How Do EMC SQUARED® System Stabilizer Products Work?

First, a comment about soil materials from an agronomist for perspective — "We will discover the nature of the universe before we discover the nature of soil materials." Consider also the National Cooperative Soil Survey lists over 20,000 distinct soil types identified as within the United States alone, with tremendous variation in texture, composition, mineralogy, and organic content. We do not pretend to have a simple answer as to exactly how the complex waterborne EMC SQUARED Stabilizer formulations react with all the different soil materials, given such widely varying chemistry in the materials that are being treated. What we do know is that based upon a combination of interactions, the EMC SQUARED System treatments have been very effective in strengthening and reducing moisture susceptibility of a wide variety of earth materials in a stabilization process driven by application of compaction energy.

Touching first on the issue of permanence, we know the EMC SQUARED Stabilizer products are themselves eventually immobilized within the soil matrix. As the stabilizer formulation stabilizes the soil material, the soil material stabilizes the stabilizer product. This stability within the treated material explains the durability of stabilization applications that have been effective for over twenty years in service without the benefits of protective pavement surfacing.

The relationship of water within the soil matrix, and fluctuations in soil moisture content are the most fundamental factors affecting the strength and stability of soil materials. Water, the Universal Solvent, is a very stable molecule with great influence on soil structure. During the construction processes that prepare a native soil for use in a constructed road subgrade or a constructed earthwork structure, the standard mixing and wetting procedures provides the opportunity to trigger the compaction water with the sophisticated water activation chemistry of the EMC SQUARED Stabilizer. The product improves the ability of water to react with a wider variety of materials within the soil matrix than would be possible in its naturally stable polar molecular state. During the mixing process, when the former bonding relationships within the soil have been disrupted, new bonding relationships can be formed and more tightly aligned as the treated soil is compressed and highly consolidated during the compaction process under strict moisture tolerances as determined by the ASTM D 1557 Moisture-Density Relations testing that govern the construction process. Taking into account that the diluted stabilizer solution is more than 99 percent water, it becomes easier to understand that the stabilizer solution has fundamentally put the water to work creating strengthened bonding relationships. We know that in nature, sand can become sandstone, clay can become claystone, shale can become shalestone, and gravel deposits can become conglomerates. Clearly, there is no need to add Portland Cement, Lime, or asphaltic binders as most soil materials have the intrinsic capability to be reconfigured into highly stable rock materials in the presence of appropriate water chemistry and consolidating pressures. So we are essentially directing water chemistry to react and generate more bonding relationships during a carefully controlled mixing and compaction process. Understanding that we are improving soils, virgin aggregates and recycled aggregate materials by assisting the capability of water to activate more bonding relationships than it would otherwise be capable of facilitating, it becomes easier to see how the EMC SQUARED Stabilizer products strengthen such a wide variety of soil types and aggregate materials.

What can be observed during the soil mixing stage of the construction process is that the EMC SQUARED Stabilizer solution counteracts the hydrophobic (water repelling) behavior of soil surface tension phenomenon and speeds the deeper wetting of the soil while at the same time imparting a pronounced cohesive force to the aggregate or soil material being treated. With these additional cohesive forces at work once the EMC SQUARED Stabilizer treatment has been applied, the soil becomes effectively heavier to move as the motor grader or bulldozer moving the treated soil will

Stabilization Products LLC
Ph: (209) 383-3296 or (800) 523-9992 Fax: (209) 383-7849
E-mail: info@stabilizationproducts.net Website: http://www.stabilizationproducts.net
Canadian Sales: Milieu Road Technologies (780) 875-9159

How Do EMC SQUARED® System Stabilizer Products Work?

typically need to downshift to a lower gearing in order to push the same volume of soil it could move previous to application of the stabilizer treatment. This would be similar to a bulldozer pushing a two ton pile of sand, and then moving over to push a two ton pile of moist expansive clay soil. The cohesive "heavy" clay soil will offer much greater resistance than the granular sandy material. Interestingly, an application of the EMC SQUARED Stabilizer solution will immediately increase the cohesion of the cohesive clay, which is the exact opposite of the lime stabilization reaction that reduces the cohesive forces within a clay soil during the treatment process.

The performance of the EMC SQUARED Stabilizer products is predicated on attaining 95% or better of ASTM D 1557 Modified Proctor compaction, the highest standard of modern mechanical compaction. The less pore and void space remaining in an aggregate or soil material following compaction, the stronger it will be and the less susceptible to moisture infiltration and fluctuations in moisture content.

Water activation chemistry that allows water to more rapidly penetrate and deeply wet soil during the mixing and moisture adjustment process, while also adding an additional cohesive force that is holding the treated material into a more highly bonded mixture is obviously going to speed operations and reduce the amount of water and energy required to achieve a specific percent compaction target. The presence of the EMC SQUARED Stabilizer product in the compaction water will also improve the ability of the contractor to mechanically compact the soil to the highest possible density, which is the most basic route to improving the stability of a soil. As the density of a soil increases, its strength increases. Also, as its density increases, both its compressibility and permeability decrease. As porosity and void ratio decrease, the engineering properties of a given soil become more dependable. The EMC SQUARED Stabilizer formulations assist the penetration of the stabilizer solution deeper into the pore and void structure of aggregate or soil material, and into the micropore structure where the stabilizer components interlock within the structure. This increases the internal bonding and strength of the compacted material while reducing moisture affinity and moisture susceptibility. The EMC SQUARED System products produce flexible or elastic layers rather than the crack-prone rigid layers that result from the use of cement and lime products, providing an alternative to the reflective cracking typical of asphalt pavements constructed above base course and subgrade layers treated with cement and lime.

When reviewing materials engineering studies where aggregate and soil materials have been strengthened by a factor of four to ten times in Resilient Modulus, Dynamic Modulus, and other laboratory test measures, in addition to case studies where stabilized soil and aggregate materials provide effective water shedding surfaces for years at a time, it is obvious that the EMC SQUARED Stabilizer treatments are delivering far more substantial benefits than just improved wetting, increased cohesion and improved compaction results during the construction phase. Revisiting the subject addressed earlier, the fact that more than 20,000 different soil types are found in the United States alone, and the similarly varied composition of aggregate materials, there will be a unique combination of bonding relationships generated in each particular material as the result of an EMC SQUARED System treatment. Among the list of stabilizing relationships will be adsorption, micro-encapsulation, cross-linking, co-polymerization, entrapment, ion exchange and covalent attachment. With clay soils in particular, some of the stability benefits of an EMC SQUARED System treatment relate to the ability to mobilize the additional cohesive forces of the stabilizer solution that embed within the clay lattice structure, pulling the lattice structure into a tighter configuration.

Stabilization Products LLC
Ph: (209) 383-3296 or (800) 523-9992 Fax: (209) 383-7849
E-mail: info@stabilizationproducts.net Website: http://www.stabilizationproducts.net
Canadian Sales: Milieu Road Technologies (780) 875-9159

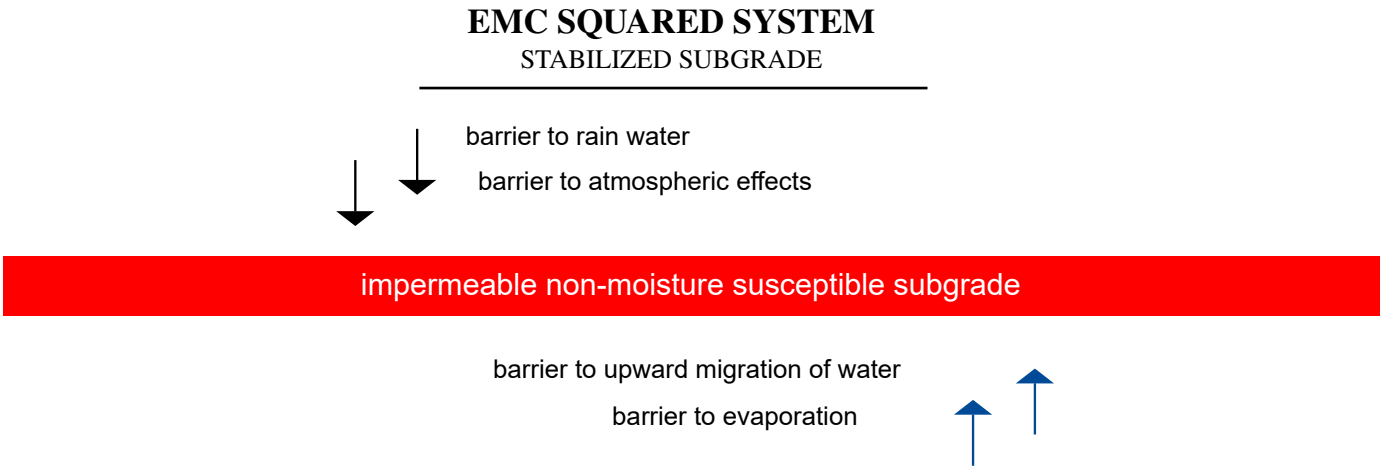
How Do EMC SQUARED® System Stabilizer Products Work?

The Multiplier Effect of EMC SQUARED System Treatments

EMC SQUARED System treatments have been shown to lower the permeability, soil suction, and moisture susceptibility of a treated soil subgrade below that of the native soils under the treated layer. The result is that the subgrade soils and base courses treated with an EMC SQUARED System stabilizer application will shed water off their surface and not soak up water from the native soils below.

Matching the Stabilizer Treatment with the Task

For over thirty years the EMC SQUARED System products have proven to be broad spectrum and versatile in application. The challenge for the project engineer will be to evaluate whether the degree of improvement that can be achieved by treating a particular aggregate or soil material will provide a constructed product that will meet performance requirements. While past performance history with similar aggregate or soil materials is of valuable reference, and index tests in a soil materials testing laboratory may be helpful in predicting performance of a treated material for a specific field requirement, the most reliable method of evaluation will include construction of field test pads or road test sections. It is these test areas that will fully demonstrate the construction equipment and procedures best suited for use in combination with the stabilizer product application, and which then can be subjected to the loading and environmental conditions that will prevail in the full scale project.



Unlike lime treatment, which increases permeability and moisture flow through the treated soil layer as a natural consequence of the flocculation process generated by the addition of lime, EMC SQUARED System treatments typically reduce moisture flow and moisture susceptibility, which promotes moisture barrier benefits. A stabilized moisture barrier layer not only retains its flexural stiffness, but also promotes the stability of the soils below as the moisture barrier cuts off the wetting and evaporative effects that otherwise drive the volume change (shrinkage and swelling) below the treated subgrade that results in the differential settlement, roughness, and cracking of the pavements above. Enhancing the stability of the native soils below the stabilized subgrade is the *multiplier effect* (EMC^2) of the EMC SQUARED System treatment.

Stabilization Products LLC
Ph: (209) 383-3296 or (800) 523-9992 Fax: (209) 383-7849
E-mail: info@stabilizationproducts.net Website: http://www.stabilizationproducts.net
Canadian Sales: Milieu Road Technologies (780) 875-9159