

City of Grants Pass
Structural Soil Specifications
As Adopted in Article 30 of the Grants Pass Development Code

Structural soil shall consist of a mixture of gravel, soil and admixtures as described below. The following sources are approved to supply the materials. Other sources may be approved, based upon satisfactory test results however, it is the contractor’s responsibility to provide the required information or testing needed to approve the source.

Engage a licensed engineer to provide site preparation specifications, pavement sections, and construction oversight as required by the following sections.

Materials

Structural Soil shall consist of the following materials:

1. Crushed rock (3/4” to 1 1/4” diameter)
2. Loam/organic Topsoil
3. Soil Binder such as “Stabilizer” (stabilizersolutions.com)
4. Water

Proportions of materials

The major components of the structural soil mixture are crushed rock and topsoil. Since when mixed together some of the topsoil fills in the voids of the crushed rock material the sum of the rock and topsoil volumes does not equal the volume of the structural soil material. There is approximately a 10% volume reduction due to mixing the materials together.

Material	Amount for 1 CY of Structural Soil	Amount for 4.6 CY of Structural Soil
Crushed Rock	23.2 cubic feet	4 cubic yards
Topsoil	5.9 cubic feet	1 cubic yard
Soil Binder	13.7 oz	4 pounds
Water	1.6 gallon	46 gallons

The target moisture content is 20% by weight of the topsoil weight. The above water content assumes the topsoil is dry. The amount of water that will need to be added depends on the moisture content of the raw materials. Actual amounts of water used will be determined during mixing based on observations of the material through the mixing procedure below.

Mixing procedure

1. Mix structural soil in batches of an appropriate size for the equipment being used. The result is to be a material that is uniformly blended together. Do not batch in quantities that will not allow the equipment to completely mix the material. Determine batch size and quantities of each material needed for the batch.
 1. Start with half of the crushed rock material.
 2. Add all the topsoil material.
 3. Add the soil binder.
 4. Add half of the estimated water.
 5. Add the other half of the crushed rock material.

6. Mix the material together.
7. Slowly add water to the mixture and continue to mix. The final amount of water will vary with moisture content of the crushed rock and topsoil. Add water in incremental amounts and mix the material between the additions of water.
8. Stop adding water and mixing when there is a minute amount of free topsoil remaining. The topsoil will coat the crushed rock and not fall out of the material. All of the crushed rock should be uniformly coated with topsoil. There should be no clumps of topsoil or uncovered crushed rock in the mixture.
9. If too much water is added to the mixture water will drain out of the material and the topsoil will wash off the crushed rock. If this occurs this batch of material is to be discarded and shall not be incorporated into the completed work.

Placement

1. Protect soils and mixes from absorbing excess water and from erosion at all times. Do not store materials unprotected from rainfall events. Do not allow excess water to enter site prior to compaction. If water is introduced into the material after grading, allow material to drain or aerate to optimum compaction moisture content.
2. All areas to receive Structural Soil mixture shall be inspected by the licensed engineer before starting placement of mixture. All defects such as incorrect grading, compaction and inadequate drainage, etc., shall be corrected prior to beginning placement of Structural Soil.
3. Confirm that the sub-grade is at the proper elevation and compacted or uncompacted, as indicated by the plans and/or site preparation specifications. Sub-grade elevations shall slope parallel to the finished grade. Clear the excavation of all construction debris, trash, rubble and foreign material. Fill any over excavation with approved fill and compact to the required sub-grade compaction.
4. Install Structural Soil in 6-inch lifts and compact each lift to 85 percent of maximum density using lightweight, handheld compaction equipment. Delay compaction 24 hours if moisture content exceeds maximum allowable and protect Structural Soil with plastic or plywood as directed by the Engineer. Do not over compact. Engage a testing company to test field density of each lift, especially in the beginning when the contractor is "getting a feel" for compacting the material to the appropriate density.
5. The water service lines that cross the structural soil material fill area may be corroded and fragile. The contractor shall take care when working around the water service lines. If a service line is damaged, develops a leak or is bent, the service line shall be replaced as per City of Grants Pass standards at the contractor's expense. The structural soil that will be the bedding for the water service lines shall compacted to conform to the grade of the water service line. The contractor shall not compact the immediate vicinity above a water service line until a fill depth of 12-inches above the water service line is reached.
6. Bring Structural Soils to finished grades as shown on the drawings. Immediately protect the Structural Soil material from contamination from water by covering with plastic or plywood as directed by the Engineer.
7. The Engineer may periodically check the material being delivered and installed at the site for mixture proportions and consistency with the material requirements of these specifications. If the installed material varies significantly from the specified material, the Contractor shall remove the material and replace with the specified Structural Soil material at no extra cost to the Contracting Agency.

Measurement

Structural Soil per cubic yard shall be measured by the neat lines as shown on the plans.

Additional Information: Physical Tests

The following are the results of physical tests performed on materials used in a successful structural tree soil project in Olympia, WA. Materials should closely approximate the materials found here.

Rock. Crushed Rock, Gradation of 100% passing 1.25 inch, 26% passing 0.75 inch, 4% passing 0.25 inch and 0.5% passing No 40 sieve by weight.

Soil. ASTM D2487 Soils Classification SW-SC Well-graded Sand with Silty Clay. With a composition of 9% Gravel, 81% Sand, 8% Silt and 2% Clay. Organic Content of 8.3% dry weight.

Stabilizer. Stabilizer as supplied by Stabilizer Solutions. 33 South 28th Street Phoenix Arizona 85034 USA (800) 336-2468

Structural Soil. Compaction and bearing tests were performed on the structural soil mixture. The proctor density of the material was 138.7 pounds per cubic foot. The California Bearing Ratio (CBR) value at 100% density was 74.

Since a high voids content was desired, 85% compaction was the target for the project. This resulted in a CBR value of 30. Subgrades in Olympia are compacted to 95% under roads and 90% under non-traffic areas. Generally, if this compaction reaches a CBR value of 20 it would be adequate for supporting our standard 4-inch concrete sidewalk or standard roadway sections. A CBR value of 30 provided sufficient bearing capacity for the sidewalk and provided about one third voids content in the structural soil.