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February 3, 2016

Mr. Terry Maier, President
Team Laboratory Chemical Corp.
28650 State Highway 34
Detroit Lakes, MN 56501

RE: Base One Stabilized Reclaimed Base
St. Croix County, Wisconsin
AET Project No. 28-01065

Dear Mr. Maier:

We are submitting this letter report of the pavement analysis we performed on the county roads with reclaimed bituminous/aggregate base stabilized with Base One, located in St. Croix County, Wisconsin.

1.0 BACKGROUND

Team Lab's Base One stabilization system is a highly concentrated and environmental friendly liquid product that improves the pavement strength at low cost. Stabilization is now affordable option that can be considered whenever aggregate and/or reclaimed bituminous are being processed and compacted for load bearing bases.

In the green road rating system, 1-5 credit points are assigned to the pavement reuse, 50-90% of existing pavement materials by estimated volume. In place aggregate and/or reclaimed bituminous stabilized with Base One can produce up to 100% reuse of the in-place pavement materials, thereby having all the five credit points.

To evaluate the strength of a pavement base layer stabilized with Base One, the non-destructive tests, Falling Weight Deflectometer (FWD) and Ground Penetrating Radar (GPR) were used in the field. The FWD equipment is capable of simultaneously providing Resilient Modulus measurement of the stabilized base layer in a non-destructive manner while testing the performance of many miles of road in a single day. The FWD produces a force impulse through the layers which closely simulates a moving wheel load and it provides a means to determine the equivalency of various materials in relation to their ability to support dynamic or repetitive loading. The GPR equipment is capable of measuring the pavement layer thickness in a highway speed and minimizing the errors in backcalculating the Resilient Modulus from FWD data.

2.0 RESULTS

A 1.85 mile section of CTH G from TH 170 to TH 128 in the south of Glenwood City, St. Croix was selected for FWD and GPR testing in 2015. The new pavement was designed for a 20-year design ESAL of 2,000,000 (SN=3.98) and consisted of 4.5” HMA type E-3 over 5” aggregate and reclaimed asphalt blend (3 inch asphalt and 2 inch gravel) stabilized with Base One on top of 6” crushed gravel base, on top of 12” of sand lift base (poor quality sand). The results are shown in the following table.

Roadway	Termini		a ₂		ESN		Spring Load Capacity	
	From	To	15th	AVG.	15th	AVG.	15th	AVG.
CTH G	TH 170	TH 128	0.14	0.19	4.2	4.5	14.3	15.0

ESN = Effective Structural Number, a₂ = layer coefficient, 15th = 15th Percentile.

A 2.45 mile section of CTH Z from CTH W to CTH T in the south of Hammond, St. Croix was selected for FWD and GPR testing in 2015. The new pavement was designed for a 20-year design ESAL of 300,000 (SN=2.92) and consisted of 1.5” HMA type E-3 over 4” aggregate and reclaimed asphalt blend (2 inch asphalt and 2 inch gravel) stabilized with Base One on top of 4” crushed gravel base, on top of 8” of sand lift base (poor quality sand). The results are shown in the following table.

Roadway	Termini		a ₂		ESN		Spring Load Capacity	
	From	To	15th	AVG.	15th	AVG.	15th	AVG.
CTH Z	CTH W	CTH T	0.18	0.21	3.0	3.3	10.7	12.2

ESN = Effective Structural Number, a₂ = layer coefficient, 15th = 15th Percentile.

The FWD and GPR results for St. Croix County showed the strength (Resilient Modulus) of the reclaimed base layer stabilized with Base One, ranging from 79,000 to 101,000 psi.

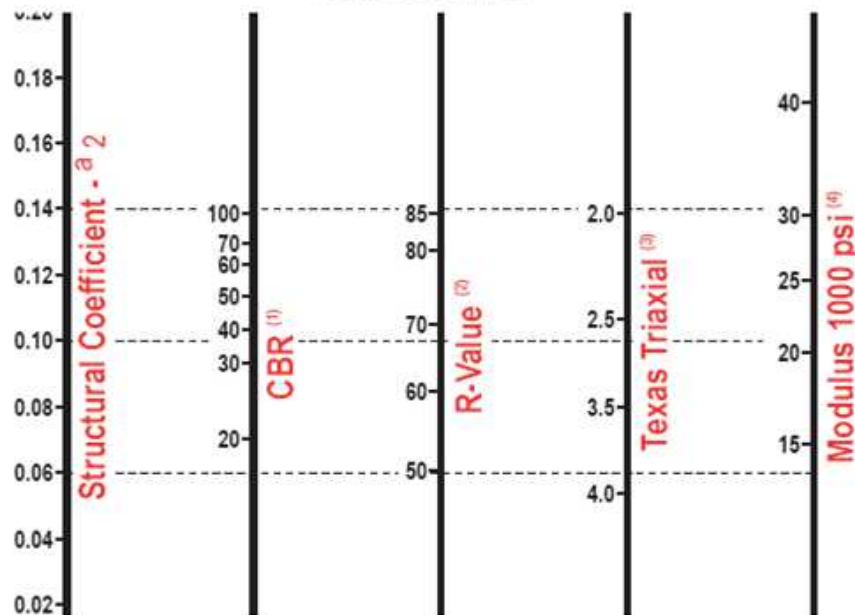
Using the following comparative chart provided by the American Association of State Highway Transportation Officials (AASHTO) for correlation with other standard index tests for additional perspective, the FWD testing demonstrated that the stabilized base was significantly stronger than 30,000 psi, a Resilient Modulus value that correlates with a CBR of 100, and an R-Value of 85.

The measurements from this group of two test values are representative of base materials with the quality between crushed aggregate and crushed gravel, so the higher moduli of the reclaimed material stabilized with the Base One (79,000 to 101,000 psi, or 2.6 to 3.4 times the referenced 30,000 psi strength) demonstrate in materials engineering measurements how this advanced broad spectrum stabilization technology is producing an entirely new level of field performance and solving problems previously unaddressed. The stabilized reclaimed county road system at St. Croix County provides an excellent example.

The national referenced base modulus is for the ideal crushed aggregate base materials and higher than the base material available locally. In Wisconsin, the high quality crushed aggregate base has the modulus of 30,000 psi but the crushed gravel has the modulus of 10,000 psi. The comparison of the lowest average base modulus of two sections to that of the WisDOT referenced base modulus for crushed aggregate and for crushed gravel showed a 1.4 and 1.9 equivalency factor, respectively.

The FWD results from all the test sections showed an all-season road and much improved SN as compared to the design SN.

AASHTO Guide for Design of Pavement Structures Base Course

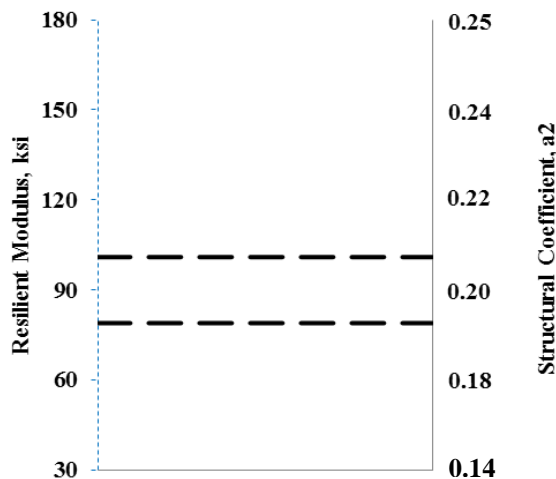


(1) Scale derived by averaging correlations obtained from Illinois.
 (2) Scale derived by averaging correlations obtained from California, New Mexico and Wyoming.
 (3) Scale derived by averaging correlations obtained from Texas
 (4) Scale derived on NCHRP project (3)

3.0 CONCLUSIONS

In summary of stabilized county roads projects in St. Croix County in Wisconsin, the Base system stabilization technology is facilitating sustainable construction of better performing roads at far lower cost than possible with conventional road construction product. Reduction in the overall environmental impacts and financial burdens on taxpayer makes Base One as a favorable option in pavement reuse.

Values of back calculated (from field FWD testing) resilient moduli typically fall within a range of from 79 ksi and 101 ksi. This is considered structurally effective in terms of stress distribution but yet not so stiff as to induce excessive shrinkage cracking distress. The estimated layer coefficient under test conditions ranges from 0.19 to 0.21 for Base One stabilized RAP and aggregate blend base as shown in the following chart.



Sincerely,
American Engineering Testing, Inc.

Peer Review by:

Chunhua Han, PE
Principal Engineer, Pavement Division
Phone #651-603-6631
Fax #651-659-1347
chan@amengtest.com

David L. Rettner, PE
President/Principal Engineer