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Pervious Concrete as a Flooring Material for Horse Handling Areas

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Bathing or rinsing a horse is a common practice for individuals who exercise, show, and sell horses. The wastewater generated from washing a horse may contain pathogens, bacteria, detergents, pesticides, urine, manure, and other suspended solids, which have the potential to pollute surface and ground waters. Typically, hard surfaces are slippery and difficult for horse hooves to gain traction, especially when horses are shod. The surface becomes even more slippery when water is added during bathing or when water is allowed to accumulate. The chemistry of most soap adds further reduction in traction and increases hazards for the handler and horse. Therefore, a horse bathing area must be constructed to protect ground and surface waters from contamination, while considering the safety of the horse and the handler.

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Locations chosen to wash horses include indoor/outdoor wash racks, stalls, hard-packed soil or grass areas, areas of packed rock, areas covered with rubber mats, and concrete and asphalt surfaces. Loose soil is not ideal because water can quickly generate a muddy, slippery mess. In addition, splashing of dirty water back on a clean horse is counterproductive. Washing horses on concrete or asphalt can be dangerous and could severely harm a horse if the animal slips and falls. Textured concrete provides better traction than wet mats, but requires a slope and drains to remove water.

Pervious concrete may be an alternative surface material for such horse facilities. Typical concrete contains approximately 5 to 8 percent air, 10 to 15 percent Portland cement, 35 to 50 percent stone or aggregate, 25 percent sand, and 15 to 20 percent water. Pervious concrete is a mixture of the same ingredients, except the sand is reduced or omitted and the amount of water is reduced. A mixed batch of pervious concrete creates an aggregate that barely wets the hand instead of the thick paste-like consistency of traditional concrete. The reduction or omission of sand and reduction in water produces a concrete pad that contains more voids, thereby allowing water to infiltrate. A properly installed concrete pad, using pervious concrete, is capable of allowing high volumes of water to permeate through the material. Depending on the aggregate used and the compacted density of the pad, the amount of infiltration of material through the pad can be varied.

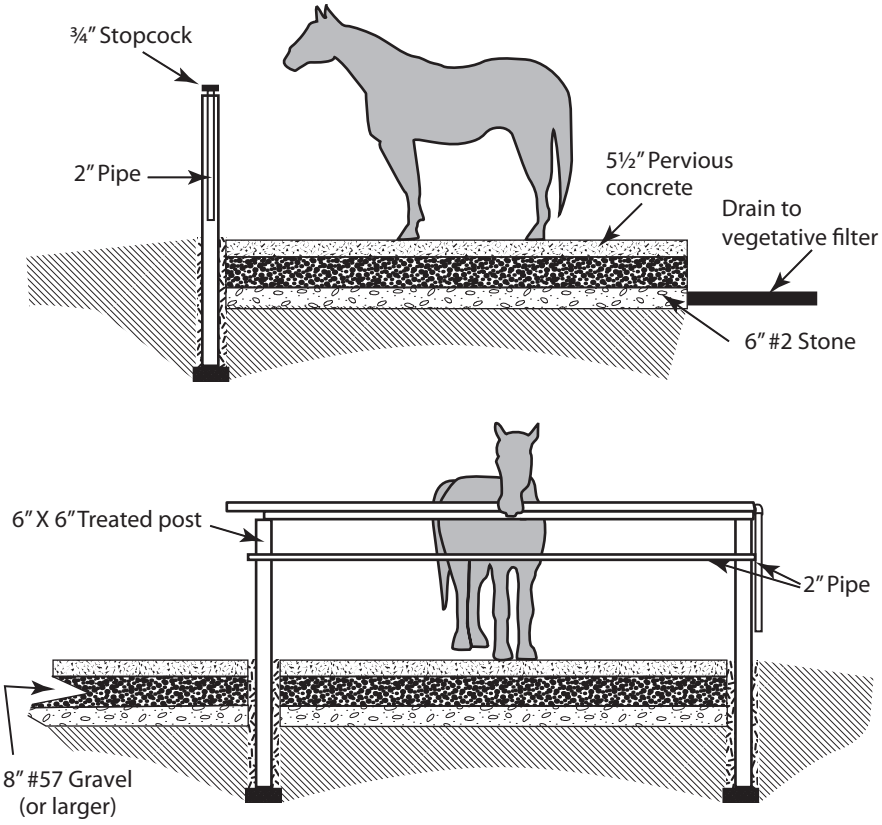
The area for a horse bath should be constructed with a substrate depth of approximately 1 foot, lined with geotextile fabric, and filled with large-size rock (e.g., No. 2 sized rock, fifty sevens, etc.). This provides a matrix capable of storing large amounts of water that slowly discharges. Typical concrete is placed in forms with a minimum of a 1 percent slope to provide a removal path for water. Pervious concrete can be installed with a mild slope or as a flat pad, because the slope is not needed to remove water. The surface nature of the pervious concrete provides more traction than most concrete finishes, even when wet. Pervious concrete requires more skill and knowledge to install than does typical concrete. The important criteria requiring more attention are the moisture content of the mix and the finishing and curing process. A high-quality concrete pad is produced by a combination of lowering the water content and compressing the concrete before it hardens. The concrete is placed much like regular concrete, but is compacted using a roller to add additional strength. For example, a pad is placed to a depth of 6.5 inches, but is consolidated to a final height of approximately 6 inches. When consulting with a contractor, it is important to communicate the purpose of the concrete pad, because they can alter the level of compaction. For instance, a pad used for vehicle traffic should be compacted much more that a pad used for foot traffic. A concrete pad used for bathing horses should not be excessively compacted,

because compaction reduces porosity. A surfactant such as biodegradable bean oil or vegetable oil is used during finishing, allowing the concrete to stay moist and cure properly. Plastic is then placed over the concrete to retain moisture and continue the hydration process for one to two weeks, depending on weather conditions. The concrete will continue to cure for approximately 28 days, before the hydration process slows down. Finishing the concrete with a float, trowel, or broom finish is not necessary. Reinforcement in the form of steel rods or mesh is not needed for this type of application. Adding steel reinforcement that has not been covered with an epoxy coating will shorten the useful existence of the concrete, because over time the weathered steel expands and will deteriorate the concrete. However, fiberglass fibers can be added to the mix and have been shown to increase strength while improving porosity.

Pervious concrete has many benefits as a flooring material for horse-handling areas. Pervious concrete provides infiltration of wash water and reduces the splashing of ponded or puddled water. Water quality may be improved, because pervious concrete provides a habitat, within the substrate matrix, for beneficial bacteria to thrive. These bacteria are capable of destroying harmful pathogens found in animal waste. Beneficial bacteria are able to survive by using the nutrients and carbon present in horse manure and urine. Soil and organic material have the potential to clog the pores in the concrete matrix. However, research has shown that some of the organic material will be decomposed by beneficial bacteria and be released as carbon dioxide gas. Keeping the concrete surface clean of any soil and manure deposited will reduce clogging of the pores. Regular pressure-washing will be needed to remove material clogging the pores. The substrate rock beneath the pervious concrete allows water to infiltrate and slowly discharge, compared to the immediate runoff of soap and dirty water from traditional wash pad areas. By removing puddled water, breeding areas for mosquitoes can be reduced. In addition, removing puddled water improves traction and reduces slippage.

Wash water infiltrating the pad and substrate can be discharged through a vegetative filter strip or other treatment system. Information on how to design a vegetative filter strip can be found in the USDA-NRCS-KY publication, *Wastewater Treatment Strips* (Code 635, May 2002). Make sure that the vegetative strip is designed to provide sheet flow on permanent vegetation outside of a floodplain. Current and future research at the University of Kentucky will examine the use of pervious concrete as a best management practice in horse facilities. Future research will focus on methods to prevent pervious concrete from becoming clogged with debris, evaluating microbial activity and resistance coefficients. Because pervious concrete allows water to infiltrate and has a thick substrate layer for water to percolate through, the chances of the material freezing and breaking are reduced. In addition, because the material allows heat transfer from the underlying soil, the material should not be snow-covered as long, compared to traditional impervious asphalt and concrete.

Persons interested in pervious concrete should contact the Kentucky Ready-Mix Concrete Association.



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