Triangle Tech Tips
References and resources from Triangle Ready Mix
Publication # 24-04-054 R1/04-25

About Synthetic Fiber Concrete Additives

Synthetic fibers designed specifically for use in concrete are made from man-made materials that can withstand the long-term alkaline environment of concrete. These fibers are added to the concrete before or during mixing. Using synthetic fibers at typical addition rates does not require any changes to the mix design.

The addition of synthetic fibers offers performance improvements in both the plastic (fresh) and hardened states of concrete. These benefits include a reduction in plastic settlement and shrinkage cracking, lower permeability, and increased resistance to impact, abrasion, and shattering.

Benefits of Synthetic Fibers During the Plastic Phase

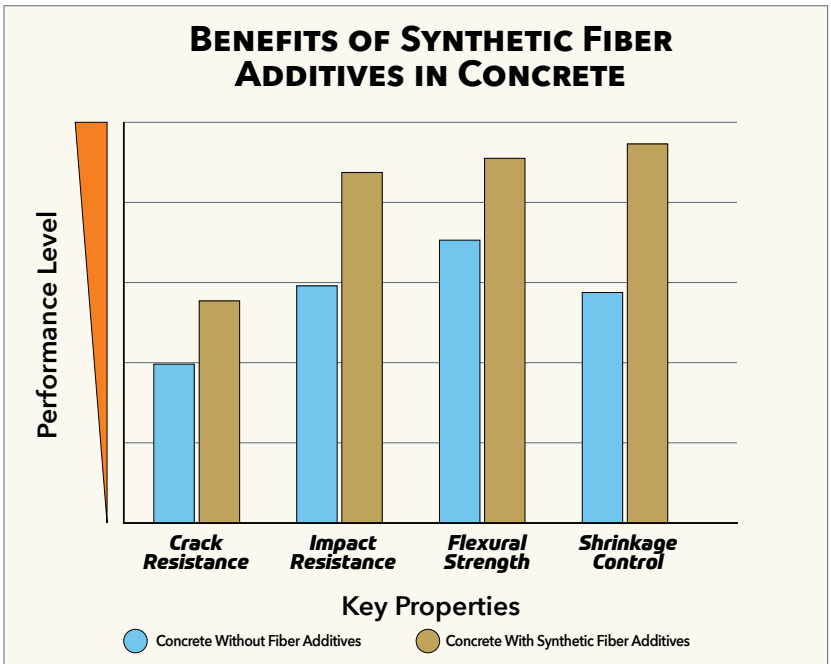
As concrete sets and begins to cure, changes in volume can create internal stress, often leading to micro-cracks or weak spots. Synthetic fibers act as a physical barrier to help control these early shrinkage cracks, preventing them from growing and compromising the concrete. They also help reduce settlement cracks by offering internal support during setting.

Because synthetic fibers are dispersed evenly throughout the mix, they interrupt the formation of large capillaries caused by water. This uniform distribution helps limit bleed water and decreases permeability by reducing both plastic cracking and bleeding tendencies.

Synthetic Fibers in Hardened Concrete

The advantages of synthetic fibers continue well beyond the initial curing stage. Once the concrete hardens, the fibers enhance its durability and toughness. Concrete reinforced with synthetic fibers is less prone to shattering under compressive stress, a risk that plain concrete faces without internal fiber support. These fibers hold the matrix together, helping the concrete resist cracking even under high-impact forces.

Abrasion resistance is also improved thanks to the fiber's ability to help maintain a consistent water-to-cement ratio at the surface. By minimizing variable bleed water and providing uniform settlement support, the surface finish is more durable and less prone to wear. Their relatively low modulus also helps absorb energy, contributing to better shock resistance and reduced surface damage over time.



Synthetic fiber additives can benefit ready-mixed concrete by improving crack resistance, impact resistance, flexural strength, and shrinkage control.

A Long-Term Advantage for Concrete Integrity

Overall, synthetic fibers contribute to the long-term integrity of concrete. They minimize early-stage cracking caused by plastic settlement and shrinkage, reduce permeability, and bolster resistance to impact, abrasion, and shattering. Additionally, synthetic fibers are compatible with a wide range of admixtures, silica fumes, and cement chemistries, making them versatile for various mix designs.

Using Synthetic Fibers as Secondary Reinforcement

When synthetic fibers meet certain performance criteria, they can serve as nonstructural temperature or secondary reinforcement. In such cases, they should be backed by performance data that demonstrates their ability to maintain structural cohesion even after cracking has occurred. Because the fibers are evenly distributed throughout the mix, they provide consistent and reliable internal support across the full concrete section.

Synthetic Fibers Can Be Used for These Applications:

1. To decrease cracking in concrete that results from plastic shrinkage.

2. As an alternative method for nonstructural secondary and/or temperature reinforcement.

3. For enhanced resistance to impact, abrasion, and shattering in concrete.

4. To improve internal support and cohesion for concrete used in steep inclines, shotcrete, and slipformed placements.

5. To reduce concrete cracking caused by plastic settlement.

6. For assistance in lowering concrete permeability.

7. For placements where nonmetallic materials are necessary.

8. For areas needing materials resistant to both alkali and chemicals.

	**DO NOT USE** **Synthetic Fibers for These Applications:**
1.	Managing cracks caused by outside pressures
2.	Improved development of structural strength.
3.	Substitution of any moment-resisting or structural steel reinforcement.
4.	Decreased thickness of ground-level slabs.
5.	Minimizing or eliminating curling and/or creep.
6.	Expanding ACI or PCA control joint recommendations.
7.	Supporting a decrease in the dimensions of support columns.
8.	Reducing the thickness of bonded or unbonded overlay sections.