

STABILIZED BASES AND SUBBASE SECTIONS

The terms stabilized base and subbase are a class of structural pavement material that are composed of aggregates and a cementitious binder blended with sufficient amounts of water that results in a mixture having a moist, non-plastic consistency that can be compacted to form a dense mass and gain strength. These classes of base or subbase materials are not meant to include the stabilization of soils or aggregates using asphalt cement or emulsified asphalt.

The purpose of a stabilized base or subbase layer is to provide a transitional load-bearing strata between pavement layers which directly receives the wheel loading of vehicular traffic, while reducing loading on the underlying subgrade soil.



Moisture intrusion de-stabilizes unbound aggregate bases and overtime lowers their load-bearing capacity. When base materials are stabilized, the permeability of the base section is reduced, while the unconfined compressive strength is substantially increased, thus removing the moisture sensitivity of the basecourse. Stabilized aggregate sections form a moisture-resistant base, thus reducing the potential for pumping action and migration of fine particles throughout the pavement layer.

Stabilized base or subbase materials may be used to provide support for either flexible or rigid pavements.

AGGREGATE SUBBASE (ASB)

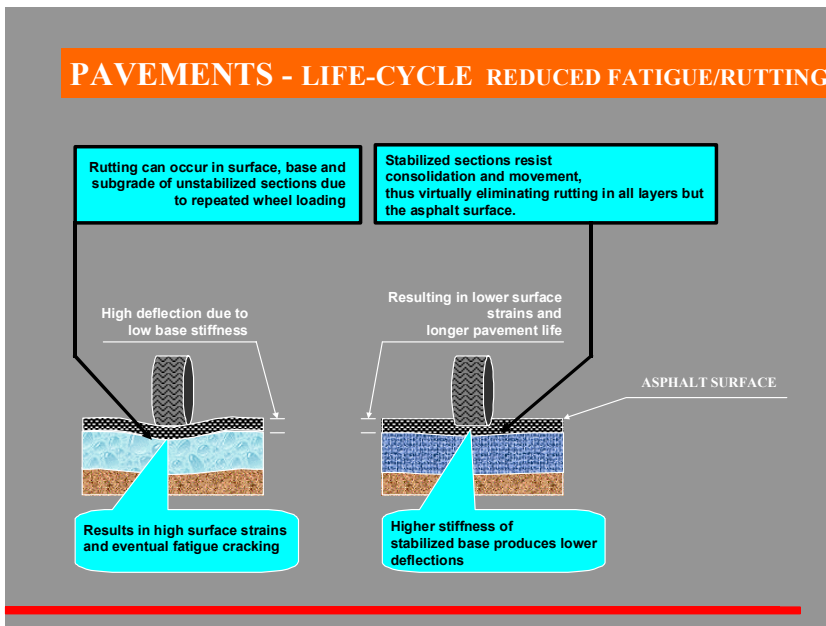
Aggregate Subbase is typically the layer between the basecourse and subgrade. The subbase generally consists of lower quality materials than the basecourse but better than the subgrade soils. A subbase section is most often incorporated when the thickness requirement for an aggregate base section exceeds 18 inches, as an effort to reduce cost. The stabilization of in-situ soils and low quality imports can also be chemically treated to meet ASB design requirements.

A wide range of aggregates and soil aggregate mixtures can be improved with chemical stabilization. Base materials that contain clay or silt fines can be modified with a small amount of quicklime to reduce expansion, prior to stabilizing with cement for permanent strength development. Aggregates with gradations that are coarse normally require higher cement contents for binding purposes.

Because of continual depletion of quarry aggregates, most subbase consist of recycled pavement materials or quarry products that can not, for various reasons meet the criteria for aggregate base. By chemically treating these substandard aggregates with a cementitious binder, the performance properties, such as strength and durability can be achieved.

CEMENT TREATED BASE (CTB)

CTB provides a stiffer and stronger base than an unbound granular base. A stiffer base reduces deflections due to traffic loads, which results in lower strains in the asphalt surface. CTB delays the onset of surface distress, such as fatigue cracking and therefore extends the pavement's lifecycle.



The thickness of a CTB section will be less than those required for unbound aggregate sections carrying the same traffic because the loads are distributed over a larger area. Its slab-like characteristics and beam strength are unmatched by unbound aggregate sections that fail when the interlocking aggregate matrix is lost due to migrating water

and pumping action. The strong uniform support provided by a CTB section will also result in reduced stresses to the subgrade. A thinner CTB section will reduce subgrade stresses more than a thicker layer of unbound aggregate, resulting in reduced subgrade failures, potholes, and road roughness.

CTB can be mixed-in-place or provided by a central plant consisting of aggregate, cement, and water that results in a strong and durable stabilized roadway base. Historically CTB was manufactured at a central plant, where concrete was typically produced. Since the advent of high efficiency mobile mixers, with controlled water additive systems, and computer control cement spreading equipment, most CTB applications are now typically performed in-place. The in-place method allows for additional quality control functions than plant mix. Since CTB hydration rates are relatively fast, within 2 hours from initial introduction of water to compaction, the in-place method allows for additional processing and grading time. Plant mix CTB requires loading, transporting, and unloading, which may result in material segregation due to moisture loss and material movement.

Chemically treated bases and subbases are widely used as pavement sections for highways, low volume roads, city streets, parking areas, airports, industrial facilities, and staging areas. The structural properties of treated bases and subbases depend on the soil/aggregate material, quantity of cementitious binder, curing conditions, and age. Typical properties of chemically treated base material are:

Property	7-Day Values
Compressive strength	300 – 800 psi (2.1 – 5.5 MPa)
Modulus of rupture	100 – 150 psi (0.7 – 1.0 MPa)
Poisson's ratio	0.12 – 0.14 (Quite variable)

BALANCING STRENGTH

In general, a cement content that will provide a 7-day unconfined compressive strength between 400 and 700 psi is satisfactory for most mixed-in-place CTB applications.



Coarser aggregates can achieve strengths as high as 1,200 psi. Even higher strengths may be achieved if it is determined that the base materials are moisture sensitive, or that special conditions exist that warrant more strength. The main reason for limiting the strength is to keep the CTB from becoming too rigid. Experience has shown that higher strengths can potentially cause stress cracks to reflect through the pavement surface. The objective is to have a “balanced design,”



CHEMICAL STABILIZATION BASES AND SUBBASE SECTION

where enough cement is used to create a stabilized base that is strong, durable, and relatively impermeable, but not so strong that it results in rigidity under flexible design, which may lead to distress in the pavement structure over time.

When CTB is applied to ridged pavement designs, such as PCC pavements, the issue of over design is not of concern as it relates to the ultimate unconfined strength and maybe beneficial from the standpoint of durability.