Roofing

Perlite lightweight concrete is a sustainable thermal insulation that is long-lasting and durable. Thermal insulation performance is sustained throughout the design life of the building because of the inherent qualities of the materials with which it is composed. The thermal performance of synthetic insulators such as polyurethane (PU foam) and polystyrene foam degrades with time, losing their insulating value by up to 30% only 50 days after production. Perlite lightweight insulating concrete is LEED compliant, VOC-free, asbestos-free, and does not contain formaldehyde or other hazardous substances.

Perlite lightweight construction aggregate

1 • See Perlite Institute brochure *Perlite: The Most Sustainable Insulation Solution for Buildings*. Perlite Institute, 2023.

Perlite Lightweight Insulating Concrete Roofing

out-performs polystyrene and polyurethane (PU foam) on virtually all sustainability metrics such as: Global Warming Potential (GWP), Ozone Depletion Potential (ODP), Photochemical Oxidants Creation Potential (POCP), Eutrophication Potential (EP), Acidification Potential (AP), Embodied Energy (EE), and Embodied Carbon (EC).

Strong, Monolithic Roofing Base

Perlite lightweight concrete roof decks offer 3-5x higher compressive strength compared with foam concrete at the same density and 20-50x the strength of insulation board. Plus, it can withstand live loads of exposed waterproofing membranes.

Excellent Retrofit Roof Base

Perlite lightweight concrete provides an ideal material for re-roofing, restorations, and roof repairs. It does not add significant load to older structures while significantly improving the thermal insulation, and providing a sloped-to-drain hard surface to apply the new waterproofing layer to. Finally, this is achieved with a thin, one-phase application.

Be sure to check that the pre-existing insulation is intact, and that the support structure is capable of safely supporting the added layers of new roofing. All loose gravel and dirt should be swept off the existing roof prior to installation. For optimum roofing performance, it is recommended that drainage is provided by sloping the perlite lightweight insulating concrete.



SIKA AT WORK ROOFING SOLUTIONS FOR ME'AISEM MALL, DUBAI

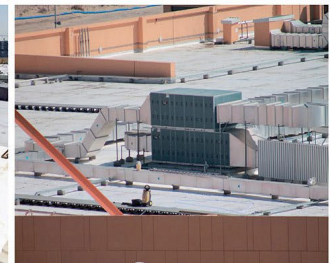
ROOFING: Sarnafill® G410-12 LF White bonded with Sarnacol® 2142 S, Sarnafil® G410-12 L White, Sarnacol® 2170, S-U Bars, Sarnafast® SBF fasteners

BUILDING TRUST



Roofing system with Perlite lightweight insulating concrete and Sika Sarnafill PVC waterproofing membrane installed on a major (22,000 m²) mall in the city center of Dubai, UAE.

ROOFING SOLUTIONS FOR ME'AISEM MALL, DUBAI, UAE



PROJECT DESCRIPTION

Located in the Me'Aisem area of International Media Production Zone in Dubai, Phase 1 of City Centre Me'Aisem Mall, valued at AED 275 million, features 60 international outlets. The mall is set within one million square feet of land, allowing for planned future expansions by 2020. The project is pursuing a LEED Gold certification and is aspiring for the highest levels of energy and water efficiency.

PROJECT REQUIREMENTS

The client required a white reflective waterproofing membrane meeting the requirements of LEED.

SIKA SOLUTION

Working in conjunction with Gulf Perlite LLC, Sika offered a sloped system providing a high level of insulation and reflectivity.

The client required all water to be discharged outside the building (no internal down pipes) and this was achieved with loose laid EPS insulation and sloped Perlite screed above. The Sarnafil® membrane was bonded to the screed, providing a light weight solution satisfying the client's requirements.

Sika UAE supplied over 20,000m² of Sarnafil® membrane.

PRODUCTS USED

- Sarnafil® G410-12LF White
- Sarnacol® 2142S
- Sarnafil® G410-12L White
- Sarnacol® 2170
- S-U Bars
- Sarnafast® SBF fasteners

PROJECT PARTICIPANTS

OWNER: Majid Al Futtaim
MAIN CONTRACTOR: Brookfield Multiplex
APPLICATOR: Tricon Trading & Contracting
SUPPLIER: Sika UAE LLC

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