Pervious Pavement—Fact or Fiction?

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Pervious cement manufactured by TecEco of Australia (image courtesy of John Harrison).

Pervious pavement is a relatively new low-impact development (LID) technique to mitigate runoff from urban surfaces and increase water quality and aquifer recharge. In addition to increasing water quality by allowing flow into and through the soil horizon, pervious pavement can result in significant capital cost savings because there is less need for retention ponds and other stormwater management structures. Pervious pavement has generally been used for walkways, parking lots, and other similar applications. However, a recent project in Shoreview, Minnesota, drew national attention for its application of pervious pavement to a three-quarter-mile residential roadway. This was the first large-scale application of pervious pavement in Minnesota.

Pervious pavement works with the natural system to manage stormwater as close to its source as possible, and allows treatment of stormwater runoff as a resource rather than as a waste product in need of handling and disposal. By using pervious pavement and other LID practices, surface water can be managed in a manner more consistent with the natural pattern of a given watershed, thus reducing excess erosion, water-quality degradation, capture of water that would otherwise recharge the underlying aquifer, and other factors exacerbated by large areas of impervious surfaces associated with most urban areas. Runoff volume is reduced by infiltrating rainfall into the subsurface, allowing water to evaporate after a storm, and creating beneficial uses for rainfall rather than transporting it away from the source via storm sewers. As an added benefit, porous pavement systems can be used as part of a strategy to obtain Leadership for Energy and Environmental Design (LEED®) certification for green building projects.

Pervious pavement is generally available in two formats: 1) turf and modular pavers, which are paving blocks with gaps that can be filled with gravel or planted with turf grass; and 2) pervious concrete and asphalt, which is structurally similar to traditional concrete and asphalt but is characterized by significantly more void space. Turf and modular pavers can consist of modular concrete or plastic units that provide structural stability while allowing gaps for turf grass or gravel fill. Common applications include driveways, right-of-ways, and overflow parking areas. They increase a site's load-bearing capacity to allow for foot and vehicular traffic, while still allowing significant infiltration. Generally turf and modular pavers are not appropriate for high-traffic or high-load areas or where snow removal is necessary. In addition, turf pavers should not be installed on top of low-permeability soils. Care must also be taken to mitigate fine sediment transport into the area covered by turf or modular pavers to prevent clogging. This can be accomplished by placing a vegetative strip around areas subject to drainage from offsite areas.

Pervious concrete and asphalt are similar in nature to their low- or no-permeability counterparts, with some important differences that allow stormwater to pass through. Pervious concrete contains little or no sand, and thus has substantial porosity. Porous aggregate is placed beneath the pavement, and a layer of filter fabric separates the aggregate from native soil. However, studies have shown the presence of voids in pervious concrete that decrease its structural stability and hence its compressive strength, resulting in a paved surface that cannot support heavy traffic loads. In addition, its tendency to clog means the surface should be vacuumed on a regular basis to remove fine-grained materials. In the past, pervious pavement sites have been characterized by relatively high failure rates relative to standard pavement. However, in many cases this has been attributed to poor design, substandard construction techniques, low-permeability underlying soils, heavy traffic, and poor maintenance.

Pervious asphalt is based on similar concepts and consists of standard asphalt from which the aggregate fines have been screened and reduced, thus allowing water to pass through. A high-porosity aggregate is placed beneath the porous asphalt, which in turn is separated from the native soil by geotextile filter fabric. Many of the same considerations with respect to care during construction, compressive strength, and potential for clogging apply to pervious asphalt as well.

In summary, pervious pavement provides means to integrate more natural rainfall infiltration and runoff attenuation patterns into the built environment. Instead of treating runoff as a waste product needing transport and disposal, pervious pavement methods allow native reuse of rainfall-derived runoff at or near its source for aquifer recharge, water-pollutant attenuation, and uptake by local flora.

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