SPACECRETE™
A New Dimension in Concrete

3D™Admix

Optimized Concrete Using 3D™Admix Modifier

3D-Admix™ is an engineered blend of active solids suspended inertly in a concentrated liquid Shrinkage Reducing Agent (SRA). This composition allows for maximum rheology modification to concrete or mortar with a very low dose of admix. The solids are of a blend developed to impart optimal properties to the modified concrete to enable rapid vertical stacking while minimizing plastic shrinkage.

The rheology-modifying effect is a combination of absorption of excess mix water, rheological structurization of the mix paste, and an initial gelling of the cement, followed by an early initial set. These thickening actions are very sensitive to shear thinning, so that the initial gelling action can be vibrated out, re-liquifying the mix, before it immediately re-gels in a more consolidated state. The vibrational consolidation, or high shear action to reenable workability can be repeated indefinitely. For expected results, the aggregate gradation must be of a spectrum for a well-designed mix.

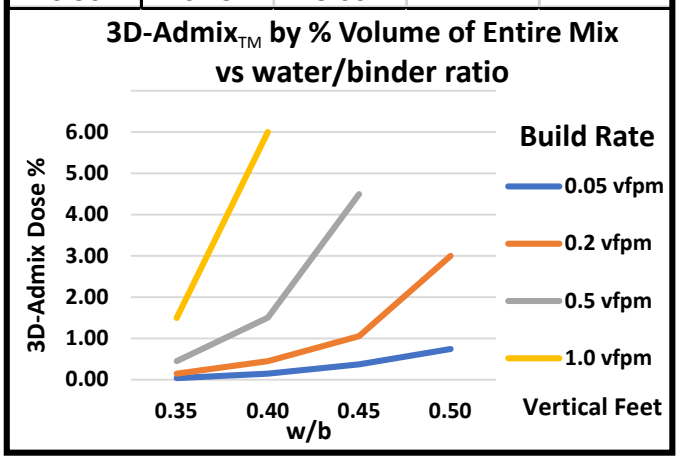
3D-Admix™ will settle, so needs to be thoroughly mixed before each use.

Dose

As 3D-Admix™ is a new technology that allows extremely high thickening with a very low dose of a liquid. There is some designed delay to the thickening action, to allow continued intermixing, but as the admix effect is so extreme, it is commonly overdosed. The dose is directly related to, and very sensitive to, the water content w/c, or w/b, of a cementitious mix. For example, a portland cement concrete with a w/b of 0.35, dosed at only 0.1% of 3D-Admix™ by total mix weight, should allow a vertical build rate of 0.2 feet per minute. As a practical matter, the total binder content should be at least 0.16 by weight (7-sack mix) for lubrication purposes, for a concrete with coarse aggregate. Mortar mixes are per user need or extrusion/surface requirements. These doses are estimates; testing should be done with your own mix.

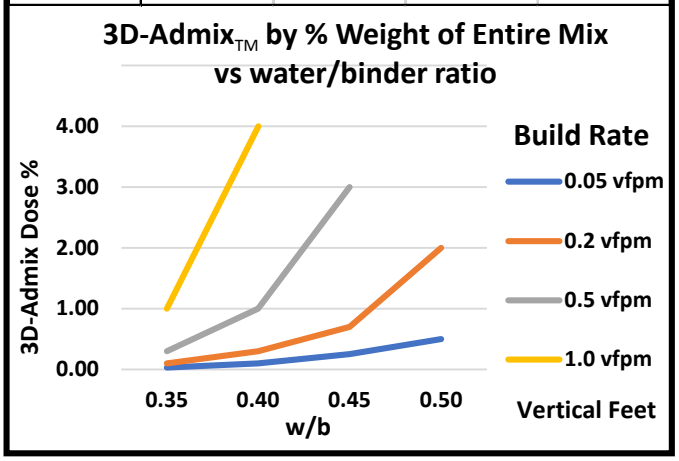
% of 3D-Admix™ by Volume

	Estimated Vertical Build Rate, feet per min			
w/b	0.05	0.20	0.50	1.00
0.35	0.05	0.15	0.45	1.50
0.40	0.15	0.45	1.50	6.00
0.45	0.38	1.05	4.50	
0.50	0.75	3.00		



% of 3D-Admix™ by Weight

	Estimated Vertical Build Rate, feet per min			
w/b	0.05	0.20	0.50	1.00
0.35	0.03	0.10	0.30	1.00
0.40	0.1	0.3	1	4.00
0.45	0.25	0.70	3.00	
0.50	0.50	2.00		



Compatibility

In reacting with water, 3D-Admix$_{TM}$ works with every hydraulic binder and Supplementary Cementitious Material (SCM) tested so far. It is primarily designed for portland cement, as it accentuates the Bingham-plastic properties inherent in portland cement, though it provides the same thickening function with all hydraulic binders and SCMs, such as fly ash, slag (GGBS), metakaolin, limestone powder, silica fume, etc. These alternates can generally be in any concentration that would be appropriate for concrete. The primary issue with some SCMs, such as slag or rice-husk ash, is where those particles increase friction rather than reduce it, reducing workability of the modified mix. Fly ash improves workability of the modified concrete. Metakaolin, ultra-fine limestone powder, and/or silica fume all benefit the rheology, but are not necessary. With 3D-Admix$_{TM}$, hydrated lime (calcium hydroxide) does not increase thixotropy.

High Range Water Reducers, up to a moderate dose, do not affect vertical build. A low dose of most retarders or set stabilizers will not affect initial thickening and gelling action of 3D-Admix$_{TM}$. A VMA at any dose will augment the 3D-Admix$_{TM}$ effect.

Do not try to thin 3D-Admix$_{TM}$ with water! This will only thicken it severely and make it unusable. In fact, it can be used to absorb aqueous spills in a pinch. If so, then mix it with dry cement, or equal, for disposal.

Intermixing

3D-Admix$_{TM}$ is intended to be intermixed within a line of pumped concrete using an inline mixer such as that developed by SpaceCrete$_{TM}$. For small batches or testing purposes, 3D-Admix$_{TM}$ can be intermixed with a paddle mixer or the equivalent in a pail. Concrete must be premixed 100% before including 3D-Admix$_{TM}$. Mixing will become more difficult quickly from thickening, so get it done quickly. Perfectly intermixing is not absolutely necessary for vertical build, but it does impart benefit equally to all of the concrete. The inline mixer developed by SpaceCrete$_{TM}$ connects to a dosing pump that can meter 3D-Admix$_{TM}$ into the concrete proportionally to concrete flow rate, and at a pressure greater than the pump line pressure at the point of injection. Some continued intermixing beyond the static mixer is usually necessary. Active inline mixing can also be suitable. Please contact SpaceCrete$_{TM}$ for more information.

Shrinkage Reduction

The 3D-Admix$_{TM}$ reduces or eliminates plastic shrinkage caused by drying conditions, as it draws curing water back into the paste matrix, rather than allowing evaporation. As the carrier liquid is a 100% concentration of a very effective Shrinkage Reducing Agent (SRA), and in combination with the subsequent internal curing provided by the thickening solids (releasing water back to the cement for hydration), the combined effect is reduced shrinkage at early stages of hydration, compared to the same concrete without 3D-Admix$_{TM}$. In combination with sufficient fiber reinforcement, improved permanent shrinkage normally will result, compared to the identical fibered concrete mix without 3D-Admix$_{TM}$. This benefit can be pronounced at doses of 1% (by weight) or higher. One factor appears to be earlier fiber bond development.

Placement

The initial set created by 3D-Admix$_{TM}$ is reversible (multiple times) with application of shear, such as by vibrating the concrete. Even when the modified concrete is at zero slump, if with coarse aggregate it responds extremely well to vibrational consolidation about reinforcing. Placing with vibration is highly efficient and also helps solidify subsequent vertical build.

As 3D-Admix$_{TM}$ functions with a retarder in the batched concrete, allowing improved interlayer bonding of 3D-prints, or faux stone carving, while maintaining vertical buildability.

Storage

Store in a sealed container in a cool dry location. Access to water or atmospheric moisture will cause the solids to swell, thickening the admix. In proper storage conditions the shelf life is 6 months.

3D-Admix$_{TM}$ will deteriorate acrylonitrile butadiene styrene (ABS) plastic material. Test any similar plastic before using it as a container. Polyethylene plastic is suitable. See the SDS for all use precautions.