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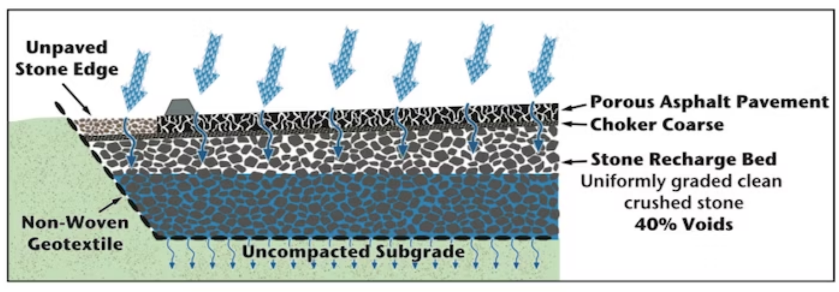
Managing Stormwater Runoff: The Power of Permeable Pavement


USGS permeable paving test plot installation

Among the various negative impacts of land development is stormwater runoff due to impervious paved surfaces. This runoff can lead to a host of problems including water pollution, flooding, stream bank erosion, decreased recharge of groundwater, and ponding on roadways.

One highly effective solution for managing runoff is **permeable pavement.** These systems allow stormwater to percolate through to an aggregate sublayer where it can infiltrate into the subsoil or discharge via an underdrain. Commonly used permeable pavements include porous asphalt, pervious concrete, and permeable interlocking concrete pavers (PICP). Porous asphalt and pervious concrete are similar to standard asphalt and concrete but with fine aggregates omitted from the mixture; PICP blocks are usually made from solid concrete. Starting from the bottom, a typical system consists of an uncompacted subgrade, a filter fabric that prevents migration of fine particles from the subgrade, a storage bed of clean, uniformly graded crushed stone, a ground-stabilizing choker course, and a porous surface layer.



Permeable pavement reduces stormwater runoff by allowing water to slowly release into the ground over a large area while filtering out pollutants and recharging groundwater. Roadways benefit from improved wet-weather traction and visibility, reduced noise, and reduced surface ponding. By cooling stormwater gradually, permeable pavement helps mitigate urban heat island effects and reduces temperature impacts on local waters. Because permeable pavement retains heat, it resists frost, promotes the melting of snow and ice, and reduces the need for deicing. Finally, the need for stormwater management systems like detention basins and retention ponds is reduced, which is particularly cost-effective in areas where land values are high.

There are a number of disadvantages, design limitations, and maintenance considerations that must be factored in when considering permeable pavement. Due to the potential for groundwater contamination, it should not be used in areas with high pollutant concentrations or where sediment loading is anticipated. Costs are estimated at about one-third higher than conventional impermeable systems, but this is largely offset by a reduced need for stormwater management infrastructure and winter maintenance.

Finelli Consulting Engineers, a Division of UTRS, can assist clients with all their permeable pavement design needs. For more information, contact us at 908-835-9500 or FCE@finellicon.com. New Jersey Stormwater Best Management Practices for Pervious Paving Systems can be found here.

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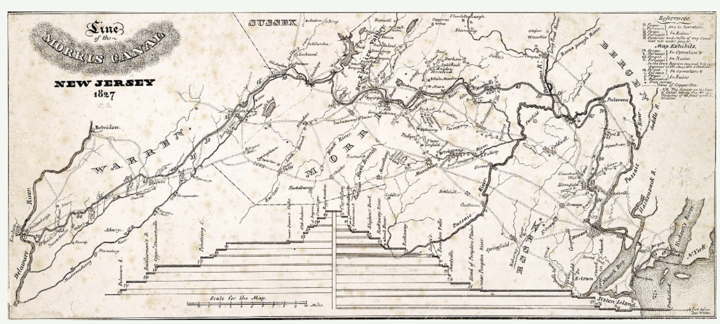
Marvels of Civil Engineering: The Inclined Planes of the Morris Canal

In the early 19th century, with a rapidly increasing need for an efficient transportation system that could carry coal from Pennsylvania to New Jersey's burgeoning industrial center near New York City, business visionaries of the time conceived the Morris Canal. Commissioned in 1824 and officially opened in 1832, this remarkable feat of engineering traversed 107 miles between the Delaware River in Phillipsburg to terminals in Newark and Jersey City.

Engineers charged with designing the Morris Canal quickly realized that a traditional system of lift locks would be too costly and impractical for the route's steep elevation changes and rocky terrain. To overcome vertical movement of 1,674 feet, or 18 feet per mile, they devised a system of 23 lift locks for small elevation changes and 23 hydraulic-powered inclined planes where changes exceeded 20 feet. The Morris Canal's inclined planes were the first and most notable of their kind to be used in the United States.

An inclined plane is a system of tracks set into a slope and submerged at both ends. Vessels were secured to wheeled cradles and hauled up the tracks to the canal's next level using a system of pulleys and counterweights. The Morris Canal inclined plane systems were powered by iron overshot waterwheels, which were later replaced by powerful turbines to increase weight capacity after the canal was enlarged to accommodate larger vessels.

The Morris Canal's usefulness began waning in the late 1800s when railroads emerged as a faster and more efficient mode of transportation that could deliver in five hours cargo that took four days by canal boat. Shortly after the State of New Jersey took over the canal In 1924, the decision was made to drain the canal and close it for good. Remnants of the canal, which once flowed less than a mile from FCE's Washington, NJ, headquarters, can still be found, and preservation efforts are currently underway in the form of the Morris Canal Greenway, which seeks to preserve the surviving sections of the canal and offer recreational opportunities to the public.



***Top photo**: Inclined Plane 7 West in Bowerstown, Washington Township. The site is now a section of Plane Hill Road. (U.S. Library of Congress). **Center**: Inclined Plane 12 East in Newark, now Raymond Blvd. adjacent to the Rutgers University campus. **Bottom**: 1827 map of the Morris Canal (New York Public Library).*