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Soil Cement Stabilization And Other Uses of Cement

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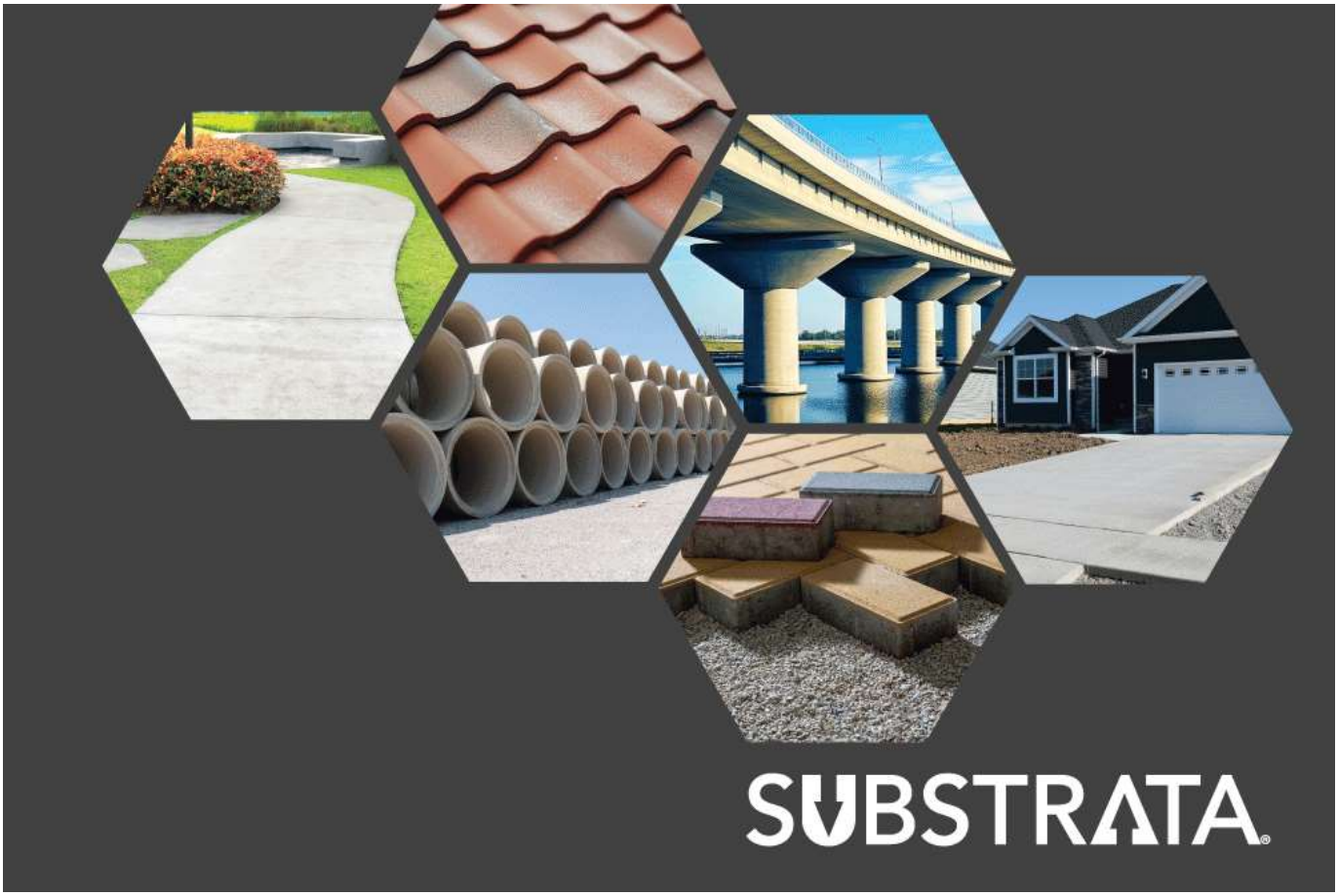

Cement is the second most-used material in the world (right after water), and if you tally it up by mass, it accounts for about half of all manmade materials, according to the Portland Cement Association.[1]

Cement is a chemical agent, usually in powdered form, that binds construction materials together and makes structures stronger. With its incredible binding capabilities, this unique material serves many purposes in all types of construction.

We'll explore some of cement's numerous uses, like making concrete, producing other construction materials, and stabilizing soil. Then, we'll discuss which types of cement work best for which projects. Let's begin!

Cement in Concrete

One of cement's most important purposes is serving as an ingredient in concrete. When you mix cement with water and aggregate, you can use it to form concrete structures like:

- Walls
- Dams
- Floors

- Bridges
- Barriers
- Artwork
- Sidewalks
- Driveways
- Cinderblocks
- Building foundations
- Parking areas and blocks
- Pipes, culverts, and sewers
- Support pillars, such as for highway overpasses

You'll even see concrete at the gas station: those waist-high arches that keep people from running over the pumps are concrete!

Cement in Other Construction Materials

In addition to concrete, cement serves as an ingredient in many other construction materials, including mortar, masonry cement, grout, stucco, and terrazzo. It also goes into many pre-made products like paving stones, roofing tiles, and countertops.

Soil Cement Stabilization

Soil cement stabilization is one of the most common means of soil stabilization in the U.S. for building safe, long-lasting infrastructure, making it one of cement's most important purposes. You might also hear people call this method **cement soil stabilization** or just **cement stabilization**.

Soil cement is what it sounds like: soil that's mixed with cement to alter its physical and chemical properties. Mixing the two together creates a substance that's much harder and stronger than soil alone. Thus, the added cement helps soil support the weight of roads and other structures.

There are several types of soil cement, including cement-modified soil, cement-treated base, and soil cement base.

Using Soil Cement

The amount of cement that contractors use varies based on the soil's characteristics. Generally, soils with higher plasticity, like clay, are stretchy and easy to mold, so they will need more cement to make them stronger and help them hold their shape. In contrast, soils with low plasticity are already fairly rigid and need less cement.

Contractors often must choose between soil cement and lime soil stabilization. Cement and lime are both binding agents, so these methods work similarly. However, in regions that lack large limestone deposits, it's usually more cost-effective to manufacture cement nearby than to truck in lime from far away.

Soil Cement in Paving

People often use soil cement stabilization for paved roads because it increases the road's durability and reduces surface issues stemming from erosion. The first cement-treated base for a paved road was made in South Carolina in 1935.[2] Since then, it's become a popular choice for both new

road construction and full-depth reclamations, which recycle existing pavement to make new roads.

However, treating unpaved roads with cement is uncommon. Many dirt and gravel roads exist due to budgetary constraints, and the expense of making soil cement is cost-prohibitive in those cases.

Pros and Cons of Soil Cement Stabilization

Soil cement stabilization is long-lasting and strong. If you select the right type of cement for the job, it should resist water, weather, and most chemicals. It can also be more cost-effective than some other soil stabilization methods, since you can mix the soil cement onsite.

That said, soil cement is not always the most cost-effective choice, especially if your project requires specialty cement. Some other cons are:

- It's brittle and prone to cracking.
- It has a large carbon footprint.
- Any mistakes during mixing or application process can compromise the roadway.
- It takes weeks to fully cure and may suffer damage if traffic returns to the roadway too early.

Cement Uses by Type

There are many varieties of cement, and we've covered quite a few of those cement types. Each has its own traits, pros, and cons that make it useful for different projects. So, let's explore some of the purposes that different types of cement serve.

Portland Cement Uses

Portland cement is the most common variety, covering a broad range of applications.

Type I (GU)

For most projects, Type I portland cement works sufficiently. You can use it in virtually any type of concrete, precast product, or construction material that doesn't require special properties.

Type II (MS or MH)

Type II portland cement resists sulfates and temperature spikes that can damage concrete, so it's good for projects like piers, heavy pillars, and retaining walls. Type II cement also works well in underground tunnels and road subbases where soils may contain moderate amounts of sulfates that would damage other cements.

Type III (HE)

Type III portland cement helps concrete cure stronger within the first three days of pouring than other cements. When you're on a tight timeline, need to remove formwork early, or are working on cold-weather projects, Type III is a good choice. It's also useful for precast products; its early strength lets manufacturers remove the products from the molds and pour the next batch quicker.

Type IV (LH)

Type IV portland cement resists temperature spikes, thermal shock, and cracking, and it's less reactive than other cements. But it may take longer to set, so it's best for projects with sufficient curing time. People use Type IV almost exclusively for large, high-volume projects like dams. It's only available by custom order in the U.S., so many contractors use portland-pozzolana or slag cement instead.

Type V (HS)

Type V portland cement works well for coastal structures, canal linings, culverts, or underwater structures. It's also good for paving, foundations, and retaining walls in high-sulfate, low-tricalcium aluminate soils. (Type III

cement may serve some of these purposes, but Type V is even more resistant to sulfates in soil and water, especially saltwater.)

Air-Entrained Portland Cement Uses

Air-entrained portland cement contains microscopic air bubbles that help produce freeze-thaw resistant concrete. Use it for cold weather projects or in climates with distinct seasons that cause concrete to expand and contract due to changing temperatures.

White Cement Uses

White cement has the same properties as Type I, but its special manufacturing process turns it white. Architectural projects, swimming pools, and ornamental designs are the perfect places to use white cement. And any time you create bright or unnaturally colored cement for decorative purposes, you'll use white cement as your base.

Blended Hydraulic Cement Uses

Blended cements combine ordinary portland cement with additives that change its chemical properties and capabilities. These cements are made for more specialized projects.

Portland-Pozzolana and Hydrographic Cement Uses

Portland-pozzolana and hydrographic cement are both good for bridges, marine structures, and underwater concrete projects. The former works because it resists chemicals that might be in the water. And the latter works because it contains chemicals that repel water to prevent damage.

Blast Furnace Slag Cement Uses

The use of **blast furnace slag cement** dates back to the 1700s, although its first production in the U.S. came in 1896.[3] It contains "slag," or byproducts from the iron smelting process, making it fairly cheap to produce. Its many uses include ready-mix concrete, water structures and dams, mass concreting foundations, and other large projects with high-chloride, high-sulfate soils.

Portland-Limestone Cement Uses

Portland-limestone cement came into use in Germany in 1965, where contractors used it for specialty products.[4] Today, it's gained popularity around Europe and the U.S. for being more cost-effective and sustainable than Type I cement; it can lower a project's carbon footprint by up to 10%.[5] It's now a common paving cement. In fact, some states like Colorado and Texas are switching almost entirely to portland-limestone cement for roadways.

Other Cement Uses

Unlike portland or blended cements, non-hydraulic cement requires dry conditions to cure properly and prevent damage over time. It's ideal for making bricks and mortar that will be higher up off the ground and less likely to experience groundwater or soil moisture.

Extra-Rapid Hardening and CSA Cement Uses

Contractors use extra-rapid hardening cement and CSAs for everything from airport runways to kitchen countertops—basically any job where you need concrete to set up fast to eliminate downtime or stick to a tight schedule. They're also effective for speeding up repairs and maintenance to important structures like fences and sewer manholes. The downside is that time is money, and in this case, that means spending more money so your cement takes less time to cure.

High-Alumina Cement Uses

High-alumina cement is very strong, yet it can be more flexible than ordinary portland cement. It works well for projects in places with extreme weather and temperature—and we mean **extreme**. High-alumina cement is an ingredient in refractory concrete that goes around kilns, furnaces, boilers, and chimneys to keep the heat in. It's also effective for sewer and marine infrastructure.

Expansive Cement Uses

Expansive cement grows slightly as it cures to prevent cracking, making it a perfect fit for large, unjointed concrete slab floors. It's also great for repairing holes in other concrete, grouting anchor bolts, building water

retention structures, or creating joints that will need to expand with changing temperatures. Finally, expansive cement is good for making pre-stressed or self-stressed concrete bridge components that will experience low tensile stress under loads.

Conclusion

Cement serves many purposes in our society. Whether you're chopping vegetables on your kitchen counter, touring the Hoover Dam, or trying to stabilize the soil under a paved road, you're counting on cement to help you get the job done.

Hopefully, now you have a better idea of the essential role cement plays in construction and soil stabilization—as well as which types of cement are best for which jobs.

Ready to learn more? Compare cement to these other soil stabilizers!

COMPARE SOIL STABILIZERS

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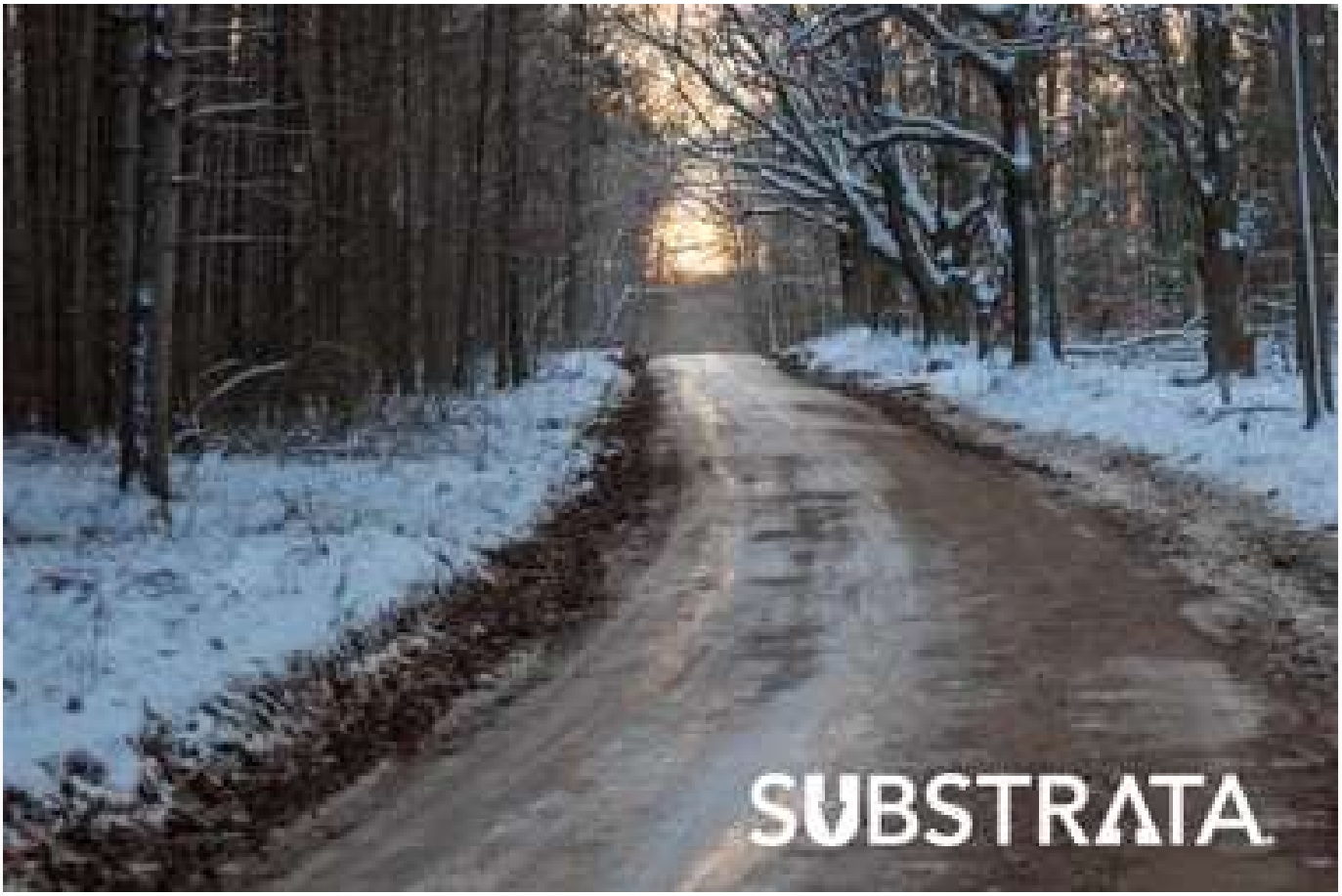

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