

Performance of OPUS SCM™ made from a range of different feedstocks



Terra's OPUS SCM™ is a supplementary cementitious material (SCM) manufactured from locally available rocks. Existing aggregate operations are the main suppliers of feedstock, but other sources, e.g. mine tailings, may also be suitable. Please refer to our *Feedstock Selection Guidelines*, for direction on rock compositions that are likely to be suitable.

Terra's process is unique: process parameters can easily be adapted to produce an SCM with consistent performance from different starting materials. To illustrate this, the table below summarizes testing results for concrete mixes containing OPUS SCM™ made from a wide range of raw materials: igneous rocks like granite and basalt, alluvial sand, materials with a high clay content, mine tailings, etc.

For all samples, a commercial concrete mix with a cementitious content of a 611 lb/yd³ (6.5 sack) was made,

using OPUS SCM™ at 20% Portland cement replacement. All concrete mixes were air entrained (~6% air) and water reducing admixtures were used, targeting a 4" slump using a water-cement ratio (w/c) of about 0.42. A direct comparison is made with 100% Portland cement mixes and with commercially available class F fly ashes mixes.

The results show that a consistent 28-day concrete compressive strength was achieved for OPUS SCM™ made from widely variable starting materials. The OPUS SCM™ concrete mixes show similar or better compressive strength than the class F fly ashes and on day 28, had reached >90% of the strength of a straight Portland cement mix. As is typical for pozzolanic materials, OPUS SCM™ continues to show strength increase beyond 28 days.

Terra has a dedicated raw material testing program. Please contact the Terra team to have your materials evaluated.

| Material | Concrete Compressive Strength | | | | Concrete Properties | | | | |
|--|-------------------------------|-------|--------|--------|---------------------|------------------------|-------|-----|-------------|
| | (psi) | | | | w/c | Unit Weight | Slump | Air | Initial Set |
| | day 3 | day 7 | day 14 | day 28 | (-) | (lbs/ft ³) | (") | (%) | (hh:mm) |
| 100% Portland Cement | - | 5590 | 5835 | 6290 | 0.42 | 144.8 | 4.0 | 7.2 | 5:06 |
| 100% Portland Cement | - | 5600 | 6040 | 6370 | 0.42 | 146.4 | 4.0 | 5.2 | - |
| 20% Class F Fly Ash (Prairie State) | 4110 | 4710 | - | 5770 | 0.43 | 146.8 | 4.0 | 5.8 | 5:30 |
| 20% Class F Fly Ash (Charah) | 3450 | 4015 | 4280 | 4755 | 0.42 | 141.6 | 4.5 | 6.9 | - |
| 20% OPUS SCM™ made from Granite | 3750 | 4340 | - | 5820 | 0.44 | 145.4 | 4.0 | 6.0 | 5:42 |
| 20% OPUS SCM™ made from Granodiorite | 4300 | 4700 | 5350 | 6100 | 0.42 | 145.6 | 3.75 | 5.2 | 4:37 |
| 20% OPUS SCM™ made from Basalt | 4402 | 4895 | 5440 | 6250 | 0.43 | 144.0 | 3.8 | 6.0 | 5:43 |
| 20% OPUS SCM™ made from Alluvial Sand/Gravel | 3920 | 4470 | 5110 | 5840 | 0.42 | 146.2 | 4.5 | 6.0 | 6:24 |
| 20% OPUS SCM™ made from Glacial Gravel | 4295 | 4780 | 5305 | 5915 | 0.42 | 144.4 | 4.8 | 6.6 | 5:42 |
| 20% OPUS SCM™ made from Pyroclastic Rock | 4140 | 4590 | 5375 | 5875 | 0.42 | 144.4 | 3.75 | 6.3 | 5:34 |
| 20% OPUS SCM™ made from Clay-Quartz Mix | 3850 | 4625 | 5105 | 5970 | 0.42 | 145.2 | 4.75 | 5.3 | 5:26 |
| 20% OPUS SCM™ made from Shale | 4330 | 5160 | 6040 | 6300 | 0.42 | 145.6 | 4.25 | 5.0 | 4:40 |
| 20% OPUS SCM™ made from Slate | 4410 | 4979 | 5650 | 6600 | 0.42 | 145.6 | 4.8 | 5.4 | 5:08 |
| 20% OPUS SCM™ made from Mine Tailings | 4395 | 4908 | 5470 | 6061 | 0.42 | 143.6 | 3.75 | 6.5 | 6:15 |



For additional information, please contact us:

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