

CIVIL INSIGHT

"Improvement makes straight roads, but the crooked roads without Improvement are roads of Genius."

William Blake

Getting Your Hands Dirty to Make Better Roads

It may go without saying, but roads and bridges are not built from the top down. However, most people only ever see or are concerned with what is on the surface of each. The truth about roads and bridges is that they are only as good as the ground they are built on. Roads made of concrete or bituminous, strong pavements, will crumble if not supported by well-prepared subgrades. Curiously, it is what we do not see that really matters. That is why Grading and Base Inspection is such an important aspect of Civil Construction.

So, what is a subgrade? The subgrade or subsoils are the soils and materials that effectively support the pavements or structures that are built on top of them. In-situ soils, called "common fill," are still sampled and tested to assess their qualities, but for the most part, the soils in place stay there, and the roadway is built on top of them. The layers of additional manufactured material placed on top of the existing ground also help with stability and the control of water. These additional materials are referred to as aggregates and are clean sand, or select granular, and gravel.

All of the materials used to build the subgrade are thoroughly tested.



The in-situ soils are sampled and tested using the Proctor Test. This test is used to determine the optimum moisture and maximum dry density of any soils. This tells the engineers just how firm or dense the soils can be, and how much moisture should be in the soils to provide the stiffest subgrade to build on. The manufactured materials are delivered to the construction site from a quarry. The testing of these materials does not end when they are made. Each layer of material placed in a subgrade is tested at various times to be sure it is meeting the specifications set by the engineer. An experienced Grading Inspector will seek out the areas that are most likely to fail.

Manufactured materials are designed to be different sizes so once mixed they achieve aggregate inter-lock. That is where the big and little pieces all are jammed together like in a puzzle making for a very stable layer of material. However, the layers of sand and gravel also allow water to drain through them. If water gets trapped beneath pavement, it can freeze and heave the road.

It may be surprising to some, but dirt and aggregates are the unsung heroes of a durable roadway. They work together to support the pavements and bridges we drive over. By understanding the qualities of the soils and aggregates the road is built on, we can hope to create durable and safe thoroughfares for our driving public. Grading Inspection is somewhat of an art-form. Attention to detail, and a keen understanding of how the materials must work together are a necessity when inspecting a road subgrade and it greatly contributes to the success of all road projects.

Manufactured Soils.

Manufactured soils are also tested using the Proctor Test, but they are also designed to meet a specific Gradation after manufacture. Testing for this requires samples of the materials to be dried and run through sieves of various sizes. The material trapped on each sieve is then weighed to see if it matches the design criteria of the Gradation.

Testing.

Testing becomes more frequent and crucial the closer to grading grade. The in-place tests include the DCP, or Dynamic Cone Penetrometer to test stiffness, the sand-cone test to measure density, the moisture test to ensure there is the right amount of moisture in the soils as they are placed. A good inspector knows when/where to take samples.

