**Specification for Controlled Low Strength Materials (CLSM)**

The permeability in the existing concrete structure is an essential and important step for the definition of its durability, performance and life time. The permeability regulates the speed of aggressive water penetration for inside the concrete besides controlling the movement of the water during the freeze-thaw process. The results represent a combination of the influence of three factors- surface porosity, water permeability and absorption.

Cellular Concrete Technologies Laboratory permeability test result in accordance to ASTM standards shown on Table 1.

Table 1: Cellular Concrete Technologies CLSM Design

|  |  |  |
| --- | --- | --- |
| Density, lb./ft3 | Permeability, k |  |
|  | cm/ second | Inch/ Second |
| 30 PCF | 1.00 x 10-6 | 4.00 x 10-7 |

Table 2: Typical Concrete Permeability

|  |  |  |
| --- | --- | --- |
| Concrete Permeability Classification | Typical Permeability, k |   |
|   | cm/second | Inch/ second |
| High permeability concrete |  1.00 x 10-0 to 1.00 x 10-5  |  4.00 x 10-0 to 4.00 x 10-6 |
| Average permeability concrete | 1.00 x 10-5 to 1.00 x 10-6 | 4.00 x 10-6 to 4.00 x 10-7 |
| Low permeability concrete | 1.00 x 10-7 to 1.00 x 10-8 | 4.00 x 10-8 to 4.00 x 10-8 |
| High impermeability concrete |  1.00 x 10-8 to 1.00 x 10-9 | 4.00 x 10-9 to 4.00 x 10-10 |
| Higher impermeability concrete | 1.00 x 10-9 to 1.00 x 10-11 | 4.00 x 10-10 to 4.00 x 10-12 |

A uniformly well graded coarse sand has a relatively high permeability with a coefficient of water conductivity of approximately 1.00 x 10-1cm/sec. On the other hand, clay has relatively low permeability with a coefficient of water conductivity of 1.00 x 10-7cm/sec. Typical coefficients of water conductivity for various backfill materials are provided in Table 3.

Table 3: Typical Water Conductivity Values Soil Type

|  |  |  |
| --- | --- | --- |
| Soil Type | Typical Permeability, k |   |
|   | ( cm/ sec) |  (Inch/ second) |
| Gravels and Course Sands | > 1.00 x 10-1 | > 4.00 x 10-2 |
| Fine Sands | 1.00 x 10-1 to 1.00 x 10-3 | 4.00 x 10-2 to 4.00 x 10-4 |
| Silty Sands | 1.00 x 10-3 to 1.00 x 10-5 | 4.00 x 10-4 to 4.00 x 10-6 |
| Silts  | 1.00 x 10-5 to 1.00 x 10-7 | 4.00 x 10-6 to 4.00 x 10-8 |
| Clays | < 1.00 x 10-7 | < 4.00 x 10-8 |

When a specific coefficient of permeability is required by engineer, laboratory data can be determined during the mix design submittal process to correlate the air content in lieu of the plastic CLSM with the permeability of the hardened CLSM. Cellular Concrete Technologies conducted testing methods and verification in accordance with the following ASTM Standards.

ASTM C138 or ASTM D6023 “Standard Test Method for Density ( Unit Weight), Yield, and Air Content( Gravimetric) of Concrete.

ASTM D6023 - 07 Standard Test Method for Density (Unit Weight), Yield, Cement Content, and Air Content (Gravimetric) of Controlled Low-Strength Material (CLSM).

ASTM C1202 “Standard Test Method for Electrical Indication of Concrete’s Ability to Resist Ion Penetration.

Hai Ngo, MSCE, LEED AP

Project Engineer

Cellular Concrete Technologies LLC

Office (949) 754-0570

Cell (626) 315-3730

Fax (949) 754-0644