UNDERSTANDING THE PROS AND CONS OF PERVIOUS CONCRETE

LORMAN®

Published on www.lorman.com - October 2017

INTRODUCING

Lorman's New Approach to Continuing Education

ALL-ACCESS PASS

The All-Access Pass grants you UNLIMITED access to Lorman's ever-growing library of training resources:

- ☑ **Unlimited Live Webinars** - 120 live webinars added every month
- ☑ **Unlimited OnDemand and MP3 Downloads** - Over 1,500 courses available
- ☑ **Videos -** More than 700 available
- ☑ **Slide Decks -** More than 1700 available
- ☑ White Papers
- ☑ Reports
- ☑ Articles
- ☑ ... and much more!

Join the thousands of other pass-holders that have already trusted us for their professional development by choosing the All-Access Pass.

Get Your All-Access Pass Today!

SAVE 20%

Learn more: www.lorman.com/pass/?s=special20

Use Discount Code Q7014393 and Priority Code 18536 to receive the 20% AAP discount.

*Discount cannot be combined with any other discounts.

Understanding the Pros and Cons of Pervious Concrete

Today's construction and engineering professionals are looking increasingly toward sustainable materials and eco-friendly options when building new structures and planning new communities. This is largely due to the unparalleled upward trend in gas prices over the course of the last decade, as well as greater awareness of climate change and its disastrous effects. Essentially, operating a business that operates with highly eco-friendly materials is simply a great way to attract a greater number of customers while delivering distinct benefits in their home and throughout the community.

Perhaps one of the best materials that today's sustainable developers have in their toolbox is pervious concrete. While the material itself is certainly nothing new, as it dates back to construction projects undertaken as early as the 19th century, the material has recently been rediscovered in the United States. Furthermore, porous concrete material is increasingly being used in paving environments, rather than in homebuilding and wall applications, as was the case in the 19th century. It presents a wide array of new options for developers and project managers. For the most part, the long list of benefits outweighs the disadvantages of pervious concrete, benefiting construction companies, consumers and the environment alike.

Before proceeding with a pervious construction project, though, it's worth understanding where the material comes from, how it can really benefit communities and homeowners, and why it might suffer from a few drawbacks in some scenarios. With a better understanding of this unique kind of concrete, and a good idea about its best uses and best practices, professionals can more effectively use it in a wide range of applications.

A Look at Composition: How to Create Pervious, or Porous, Concrete

The key thing to understand about pervious concrete is that it actually is created using many of the same materials mixed in with traditional concrete. The mixture generally involves rocks, cement, and water, but leaves behind the large amount of sand found in more traditional concrete applications. The lack of sand is what helps the concrete to be just a bit looser, or less bound together, and this allows for water and snow to seep through the concrete and down to the ground, rather than running off the concrete as is normally the case.

Typically, the key thing to remember about pervious concrete is that it must involve quite a bit more rocks than can be found in traditional applications. This, again, reinforces the looser and more porous nature of pervious concrete installations. The general rule for contractors is to mix 1 part cement with 3 parts rock. Those rocks should be typical pea gravel found at most nearby hardware stores and quarries, able to easily vanish within the larger concrete mixture once it has been treated with water.

For the purpose of pervious concrete creation, water is added in largely the same cautionary way that it is with traditional concrete. This is probably the hardest part of the entire mixture, as water can easily become too much. That will lead to heavy concrete that requires extra cement, largely reducing the porous nature of the material after it has been mixed by contractors.

Either way, the differences between pervious and traditional concrete are clear. A small amount of water is added to a rock and cement mixture, without the traditional sand that is used in less porous concrete mixes. It should be noted that this "recipe" of sorts is virtually required to be performed by hand, as it is difficult if not impossible to find bagged pervious concrete mixes on the market today. Those creating pervious concrete on their own should also be aware that direct sunlight can quickly dry out the mixture, much more quickly than it would a traditional concrete mix. Be sure to perform the task in the shade, exposing pervious concrete to sunlight only after it has been placed into a sidewalk, parking lot, or some other permanent location.

The Origins: How Pervious Concrete Came to Be a Driving Force in Construction

Though pervious concrete is one of the hottest buzzwords in 21st century sustainable development, the material itself is decidedly old. In fact, it was used in home construction throughout England, Scotland, and several other northern European countries in the 1800s. Its popularity has waxed and waned ever since, largely depending on economic conditions and the ease of access to traditional cement and concrete products.

The primary goal behind developing pervious concrete in the 1800s in fact had nothing to do with the sustainability of the material. Instead, the main motivation behind using more rocks and less cement had everything to do with the cost and availability of cement itself. At various times throughout British and European history, cement has been scarce or prohibitively expensive. This was the case multiple times during the 1800s, and it happened again after the first and second World Wars.

Instead of relying on heavy cement concentrations, builders simply used more rocks to solidify the mixture. The mix was just as strong and as useful in construction as traditional concrete would be, but it often could be made at a fraction of the cost. Building with pervious concrete was conducted on single-story homes throughout the 19th century but, in the 1920s, the material was expanded to use in two-story homes in the British Isles and in other locations throughout Europe.

The material did not become mainstream in the United States until some time later, with the first major implementations of pervious concrete in America dating back only to the early 1970s. These uses were the first to be enacted for the primary goal of sustainability as well as cost management, and pervious concrete has been associated with those two goals in the United States ever since.

Today, the material is increasingly being used by developers and municipal governments as a way to reduce damaging runoff in major urban environments as well as suburban areas. Pervious concrete is most likely to be found in low-traffic locations, like residential sidewalks and parking

lots, as well as in residential walkways and outdoor patios. There are a number of limitations inherent with pervious concrete that restrict its use in areas with significantly more traffic, however.

Recognition by the United States Environmental Protection Agency

Some time after pervious concrete became a mainstream material in United States construction, the Environmental Protection Agency began to study the material as a way to improve regulations concerning dangerous runoff after major storms around the country. The Environmental Protection Agency had long been looking into more sustainable materials for both residential and commercial construction, and pervious concrete applications were a primary area of interest.

After a brief study of the benefits and disadvantages concerning the material, the head of the EPA at the time made pervious concrete its "best practice" for paved services in low-traffic commercial and residential areas. The agency specifically cited the material's ability to absorb water and return it to the earth as a reason for construction companies to give it a serious look.

Today, pervious concrete is one of the most popular materials among developers in both residential and commercial environments. Its benefits are widely known, and benefit everything from infrastructure development to overall construction costs and the delicate ecosystems that surround most homes and businesses throughout the United States.

Sewer System Costs: A Prohibitive Factor in Modern Construction Projects...Mostly

Since the Environmental Protection Agency first studied pervious concrete as a long-term, highly sustainable material for use in low-traffic areas; the agency has developed far tighter restrictions concerning runoff. In part, pervious concrete is to blame for this fact. With the knowledge that concrete could be used specifically to absorb water and return it to the earth, rather than direct that water to storm drains and sewage systems, the agency set out to redefine the requirements when undertaking new commercial or residential construction.

What followed was a series of regulations that made it imperative for builders to figure out how to eliminate virtually all storm runoff from their properties. In the absence of a pervious concrete installation, developers would have to install an extensive network of sewers and drains to meet the Environmental Protection Agency's demands. This was, and remains, prohibitively expensive for the vast majority of developers in every industry. Sewers require an extensive amount of digging, burial, and long-term maintenance, and it's simply not possible for smaller developers to commit to that kind of undertaking.

In the absence of these extensive and expensive sewer systems, the EPA recommended the use of pervious concrete. Citing studies done previously, the agency recommended that developers use the material on driveways, residential sidewalks, commercial and residential parking areas, and virtually anywhere else that was practical. Because pervious concrete is significantly less expensive in large amounts than is the installation of a sewer system, use of the material quickly took off and today it remains a primary component of virtually all new homes.

The cost benefits of pervious concrete are obvious in other ways as well. The cost of cement remains the driving factor in the cost of all concrete, pervious or not. As seen in Europe throughout the 19th and 20th centuries, opting for pervious concrete reduces construction costs demonstrably. Cost savings are one of the leading motivators causing today's developers to switch to the material.

The Heat Island Effect and Pervious Concrete's Impact on Warmth

Much of the discussion about pervious concrete's environmental benefits focuses on how the material essentially eliminates run off and returns water immediately to the ground without polluting it or causing damage to the nearby ecosystem. That's all a very worthy objective, and it remains the most notable benefit. There is something else that comes from the use of pervious concrete, however: A distinct drop in warmth.

Because pervious concrete is a looser material, it actually is less capable of holding in heat than traditional pavement. This helps to reduce, if not eliminate, the well-known "heat island" effect in areas where there is a great deal of pavement for roads, parking, and residential sidewalks. Because heat is more freely and continually released back into the air, nighttime temperatures decline more significantly and cooler homes are a direct result.

The reduction in warmth retention results in one immediate effect: Greater comfort when going outdoors during the summer. It's also worth noting, though, that a significant decrease in nighttime temperatures can also mean less use of air conditioning systems. This reduces utility bills and helps to shrink the size of a homeowner's carbon footprint. In an era of skyrocketing utility costs and carbon-sensitive Americans, this secondary effect is one that definitely deserves mentioning at the outset of a new construction or repaving project.

Built-In Filters Actually Help to Create Cleaner, Better Water from Runoff

On its own, runoff wouldn't necessarily be very devastating. In an ideal world, runoff would not encounter pollutants, dirt, or debris, and it would simply return to local lakes and streams without meriting much attention at all. There is no such thing as an ideal world, however, and there really is no such thing as "clean" storm runoff water. Indeed, most runoff is actually quite hazardous both to people and to plants. That's why pervious concrete's elimination of runoff is such a good thing.

Beyond merely eliminating runoff, though, porous pavement installations can actually help filter rainwater as it enters the ground. That's a stark difference from the polluted runoff typically associated with less porous pavement types and it makes for a significant environmental benefit. Studies have shown that water filtered through pervious concrete is up to two times cleaner and more pure than typical runoff.

When it comes to protecting homeowners and their families, as well as the natural environment near the home, pervious concrete deserves serious discussion and consideration. This built-in filtration is hard to find in any other construction material currently in use, and developers would do themselves and their clients a disservice not to consider it.

Those in Search of a LEED Certification Will Love Pervious Concrete

Finally, it bears mentioning that pervious concrete earns developers "LEED points" when it's used. For those not in the know, LEED stands for Leadership in Energy and Environmental Design. The industry group is chiefly responsible with awarding building projects distinction based on their environmental benefits, sustainable materials, and even energy independence factors.

LEED has identified three key areas where pervious concrete helps the sustainability of buildings where it is used. These areas are all over the map, but consist of the following:

- Solar reflectance
- Onsite water treatment
- Building innovation

These three components can help buildings jump to the next-best certification category offered by LEED, improving the building's marketability as well as its sustainability factors and environmental independence.

Maintenance is a Definite Source of Concern with Pervious Concrete

While there are numerous positive factors that result from a pervious concrete installation, there are some negative factors. Chief among them is the added expense that will need to be undertaken either by the construction company, the homeowner, or the business owner upon taking ownership of the pervious concrete installation. This added expense comes from the need for regular maintenance, specifically the cost of cleaning out the concrete's porous spaces.

As mentioned earlier, pervious concrete uses more rocks and less cement so that the mixture is looser and able to absorb water. As part of this process, sand is eliminated. The problem with pervious concrete arises from the presence of sand and dust after installation. Sand and dust will, over time, clog the holes that make the material so sustainable and porous. This will require an extensive regular cleaning routine.

Generally, cleaning pervious concrete means working with a contractor to use a large vacuum-like device to actually suck up all of the dust and sand that has settled into the material's gaps over time. This is definitely not a cheap process, so the costs should be discussed and accommodated before pervious concrete is used for any project. Furthermore, those requesting pervious concrete should be made aware that, without regular maintenance like this, their concrete will produce just as much runoff as a more traditional product would create.

Pervious Concrete is a Far Stiffer than Traditional Concrete

Another problem that arises from the installation of pervious concrete is its overall greater amount of stiffness as compared to traditional concrete products. This might seem like a good thing to those who aren't aware of how stiffness works in concrete, as it does almost sound like pervious concrete is more durable. That is just not the case, however. Pervious concrete's greater degree of stiffness and rigidity does not bode well for long freezes or areas where the climate typically shifts back and forth between sub-freezing and milder temperatures.

While all concrete and pavement is subject to cracks and malfunctions because of freezes and warm-ups, pervious concrete is actually much more sensitive to these occurrences. It is far more likely to crack when the weather is cold, and those cracks are likely to be deeper, longer, and more severe than the cracks in traditional pavement or traditional concrete areas.

Choosing pervious concrete requires a firm commitment to maintenance, as well as an understanding of the material's unique sensitivity to things like dirt and cold weather. While it is easily a great material for low traffic areas, many people may not want to use pervious concrete for major roads and highways or even longer home driveways that see a lot of regular use.

A Lack of Qualified Pervious Concrete Installers Could Be a Problem

It might come as a surprise to many, but there is actually a distinct lack of qualified pervious concrete installers and contractors who know how to handle the substance. Though it is very similar to traditional concrete, its differences are such that a lack of experience with more porous types of concrete can actually reduce its longer-term viability.

When pervious concrete is fully mixed and ready for use, it has a unique texture that is hard to manage, even by those who have been working with the material for quite some time. This slightly thicker, stiffer texture requires a great deal of training and hands-on experience, which only a handful of contractors in each region have completed at the present time. Furthermore, pervious concrete generally requires a quick and thorough application of polyurethane in order to enhance its durability and longevity even in low-traffic areas.

Without these essential skills, the material's benefits can be harder to recognize and more expensive to maintain over the course of its viable life. This lack of contractors is something that is improving, however, especially as construction moves firmly into the area of eco-friendly materials, green building, and LEED-certified structures that have real benefits for all ends of the equation.

Eco-Friendly Pervious Concrete is Improving by Leaps and Bounds

Though its use as a sustainable building material is relatively new, relatively speaking, pervious concrete has already made a big impact on many construction projects. It's a key part of virtually all LEED-certified construction projects in the United States, and it's increasingly being found in suburban sidewalks, home walkways, parking areas, and numerous other facilities like garages. Its growth looks only to continue in the future as developers focus on better material composition, higher-skilled workers who know how to work with pervious concrete, and long-term maintenance that keeps the product viable.

Those in the construction and engineering industry who are considering learning more about pervious concrete, or undergoing the training necessary to perform a capable installation, have virtually nothing to use. The material is more common by the day, more durable by the year, and it serves as a valuable way to market existing construction and contracting businesses as sensitive to the environment and mindful of sustainability.

Keep in mind that pervious concrete is not a one-size-fits-all solution, and be mindful that it should be installed only in friendly climates, low-traffic areas, and applications where regular maintenance will not be a problem. With a focus on these smaller details, pervious concrete really will be the future of sustainable construction.