

PERLITE LIGHTWEIGHT AND INSULATING CONCRETE

Perlite concrete aggregate combined with portland cement and water produces a lightweight insulating concrete used for lightweight roof decks, floor fills, lightweight structural decks, insulation for steam and coolant lines, bases of cryogenic storage tanks, oven insulation, interstitial spaces in reconditioned water and sewer lines, interstitial floors in hospitals, lightweight pre-cast forms and blocks, statuary, basic fills, and many other applications where a lightweight permanent concrete is desired.

Physical properties of perlite concrete vary according to mix designs. Perlite concrete can be made with a dry density of 320 kg/m³ or with the addition of sand or other aggregates up to 1440 kg/m³. The lower the density, the higher the insulating value. For most uses to maintain a proper balance between insulation value and compressive strength, a 1:6 (one part portland cement by volume to 6 parts perlite by volume) mix is chosen with a density between 380 - 440 kg/m³. This provides a K-value range of approximately 0.084 W/m.°K (0.58 - 0.66 Btu.in/h.ft²°F) and a compressive strength of 860 - 1375 Pa (125 to 200 psi).

PHYSICAL PROPERTIES AND MIX PROPORTIONS FOR PERLITE CONCRETE

TYPICAL MIX PROPORTIONS				
Cement to Perlite Ratio (volume)	Cement (litre)	Perlite (litre)	Water (litre)	Air Entraining Agent
1:4	191	764	231	(a)
1:6	127	764	204	(a)
1:8	99	764	189	(a)
TYPICAL PROPERTIES				
Cement to Perlite Ratio (volume)	Dry Density (kg/m ³)	Comprehensive Strength (KPa)	Wet Density (kg/m ³)	Approx Thermal Conductivity (K-value)
1:4	580 – 657	2000 – 3440	770-900	0.144
1:6	380 – 440	860 – 1375	610-705	0.084
1:8	290 – 380	550 – 850	545-640	0.074

Mixing is critical to expected properties and yields. Over-mixing or excessive water will adversely affect results. In paddle-type mixer, mix cement, water and air-entraining agent into a slurry. Then add perlite aggregate and mix only until coated (approximately 2-5 minutes)

Notes:

Air Entraining Agent

Perlite concretes require air entrainment of some type. The use of the correct amount of air entraining agent is very important. Air entraining agents (essentially special industrial soaps and/or foaming agents) produce countless tiny air bubbles that reduce the density of the concrete, increase the yield, and contribute to the insulation values. These bubbles also help prevent cracking and damage from freeze/thaw cycles. They do this by absorbing the effects of the concrete expanding and contracting.

When adding air entraining agents, generally the intent is to create approximately 8-15% air in the final mix. This can be achieved by a variety of products.

It is important to remember that there are different kinds of air entraining agents and different concentrations. Some possible air entraining agents are:

- ALCOLAC-
 - Siponic-liquid
- BASF:
 - Micro Air
- Clariant
 - AG-Hostapur OS
- Grace Construction Products:
 - Darex Range

Please note: These companies and products have been used by contractors and transit mix companies during the last few years. There are others being used, and probably any reputable form of air entrainment will work as long as the final result is in the 8-15% air range. By listing these products, we do not necessarily endorse them or assume any liability for them or for any mixes made with them.