# Layer Equivalency Between EMC SQUARED® System Stabilized Aggregate Materials and Hot Mix Asphalt

## And how many inches of typical aggregate base rock are required to provide the same layer equivalency as one inch thick layer of EMC SQUARED System stabilized aggregate?



**EMC SQUARED System stabilization treatments can provide bound aggregate layers that most closely resemble hot mix asphalt pavement** when matched with aggregate base course and recycled pavement aggregate materials that have suitable gradation and adequate natural binder contents. Like asphalt pavement, these stabilized layers have some degree of elasticity and flexibility. While asphalt emulsion treatments also provide bound aggregate layers that are flexible, they typically do not attain the high density, strength and toughness as do bound layers treated with EMC SQUARED System products. In contrast to these flexible pavement and flexible base course treatments, aggregate base course materials treated with cement (cement treated base, or CTB) are more rigid or brittle in nature, and characterized by shrinkage cracking.

While aggregate materials treated with EMC SQUARED System products have been utilized as bound base course layers under pavement surfaces for projects ranging from industrial site access roads to city streets, county roads and interstate freeways, where EMC SQUARED System products really stand head and shoulders above asphalt emulsion and cement treatments is in the stabilization of aggregate materials for road running surface applications. This is where the unique combination of strength, flexibility and moisture resistance offered by EMC SQUARED System treatments demonstrate a level of performance that neither asphalt treated base nor cement treated base materials can duplicate. EMC SQUARED System treatments have, to date, provided stabilized aggregate running surfaces that have endured as many as twenty years of vehicular and truck traffic. Aggregate layers constructed with asphalt emulsion and cement treatments, on the other hand, must be promptly covered with pavement materials or bituminous surface treatments as they are not adequately bound to resist the effects of weather and the direct impact of car and truck tires.

Because EMC SQUARED System products are a small fraction of the cost of asphalt and cement products, comparative performance in materials testing makes them an impressive value for road construction projects. The laboratory tests on the following pages confirm that a variety of materials, including asphalt millings, recycled pavement aggregates and virgin aggregate base course materials, have been improved by EMC SQUARED System treatments to the degree that they have layer equivalency with conventional hot mix asphalt pavement materials. This means that a one inch thick layer of stabilized material has equivalent load bearing capability to a one-inch layer of hot mix asphalt. This does not imply that the stabilized material would be a direct substitute for an asphalt pavement running surface, but it does indicate that it would be equivalent to hot mix asphalt pavement when used as a base course layer in place of asphalt. As one of the possible practical applications of this knowledge, a pavement engineer could reduce costs on a road construction project designed for six inches of hot mix asphalt by substituting four inches of a stabilized base course material and using only two inches of the more costly hot mix asphalt pavement as the running surface. Hot mix asphalt pavement mixtures are formulated with high quality pavement grade aggregate materials that are crushed and screened to meet strict gradation specifications for use in combination with heated asphalt binder products. The plant mixing of the heated aggregate and asphalt binder are conducted according to strict quality control standards, as is the paving machine mix placement process. Given the same level of attention to the selection and manufacture of paving grade aggregate materials, to a plant mixing process and to paving machine placement, indications are that EMC SQUARED System cold-mix pavement products would be functional alternatives to hot mix asphalt for pavement running surface applications.

From years of monitoring and documented case histories, the field evidence has long pointed to the fact that aggregate layers constructed with EMC SQUARED System products have functioned as smooth running, all weather road surfaces most closely resembling asphalt pavement in their load bearing capability. This field experience has strong correlation with the results of studies conducted by independent pavement material testing laboratories. Following are comparative test results from three types of laboratory materials tests that have been used to evaluate the performance of hot mix asphalt materials, stabilized aggregate materials and untreated aggregate materials. These tests each evaluate different aspects related to the performance of a particular material as a load bearing layer. The three test methods are Resilient Modulus, Marshall Stability, and Suction and Dielectric (Tube Section) Testing. A summary is provided on page 8, addressing the test results and their implications for cost savings and more sustainable construction practice.

**Stabilization Products LLC**
Ph: (209) 383-3296 or (800) 523-9992
E-mail: info@stabilizationproducts.net
Website: http://www.stabilizationproducts.net

Canadian Sales
Milieu Road Technologies
(780) 875-9159

Resilient Modulus testing is the method standardized by the U.S. Department of Transportation's Federal Highway Administration (FHWA) for the evaluation of pavement materials performance and recognized both nationally and internationally. In the interest of replicating the dynamic loading conditions that pavement layers experience under constant automobile and truck traffic, Resilient Modulus testing evaluates the performance of pavement materials by applying repetitive loading. Resilient Modulus testing evaluates the elasticity of the pavement material or base course and its ability to be resilient and return to its original shape and size without any permanent deformation, or damage, after repetitive loading cycles are applied. The comparative resiliency of a pavement material or base course allows pavement design engineers to determine the load bearing capacity of a certain layer thickness of a specific pavement or base course material and to evaluate layer equivalency. Following below is a report by a pavement materials engineer reviewing the Resilient Modulus testing conducted by the University of Nevada Reno (UNR) materials testing laboratory and summary comments regarding the Layer Equivalency Factor associated with these test results.

psi Information To Build On

January 16, 2004
Project No.: 282-40001

Mr. Bob Randolph
Soil Stabilization Products Company, Inc.
P.O. Box 2779
Merced, CA 95344-0079

Subject: Review of Resilient Modulus Testing On Aggregate Base Materials
Stabilized with EMC Squared Stabilizer
Las Vegas Springs Preserve
Las Vegas Valley Water District
Contract No. 1024

As per your request, PSI has reviewed diametral resilient modulus results performed by the University of Nevada Reno (UNR), on Type II aggregate base material sampled at the Las Vegas Springs Preserve project and treated with EMC SQUARED® (1000) stabilizer supplied by Soil Stabilization Products Company.

The EMC SQUARED stabilized Type II aggregate base was installed as an aggregate base coarse for several miles of paved access road. The surface of the access road was constructed using a flexible Resin Pavement supplied by Soil Stabilization Products Company. The Type II aggregate base material was produced by Southern Nevada Paving at their West Charleston Pit.

Prior to sampling and testing, Dan Ridolfi of PSI had an opportunity to visit the Las Vegas Springs Preserve during construction of the Type II aggregate base and flexible resin pavement surface, and retum after completion of access road construction to observe the finished products.

Samples used to evaluate resilient modulus were obtained and fabricated for testing by Kleinfelder, Inc. To prepare the samples for testing, water was added to each sample so the moisture content of each sample was at optimum moisture content for the treated material, as determined by ASTM D1557, prior to compaction. EMC SQUARED Stabilizer was added to the water used to adjust the sample moisture content such that 9.35 ml of EMC SQUARED Stabilizer per cubic of foot of treated aggregate was added to the mixture. The treated material was then compacted using the methods specified in ASTM D 1557.

Two, six inch diameter samples were fabricated as described above for resilient modulus testing at the (UNR). Two additional six inch diameter samples were fabricated as described above without EMC SQUARED Stabilizer. UNR performed diametral resilient modulus dry at 77° F on each of the four samples. The results of the resilient modulus tests are presented in the following table.

**Table 1. Resilient Modulus results reported by UNR**

| Sample ID | Average Resilient Modulus psi (ksi) |
|---|---|
| SNP Type II AB With EMC$^{2™}$ | 272,500 psi (272.5 ksi) |
| SNP Type II AB | 51,000 psi (51 ksi) |

The diametral resilient modulus was chosen because a relatively high resilient modulus value was anticipated. The diametral resilient modulus measurement technique versus a triaxial type measurement (that is typical of unbound material) is more conservative due to the lack of confining pressure. We would expect a higher resilient modulus value had a triaxial type measurement been selected.

Based on the resilient modulus information provided, the resilient modulus measurements were then converted to AASHTO pavement section design layer equivalency factors used for pavement structural design. The conversion was made from conversion charts published by Van Til et al. for NCHRP 128.

**Table 2. Resilient Modulus Results and Layer Equivalency Factors**

| Sample ID | Average Resilient Modulus psi (ksi) | Layer Equivalency Factor |
|---|---|---|
| SNP Type II AB With EMC$^2$ | 272,500 psi (272.5 ksi) | 0.35 |
| SNP Type II AB | 51,000 psi (51 ksi) | 0.10 |

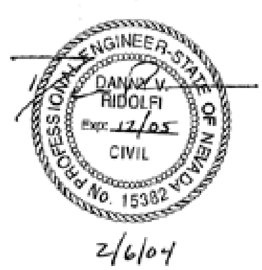
Using the current AASHTO design guide for pavement sections (Dated 1985) typical dense graded hot mix asphalt would be assigned a layer coefficient ranging from 0.35 - 0.45. The standard of practice in Southern Nevada is to assign a layer coefficient of 0.35 for dense graded hot mix asphalt. In Southern Nevada dense graded high quality aggregate base is typically assigned a layer coefficient of 0.12. A pavement's structural capacity is calculated by summing the product of the layer thickness by the layer equivalency factor for each layer and then adjusting that product for the base and sub grade layers to account for potential drainage issues, With all things being equal and a choice of two different aggregate bases with the structural layer coefficient of the second twice that of the first, a pavement section constructed with the second aggregate base would theoretically require one half the aggregate base thickness.

Based on the calculated layer equivalency factors and industry standards, the EMC SQUARED stabilized aggregate base appears to provide significantly greater load carrying capacity than untreated Type II aggregate base, and a load carrying capacity approximately equivalent to that of typical Southern Nevada dense graded hot mix asphalt.

We trust the information provided satisfies your requirements. Should you have any questions or require further information, please feel free to contact the undersigned at (702) 873-1775.

Respectfully submitted,

PROFESSIONAL SERVICE INDUSTRIES




Dan V. Ridolfi, P .E.
Materials Engineer

Concrete, with its slab-like behavior and requirement for expansion joints, is classified and tested as a "rigid pavement" material. Hot mix asphalt pavement, with more elastic behavior and joint-free construction, is classified and tested as a "flexible pavement" material. The Marshall Stability Test Method (ASTM D 1559) has long been a standard procedure used by materials testing laboratories for evaluation of hot mix asphalt pavement mixtures and other types of flexible pavement materials. The stability of a pavement mixture is tested after the pavement specimen is heated to 140° Fahrenheit temperature, which is representative of hot weather service conditions. Stability is the maximum load resistance that a pavement mix test specimen will develop under compression. Stability translates into the resistance of a paving mixture to distortion, to displacement, to shearing stresses, to rutting and to shoving. Stability is dependent upon both internal friction and cohesion. Internal friction is primarily a combination of the frictional and interlocking resistance of the aggregate in the mix. Cohesion is primarily a measure of the adhesive quality and binding force of the binder material and the efficiency of the specific application rate of the binder in relationship to the specific aggregate material.

Provided at the top of the next page are the Marshall Design Criteria provided by the Asphalt Institute for different traffic classifications starting at 750 pounds for light traffic, 1200 pounds for Medium Traffic and 1800 pounds for Heavy Traffic. A higher stability measure indicates greater bonding strength and resistance to rutting. As part of the Marshall Stability test, a "flow" measurement is also taken to evaluate the relative flexibility of different pavement mixtures, with the higher Flow measurements indicating more flexibility. Hot mix asphalt mixtures typically range from 2,000 to 6,000 pound stability values when subjected to Marshall Stability testing, depending upon the quality of the aggregate and whether polymer modifying agents are added to the mix. Marshall Stability is also a good index test to evaluate the comparative performance of stabilized aggregate materials and stabilized recycled pavement materials.

## STABILIZED RECYCLED ASPHALT MILLINGS

Pictured at right are test reports for a comparative stability testing study reviewing the effectiveness of EMC SQUARED® Stabilizer (1000) treatment in comparison to an asphalt emulsion treatment of a recycled asphalt pavement material. Asphalt millings treated with the EMC SQUARED Stabilizer have provided serviceable city street running surfaces over miles of hilly terrain for five years without requirement for maintenance, prior to being overlayed with hot mix asphalt pavement. Given this track record, the fact that the stabilized asphalt millings met the minimum Heavy Traffic performance specifications of the Asphalt Institute is no surprise. In this comparative testing series, the millings treated with the asphalt emulsion product achieved only half the strength of the EMC SQUARED System treatment (906 pounds versus 1,863 pounds).

## STABILIZED AGGREGATE BASE COURSE

As with the variable stabilities of different hot mix asphalt mixtures, the overall quality and gradation of the aggregate material has major impact on the Stability and Flow values of a stabilized aggregate material. The next set of test results summarized, are for stabilized aggregate base course materials, produced from natural rock deposits and free of any recycled pavement content. These aggregate materials were more well-graded than the treated asphalt millings that were described in the test reports above, and they produced far higher stability values (8,740 pounds to 11,920 pounds). Comparing these stability values to conventional hot mix asphalt test results, layer equivalency is once again apparent. These stabilized aggregate mixtures are well-bound and flexible, similar to high quality hot mix asphalt mixtures. Given this similarity in layer equivalency and flexural characteristics, they are outstanding match ups as highly bound base courses for flexible pavements.

## STABILIZED RECYCLED PAVEMENT MATERIALS

Well graded recycled pavement aggregate materials formulated with a blend of asphalt millings and crushed concrete aggregate typically provide the highest stability values of the various types of aggregate materials stabilized with EMC SQUARED System treatments. As shown in the test results at bottom right, these stabilized recycled materials have similar flexibility to hot mix asphalt pavement materials, and roughly double the Stability. Field installations of stabilized recycled pavement aggregates have provided years of performance as road running surfaces under heavy traffic without requirement for maintenance. These high Stability test results reported at right correlate well with this impressive level of field performance.

# ASPHALT INSTITUTE MARSHALL DESIGN CRITERIA

| Marshall Method Criteria | Light Traffic Surface & Base | | Medium Traffic Surface & Base | | Heavy Traffic Surface & Base | |
|---|---|---|---|---|---|---|
| | Minimum | Maximum | Minimum | Maximum | Minimum | Maximum |
| **Stability** (lbs) | **750** | | **1200** | | **1800** | |
| **Flow** (0.25mm) | **8** | **18** | **8** | **16** | **8** | **14** |

1992

**KLEINFELDER**

*A Consulting engineering firm providing Environmental, Geotechnical, Materials Testing and Construction Management services since 1961.*

**PROJECT NO:** 16653 **PROJECT NAME:** **Soil Stabilization Products Co., Inc.**

**To:** **Soil Stabilization Products Co., Inc.**

**Date:** **April 7, 2008**

**Specimen #:** ***10023A, 10023B, 10023C***

**Kleinfelder, Inc.**
*1410 F Street*
*Fresno, CA 93706*
ph: (559) 486-0750
fax: (559) 442-5081

**Description:**

**Technician:** Kyle Kubik / Jason Ruiz

**Aggregate Source:** Asphalt Millings
Mojave County, AZ

**Lab Coordinator:** Paul Geitner

**Pavement Type:** EMC SQUARED® Stabilizer (1000)

| Marshall Flow and Stability (ASTM D-1559 / AASHTO T-245) | | | |
|---|---|---|---|
| **Specimen Number** | 10023A | 10023B | 10023C |
| Thickness | 2.1900 | 2.0300 | 2.1900 |
| Correction Factor | 1.25 | 1.47 | 1.25 |
| Dial Reading | 177 | 136 | 134 |
| Measured Stability | 1677 | 1293 | 1274 |
| Flow | 10 | 8 | 9 |
| Corrected stability | 2100 | 1900 | 1590 |
| 140 deg. air bath for 2 hours | | | |
| Average flow | | 9 | |
| Average stability | | 1863 | |

**KLEINFELDER**

*A Consulting engineering firm providing Environmental, Geotechnical, Materials Testing and Construction Management services since 1961.*

**PROJECT NO:** 16653 **PROJECT NAME:** **Soil Stabilization Products Co., Inc.**

**To:** **Soil Stabilization Products Co., Inc.**

**Date:** **April 7, 2008**

**Specimen #:** ***10022A, 10022B, 10022C***

**Kleinfelder, Inc.**
*1410 F Street*
*Fresno, CA 93706*
ph: (559) 486-0750
fax: (559) 442-5081

**Description:**

**Technician:** Kyle Kubik / Jason Ruiz

**Aggregate Source:** Asphalt Millings
Mojave County, AZ

**Lab Coordinator:** Paul Geitner

**Pavement Type:** 2% CSS-1h only

| Marshall Flow and Stability (ASTM D-1559 / AASHTO T-245) | | | |
|---|---|---|---|
| **Specimen Number** | 10022A | 10022B | 10022C |
| Thickness | 2.0000 | 1.9500 | 1.9700 |
| Correction Factor | 1.47 | 1.56 | 1.47 |
| Dial Reading | 70 | 58 | 60 |
| Measured Stability | 673 | 561 | 579 |
| Flow | 13 | 13 | 14 |
| Corrected stability | 990 | 880 | 850 |
| 140 deg. air bath for 2 hours | | | |

Notes: ______________________________

## STABILIZED RECYCLED ASPHALT MILLINGS

| Marshall Method Criteria | Average Stability | Average Flow |
|---|---|---|
| **EMC SQUARED Stabilizer Only**<br>**Asphalt Millings - Mojave County, AZ** | **1,863** | **9** |
| **2% CSS-1h Asphalt Emulsion Only**<br>**Asphalt Millings - Mojave County, AZ** | **906** | **13** |

## STABILIZED AGGREGATE BASE COURSE MATERIALS

| Marshall Method Criteria | Average Stability | Average Flow |
|---|---|---|
| **EMC SQUARED Stabilizer (1000)**<br>**Aggregate Base Rock, Cemex, AZ** | **11,920** | **12** |
| **EMC SQUARED Stabilizer (1000)**<br>**Asphalt Aggregate Base Rock, Cloud Mining, NM** | **8,740** | **10** |

## STABILIZED RECYCLED PAVEMENT MATERIALS

| Marshall Method Criteria | Average Stability | Average Flow |
|---|---|---|
| **EMC SQUARED Stabilizer (1000)**<br>**Recycled Aggregate, CVT, CA** | **13,230** | **11** |
| **EMC SQUARED Stabilizer (1000)**<br>**Recycled Aggregate, Vulcan, CA** | **10,520** | **7** |

All Marshall Stability Testing done by Kleinfelder Inc.

Resilient Modulus and Marshall Stability testing have helped to illustrate the strength and flexibility that have long been evident in field applications of EMC SQUARED® System treatments. Their unique effectiveness in treating the "affinity" of soil and aggregate materials for water (known as moisture susceptibility) has also long been evident in field applications, but not well addressed by older generation laboratory tests. These tests were simply not sophisticated enough to evaluate the moisture susceptibility of a particular aggregate or soil, or the effectiveness of a stabilizer treatment in addressing the moisture susceptibility problems specific to that material.

Fortunately, research conducted by the Texas Transportation Institute (TTI) and the Finnish National Road Administration (FNRA) has demonstrated that electrical properties, dielectric value and electrical conductivity, can be used to classify aggregate materials in regards to both strength and deformation properties as well as moisture and frost susceptibility. This test method, known as Suction and Dielectric Testing (or Tube Suction), has been incorporated in the National Cooperative Highway Research Program (NCHRP) for classification of aggregate materials. Many papers have been published by TRB in the Transportation Research Record on this laboratory testing methodology, including a paper which reports on the effectiveness of the EMC SQUARED System in stabilizing aggregate surface course materials[1]

The use of Suction and Dielectric testing has proven out in evaluating the effectiveness of EMC SQUARED System treatments. The test method accurately measured the performances of aggregate materials in the materials testing laboratory following their field evaluation in both unstabilized and stabilized conditions while serving as running surfaces for three unpaved roads in cold climate locations. On each of the three road construction projects, the stabilized aggregates provided running surfaces for vehicles and trucks. Two of these stabilized aggregate running surfaces were subjected to very heavy truck traffic. During this time, months in one case and years in the others, the stabilized aggregates provided excellent running surfaces requiring little to no maintenance and with no evidence of moisture penetration or frost damage. The stabilized aggregate surface courses were eventually used as a stabilized or "bound" bases for asphalt pavement's bituminous surface courses, having first proven effective while directly subjected to the full range of environmental conditions, to heavy truck traffic and to winter snow plowing operations. The laboratory test results, summarized below and pictured at right, correlate well with observed field performance. The untreated aggregate materials were highly unstable as road running surfaces in the presence of moisture. Following treatment with EMC SQUARED System applications, the stabilized aggregate road surfaces acted similarly to asphalt pavement in their ability to retain strength in the presence of moisture while providing flexible running for surfaces servicing heavy truck and vehicular traffic.

## SUCTION AND DIELECTRIC TESTING

| Aggregate Samples | Untreated | EMC SQUARED Stabilizer (1000) |
|---|---|---|
| Alaska | 17.5 | **8.0** |
| New Mexico | 35.0 | **7.1** |
| Nevada | 17.3 | **7.7** |

**References for Dielectric Constant Values of Highway Materials**

| MATERIAL | DIELECTRIC VALUE |
|---|---|
| Dry Aggregates | 4 - 6 |
| Asphaltic Concrete | 5 - 7 |
| Portland Cement Concrete | 7 - 9 |

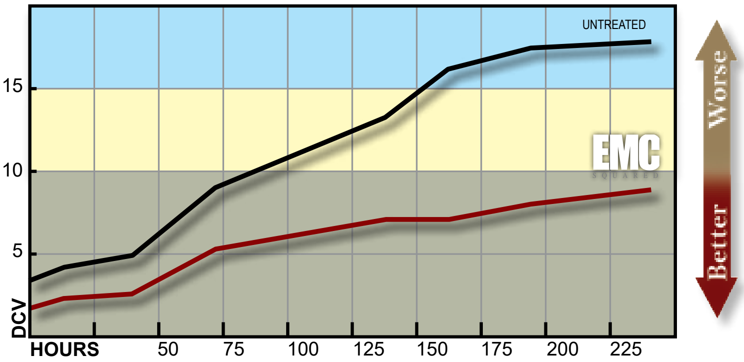
**A Dielectric Value of greater than 15** indicates that the aggregate is wet or water saturated and extremely moisture and frost susceptible

**A Dielectric Value of 10 to 15** indicates that a significant amount of free water has accumulated within the aggregate during the testing period and is a warning signal that the material is moisture sensitive and frost susceptible

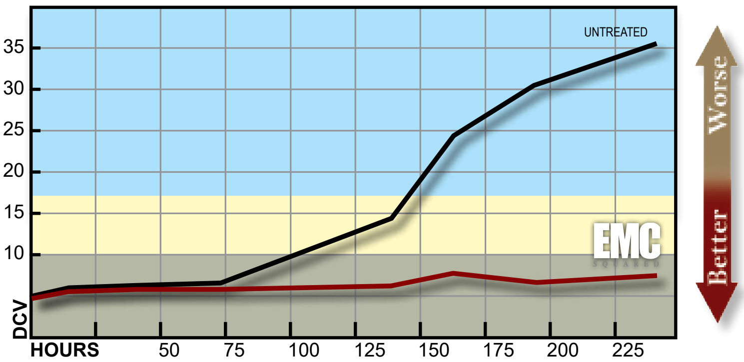
**Aggregate materials with a Dielectric Value of less than 10** are considered non-moisture sensitive and non-frost susceptible in service for road and highway base applications

Notice in the test results above for the three stabilized aggregate surface course materials that they were improved by the EMC SQUARED System application from a condition of being extremely moisture and frost susceptible to a performance level equivalent to asphalt and concrete pavement. The capability to impart this level of moisture resistance to extremely moisture susceptible aggregate materials is unequaled by asphalt emulsion, cement and lime products. The EMC SQUARED System has a completely unique combination of performance advantages. The capability of this product technology to effectively treat so many moisture susceptible aggregates at extremely low cost has profound implications for more sustainable road construction practices.

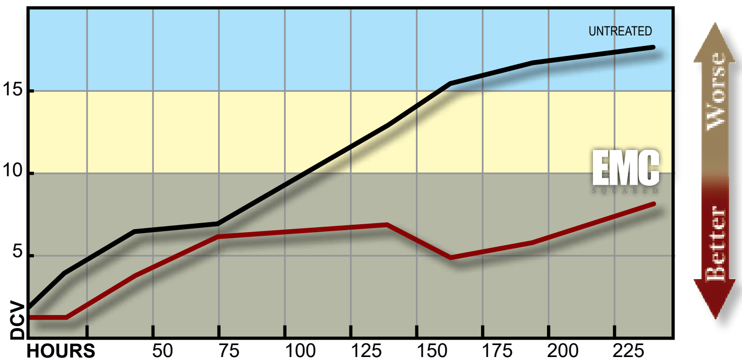
1) Syed and T. Scullion, Texas Transportation Institute, Texas A&M University, College Station, TX 77843-3135. R.B. Randolph, Soil Stabilization Products Company, Inc., Merced, CA 95344 "Tube Section Test for Evlauating Aggregate Base Materials in Frost and Moisture Susceptible Environments" Transportation Research Record 1709, January 2000, 78-90













EMC SQUARED System products are used in combination with natural earth materials such as aggregates and soils and mixtures of reclaimed asphalt and concrete pavements. The products are components in the construction of a final product. Engineering and construction controls are vital to the selection of all the ingredients and construction processes which will deliver the final product, and the excellence of that end result is, in large measure, dependent upon engineering judgements and construction quality control measures.

This publication is solely for use by professional personnel who are competent to evaluate the significance and limitations of the information provided. It was reviewed carefully prior to publication. Stabilization Products LLC and Milieu Road Technologies assume no liability for its accuracy or completeness. Final determination of the suitability of any information or material for the use contemplated, or for its manner of use, is the sole responsibility of the user.

**Stabilization Products LLC**

Ph: (209) 383-3296 or (800) 523-9992
E-mail: info@stabilizationproducts.net
Website: http://www.stabilizationproducts.net

Canadian Sales
Milieu Road Technologies
(780) 875-9159

The enclosed results of Resilient Modulus, Marshall Stability and Suction and Dielectric testing effectively translate the unique package of stability improvements available from the EMC SQUARED® System product technology, including the capability to improve select aggregate materials to layer equivalency with hot mix asphalt pavement materials. These tests have confirmed similar resiliency, strength, flexibility and resistance to moisture infiltration. This outstanding performance becomes more significant when coupled with the cost savings over conventional products and materials, and the potential to reduce environmental impacts. Addressing comparative costs first, the EMC SQUARED System product that provided twice the stability as the asphalt emulsion product in treatment of asphalt millings (page 5) was approximately one-sixth the product cost. Comparing current costs to treat one ton of aggregate, the EMC SQUARED System treatment is approximately five-percent of the cost of the asphalt binder product that is used in the manufacture of hot mix asphalt. In comparison to current cement pricing for a cement-treated base product, the EMC SQUARED System treatment would range from one-third to one-sixth the product cost, depending upon the percentage rate of cement added.

While all three materials laboratory test methods demonstrated the similarity of EMC SQUARED System stabilized aggregate materials to hot mix asphalt materials, the Resilient Modulus test results (page 3 Table 2) provide the test data necessary to discuss the layer equivalency relationship between the untreated aggregate base material and stabilized. First, reviewing the Resilient Modulus results, the untreated aggregate tested at 51,000 psi (51 ksi), while the EMC SQUARED System treatment improved its performance to 272,500 psi (272.5 ksi), an improvement of over five times. Then, using the AASHTO pavement design layer equivalency factors, we have the ability to look at the comparison in layer thickness requirements between conventional untreated aggregate base rock and the stabilized layer. The pavement engineer in charge of the Resilient Modulus testing study, for sake of example, uses a case where one aggregate base material has twice the layer coefficient of the other (for instance, 0.12 versus 0.24). “With all things being equal and a choice of two different aggregate bases with the structural layer coefficient of the second twice that of the first, a pavement section constructed with the second aggregate base would theoretically require one half the aggregate base thickness.” Now referring to the actual test results (0.10 for the aggregate base and 0.35 for the stabilized aggregate), we have the answer to our layer equivalency question. It would require over three inches of conventional aggregate base course for layer equivalency to a one-inch layer of EMC SQUARED System stabilized aggregate. That’s a big potential for construction cost savings and reduction of construction related environmental impacts.

As addressed on page 1, in order to provide a stabilized aggregate product that is fully equivalent to hot mix asphalt as a pavement running surface, the same level of attention needs to be focused on the manufacturing of the aggregate, on plant mixing the paving mixture, on use of paving machine asphalt equipment and highly controlled installation procedures. Laboratory testing programs have verified that the EMC SQUARED System products can impart the required levels of pavement materials performance, and field case histories have demonstrated impressive performance using aggregate base rock, asphalt millings and recycled pavement aggregate materials as stabilized road running surfaces. The evidence is clear that we have the product technology in hand for the production of low cost, environmentally friendly pavement materials. The key is to use similar materials quality control, manufacturing and installation processes.

Last, but not least, is the potential to reduce the environmental impacts associated with road and pavement construction and with the heat absorbency problems of installed asphalt pavement surfacing. For starters, EMC SQUARED System products are non-toxic and highly concentrated liquid products that are diluted with water prior to a cold-applied mixing process. Any place this green product technology can be substituted for asphalt based products, a clean product replaces a product that uses fossil fuel energy during its heated manufacturing and installation processes, and that produces a heat absorbent black surfacing that radiates heat. With light colored aggregate mixtures, EMC SQUARED System stabilized aggregate materials will be solar reflective, high albedo surfaces, appropriately reducing the contribution to global warming and climate change. Equally important is the subject of layer equivalency with conventional aggregate base and recycled base materials that are not stabilized. With a low cost clean stabilizer technology that can reduce base layer thickness by half, or more, there are a cascade of environmental benefits that can flow from the initial engineering decision to utilize the EMC SQUARED System product. A thinner base layer requires less preparatory excavation and less installation work, less mining of non-renewable aggregate resources, and fewer truck trips to haul the aggregate, thereby reducing safety hazards and damage to the paved surfaces of the adjacent access roads. By eliminating half the operation of diesel powered equipment at the aggregate mine location, on the trucking haul, and at the construction site, the use of the advanced stabilizer product technology has major beneficial impact in reducing construction related contributions to green house gas emissions, smog formation, Urban Heat Island effect, global warming and climate change. Doing more with less is the essence of sustainable construction practice and the EMC SQUARED System products set the standard.