Construction Materials

- **Contamination** --Avoid any clay or fine silt-sized particles in wearing surface as these prevent proper adherence between aggregate and the asphalt. Serious plucking may eventuate, if used.
- **Surface Adhesion** -- Certain rock types are “hydrophilic” or attracted to water. These result in poor adhesion of asphalt to aggregate and wearing surface breakdown. For this reason, highly silica -rich rocks (i.e. granite, rhyolite) are less preferred aggregate material.
- **Precautions** -- These days, road authorities pre-coat the aggregate as standard procedure to minimise aggregate stripping and hydrophilic properties.

- **Road Base materials**: divided into Unbound & Bound materials:
  - **Bound Materials** consist of particles which are strongly bound together by additives such as lime, cement, or bitumen; and
  - **Unbound Materials** act as discrete particles under load, despite some degree of mechanical interlock between particles. Particles are typically granular & treated for other factors.

Construction Materials

- The choice of Road base material depends on three factors:
  - Strength of subsoil;
  - Local climatic and physiographic variables; and
  - Projected road usage (volume and types of vehicles).
- Desirable properties of Unbound materials include:
  - **Grading:** should be well-graded facilitating interlocking between particles, high compaction, low porosity & better stress distribution. (Grading refers to a wide size range distribution in the aggregate.)
  - **Impermeable**: material should not be subject to water absorption.
  - **Strength and Durability**: must be highly resistive to disintegration when subjected to traffic in any of the sub-base, base, or road shoulder positions.
  - **Particle shape and surface texture**: angular, equidimensional and rough surface texture desirable.

Construction Materials

- Suitable Aggregate Sources:
  - Crushed igneous rocks, i.e. basalt;
  - Crushed non-foliated metamorphic rock, i.e. quartzite, hornfels;
  - Laterite (residual Fe-Al hydroxides/ oxides from deep weathering);
  - Local soils, if they are non-swelling and suitable.
  - Crushed river gravels.
- Less Suitable Sources are:
  - Clastic sedimentary rocks;
  - Foliated metamorphic rocks, i.e. schists, slates, etc.;
  - Chemical sediments, i.e. limestone, etc.
  - Biogenic sediments, i.e. coralline limestone, etc.

Construction Materials

- **Concrete Aggregate:**
  - Comprises 60-80% of concrete;
  - Inherent properties of aggregate affect concrete workability, strength and curing shrinkage; and
  - Sand, gravel and crushed rock commonly used.
  - **Desirable properties include:**
    - **Well graded aggregate** - Complete range of particle sizes;
    - **Highest strength rock available** - between 70-300 MPa compressive strength;
    - **High impact resistance** according to Los Angeles Abrasion test:
    - **Equidimensional sized particle shape**;
    - **Strong bonding** between cement paste and aggregate;
    - **Non -porous aggregate**;
    - **Unweathered aggregate** free from clays and thereby avoiding volume changes;
    - **Appropriate SG** (density) for application.

Construction Materials

- **Negative factors for aggregates are**:
  - **Clays** and swelling clays (any weathered rock aggregate is unacceptable);
  - **Coatings** on aggregate particles;
  - **Soluble salts** and organic impurities weaken concrete and salt may corrode; and
  - **Reactive silica** which occurs in amorphous and crypto-crystalline silica reacts with alkalis in the cement paste and leads to expansion and cracking of concrete. Normally occurs as Opal or Chalcedony, and rarely as Volcanic Glass.
- Suitable rock types are essentially the same as previously identified:
  - Most igneous rocks provided they do not contain significant Olivine or Reactive Silica;
  - Few sedimentary rocks ,i.e. Conglomerate, and Greywacke, but not Sandstone, Shale, or Mudstone; and
  - Metamorphic rocks such as Quartzite, Hornfels and Gneiss, but not Slates and Schists.