When Are Plain Gravel Surfaces Really Porous?

Invisible Structures, Inc. makes reinforcement structures for two forms of porous pavements – Grasspave2 and Gravelpave2. When project demands call for porous pavement, and construction budgets are tight, someone will usually suggest that plain old gravel will work just as well, and cost less money. Is this suggestion true?

Historical Gravel Pavements are not Porous

Traditional methods and materials used to construct gravel roads, drives, and parking surfaces are designed to shed water – not to allow water to quickly penetrate and pass through the cross-section. This is accomplished by sloping or crowning the surface for rapid surface runoff, and using a gravel mixture that includes a wide range of particle sizes, including "fines" (materials that pass a #200 screen, or <.075 mm) that compose up to 20% of the mixture. The fines are effective at maximizing compaction of the gravel mixture, but at the expense of porosity.

In the presence of rainfall, the surface layer can absorb water, soften the fines, and allow the larger stone materials to begin to migrate. This can be visualized as washboard or rutted surfaces. Dry surface conditions can generate significant amounts of dust thrown into the air by passing tires – actually lifting fines out of the surface.

In the presence of subsurface moisture, capillary (upward) water movement can easily occur in the cross-section, creating soft spots that can lead to potholes, or soft sections of pavement where dramatic expansion or settlement can be exhibited. This capillary movement problem is further complicated in the presence of freezing weather, where ice lenses can be created, which dramatically alter surface gradients and travel comfort.

These historical gravel pavements evolved into base courses for asphalt and concrete paved streets and highways. Little thought was given to benefits of a porous base course – only focusing upon adding a surface (wearing course) that could handle greater amounts of traffic and not be as sensitive to rainfall and other weather conditions.

Porous Pavement Components

Sub Base – Ideally, all pavements should be constructed over porous sub soils that can be compacted without loss of porosity and assist with load bearing support. This is impossible given the vast expanses of clay, silt, organic and wet soil conditions that exist around the world. These less than perfect soil conditions are the primary reason for the existence of geotextile fabrics, geogrids, geocells, and other forms of isolation, containment and reinforcement for pavement materials.

Base Course – Porous base courses are composed of mixed stone (.25 to 1.0 inches, 6 to 25 mm) and sand (.0004" to .25", 0.1 to 4.0 mm), and NO FINES! The sand component is usually about 33% of the mixture, and will fill the voids between the larger stone elements to create load bearing stability of the mixture. When compacted, this mixture will retain a void content (air space) of approximately 35%. This void space can be filled by water (rainfall) and used for temporary stormwater storage. Example: an 8" (20 cm) deep porous pavement section x 35% = 2.8" (7.1 cm) of rainfall storage over the pavement area.

Wearing Course – For a pavement to be porous, the top surface, known as the wearing course, must also be porous and allow water to pass through. We use both grass and fine gravel (.001” to .31”,