CBR AND PAVEMENT DESIGN

Pavement is the durable surface intended to support traffic. Without the pavement, most natural soils would quickly rut and fail to support wheel loads. The most common pavements are asphalt and concrete. A pavement section typically includes: a wearing surface (asphalt or concrete), an aggregate base course, and a soil subgrade. Pavement design considers: the traffic loading conditions, the number and mix of trucks and cars that will use the road over its life, the expected design life of the pavement, an estimated growth in traffic volume, the importance of the roadway, serviceability requirements, and the strength of the subgrade.

This ***Lessons Learned*** will concentrate on the strength of the subgrade, which has a significant impact on the design and thickness of the pavement section. If the subgrade "pumps" or can not support a single pass of a loaded truck tire without rutting, the subgrade is judged unstable and any pavement placed above will likely fail prematurely. The stronger or better the subgrade, the thinner the pavement section needs to be to spread out and support the applied wheel loads. Obviously, thinner pavement sections cost less. Conversely, if testing indicates the subgrade is weak or poor, the subgrade may need stabilization and/or a thicker pavement section to support traffic over the design life of the pavement.

To measure the strength of the subgrade in a reproducible way for design, a laboratory test known as the California Bearing Ratio (CBR) was developed by the California Division of Highways around 1930. Since then, the test has been widely adopted by numerous states, counties, U.S. federal agencies and other countries. Because of softer rock in the area, some states like Florida have adopted a similar test known as the Limerock Bearing Ratio (LBR). The CBR test compares the force required to penetrate a standard size piston 0.10 inches into a compacted soil sample with the force required to penetrate the same piston the same depth into a standard crushed rock sample. The CBR test is usually performed in the laboratory on undisturbed or compacted samples which are soaked in water before the test to simulate worst case field conditions. The table below shows typical CBR ranges for various soil types.

General Soil (USCS Soil Type)	CBR Value
Graded Aggregate Road Base (GAB)	100
Natural Gravel (GW, GP, GM, GC)	20 – 40
Medium to Coarse Sand (SW, SP)	10 – 40
Silty or Clayey Sand (SM, SC)	5 – 40
Low Plasticity Clay or Silt (CL, ML)	15 or less
Highly Plastic Clay or Silt (CH, MH)	15 or less
Organic Clay or Silt (OL, OH)	5 or less

In spite of its qualitative nature, the CBR test process still remains the most generally accepted method of determining subgrade strength, and as such this information, along with information on traffic flows and traffic growth is used to design pavements. One of the most commonly used documents on roadway design using CBR information is the *AASHTO Guide for Pavement Structures, 1993 and 1998 Supplement.*

We hope this ***Lessons Learned*** will be useful to you on future projects. If you need any assistance on pavement design, please contact your nearest ECS office.

Respectfully,

ECS Corporate Services, LLC