Willow Creek™
Permeable Pavers

Permeable Concrete Pavers – Questions & Answers

Question: What is the load capacity of these systems?

Answer: The same methodology for flexible pavement per AASHTO designs – the structural coefficient for asphalt and concrete pavers are the same. Port applications with 80,000 lb/axle loading (e.g. Port of Oakland) are in use.

Question: How much underlayment is required to support the pavers and is this system applicable for a street that probably has utilities and vaults located in its substrate?

Answer: Design for detention is usually performed first, then compared with structural design and evaluated for long-term performance taking into consideration soils and design life factors. In one scenario, the detention requirements in the City of Chicago required a design to accommodate a 100 year storm, but a 24" sub-base would meet a 24-hour, 100 year storm. A factor that the city was interested in is that the pavers could be removed and replaced in the event access is required for these utilities and vaults.

Question: How much stormwater can these systems absorb?

Answer: The coefficient of runoff for permeable pavements at dead flat has been proven to be .15, where asphalt is .98 using the rational method. Recommendation is a minimum 1% grade and then the c value becomes .25. The design value should be at .40 to allow for 50% clogging in the first five years. After that time period, the bacteria system is on a 100% breakdown of first-flush pollutants, which takes 5 years to complete. At this point, the system will continue to absorb a minimum 2.5" storm event. The void ratio in the sub-base aggregate is 40%. There is still another 9" of system (paver depth, setting bed and base depth) left to store runoff from rainstorms; however, it is not part of the design… There is a degree of error designed onto this system.

Question: Are there any streets where this type of pavement has been used?

Answer: Yes. There is a permeable paver street in Havre de Grace, MD, Westmoreland Street in Portland, OR and also a town home project that has been a case study in Connecticut called Jordan's Cove. Unit pavers have been used in streets in America for over 100 years, but the material was clay. Concrete pavers have been in place for approximately 35 years in the U.S. The use of permeable pavers in England, Germany, Australia and Japan is well documented for the past 20 years. There are successful permeable unit paver applications in the U.S.; however, these are primarily parking lot applications. The Howland Hook terminal at the Port of New York/New Jersey has permeable pavers being utilized in a container yard.

Question: What about handicapped accessibility – how does this system address those city needs?

Answer: Unit pavers are acceptable for handicapped movement as proven by the University of Pittsburgh study. The use of permeable pavers, assuming the openings do not exceed 13mm, will not conflict with ADA standards. There are also pavers that have truncated domes that could be used at curb/ramp areas.

Question: Is this system applicable to a street or would you recommend it for a city sidewalk or merely parking areas?

Answer: Any area that requires a pavement surface could be designed with permeable pavers. The issue is to understand the needs of the client, site and users of the pavement. Sites that are stormwater hotspots and have high exposure to toxic materials (e.g. scrap yards, fuel stations, etc.) would not be a good application for a permeable pavement system. Areas that pose concern regarding the possible migration of pollutants into the groundwater could use an impermeable membrane to contain these fluids and be sent to a secondary system for treatment. These membrane systems could also be utilized for capture of grey water and then used for irrigation purposes.

Question: Could this system be designed to absorb first flush detention while sending the overflow to the storm system?

Answer: Yes. One of the functions of this system is as a post-structural BMP to trap and process first flush pollutants, naturally.

Question: How much do these systems cost? By percentage, how much higher is this method than a typical urban street cross section?

Answer: The cost for a permeable unit paver system is site specific and would need to be compared with an urban street cross section that performs all the functions that a permeable system provides. In the Midwest, street applications with curb, base aggregates, paving and stormwater costs are typically budgeted at $225-$300/lf for a 30' wide street. It is possible to furnish and install a Bio-Aquifer Storm System (BASS) product with the same capitalization pricing. Parking lots and other applications could see this comparison at a 10%-20% higher capitalization for a permeable pavement system, but the real competitive asset for BASS is in the durability and maintenance costs. Lifecycle costs need to be considered when selecting a stormwater management system, as the owner will realize a savings within a 30-year period, as illustrated at the Morton Arboretum project where a 22-year breakeven cost has been forecast.

Question: What kind of maintenance is required for this type of system?

Answer: Typically, normal BMP practices for parking lot and roadways would be used where street sweepers are employed to remove loose debris and silt build-up. Winter maintenance is actually reduced, due to the excess amount of air in the void area of the aggregates; this space acts as an insulation barrier. Permeable pavement surfaces freeze at lower temperatures than asphalt and other impervious surfaces. Will not trap water and slush on the surface during a 24- hour freeze-thaw cycle. They will not require additional salting or plowing.

Question: For vacuuming an area when re-instatement is required, how long would this maintenance take and how long would a street be blocked off?

Answer: The sweeping process would be the same as the city now uses and there would be no need to close the street. The remedial issue could be addressed with removal of aggregates from the clogged voids. Again, visual inspection would determine when and if remedial action is needed to increase percolation in the paver openings. For safety reasons, it would be recommended the area be blocked off to perform any remedial work- the time required to remove and replace aggregates would be minimal, as the equipment used can cover large areas in a short period of time.

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