Pavement Materials

Lecture 12

Pavement Unbound Layers

- **Granular (Physical) Stabilization** **Lecture 09**
- **IDENTIFICATION** **Lecture 10 & 11**
- **EVALUATION**
- **SELECTION**
- **CONSTRCUTION**

Aggregate Investigation

- **Field Investigation *(Material Sourcing)***
- **Laboratory Evaluations**

Field Investigation

Field Investigation

- **Field Investigation for concrete materials prior to construction are chiefly confined to**

- **Prospecting for Aggregates**
- **Exploration and Sampling of Available Deposits**

- *Judgement and Thoroughness in conducting preliminary field investigations are usually reflected in the Durability and Economy of the completed structures.*
- *Awareness of the Effect of different properties of the aggregates on the behavior of pavement layers is must for the Investigation Team.*

Aggregate Sources

- **Natural Aggregate**
- **Rock Quarries**

- **<u>Natural Deposits</u>**
- **Stream/River Deposits**
- **Glacial Deposits**
- **Fluvial Glacial Deposits**
- **Talus Deposits**
- **Wind Blown Deposits**

Aggregate Sources

- **Prospect Sources**
- **Existing Sources**

- ***Information is obtained from***
- **Geological Maps**
- **Soil Survey Maps**
- **Aerial Photographs**
- **Satellite Imageries**

photo courtesy of Glacier Northwest

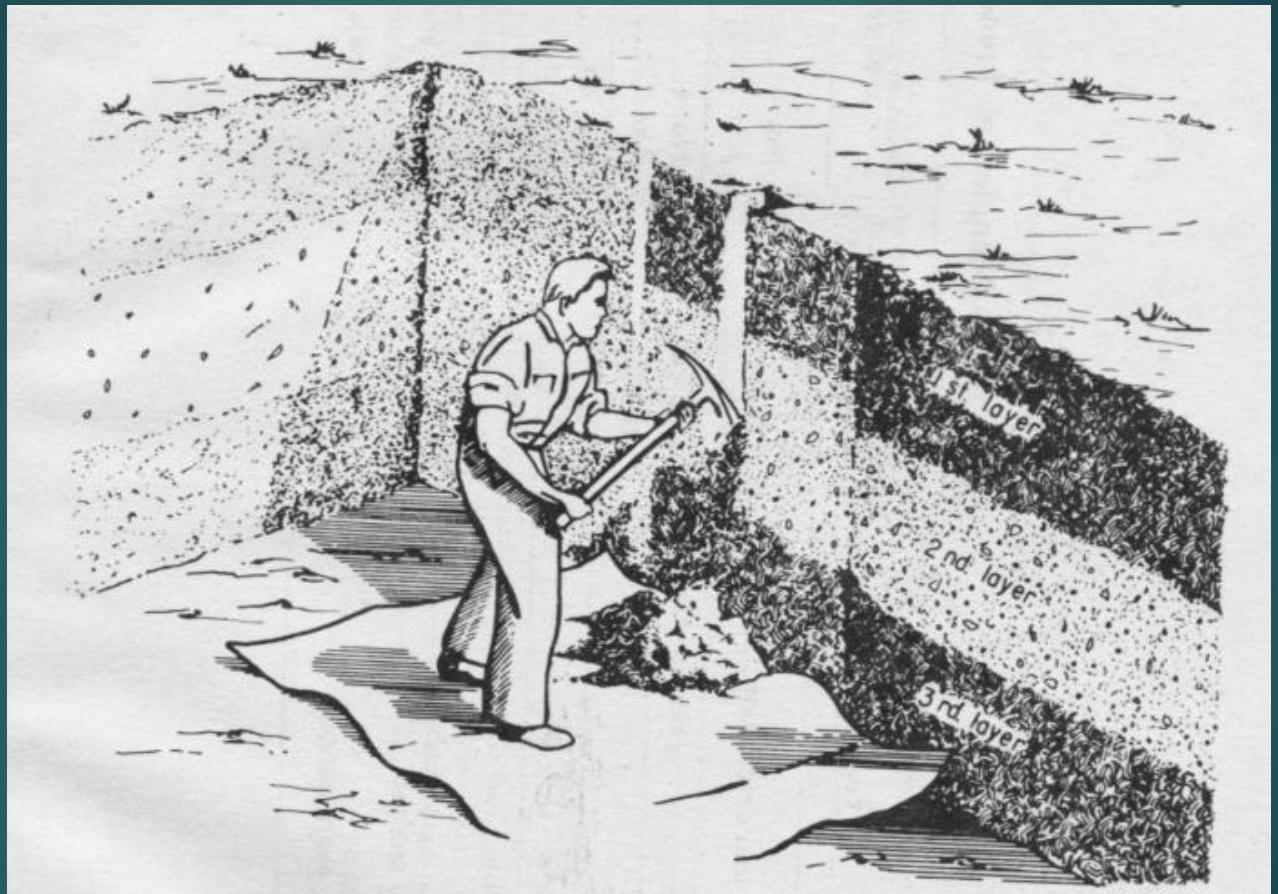
Aggregate Prospecting

- **Shallow Deposits**
- **Rock Quarries**

- **Shallow Deposits**
- **A grid of test pits/trenches**
- **Representative Sampling**
  - **from different depths**
  - **from bottom and sides**
- **Typical of the average properties**

Aggregate Prospecting

- **Sampling Trenches**



Individual samples are taken from each layer of soil.

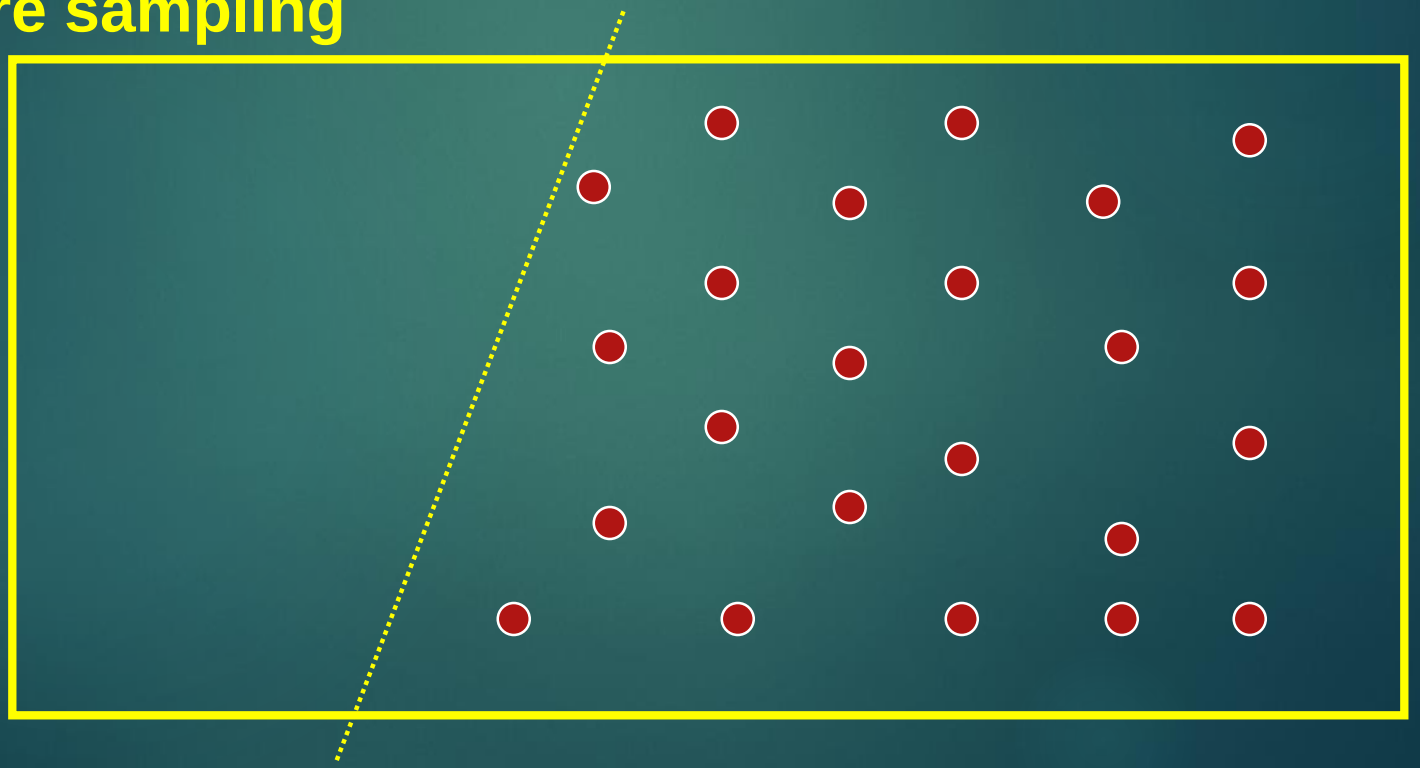
Composite samples are taken from two or more layers of soil.

Figure 1–1.—Sampling trench. PX–D–4784.

Aggregate Prospecting

- **Rock Quarries**

- **A grid of boreholes**
- **large sized holes**
- **core sampling**

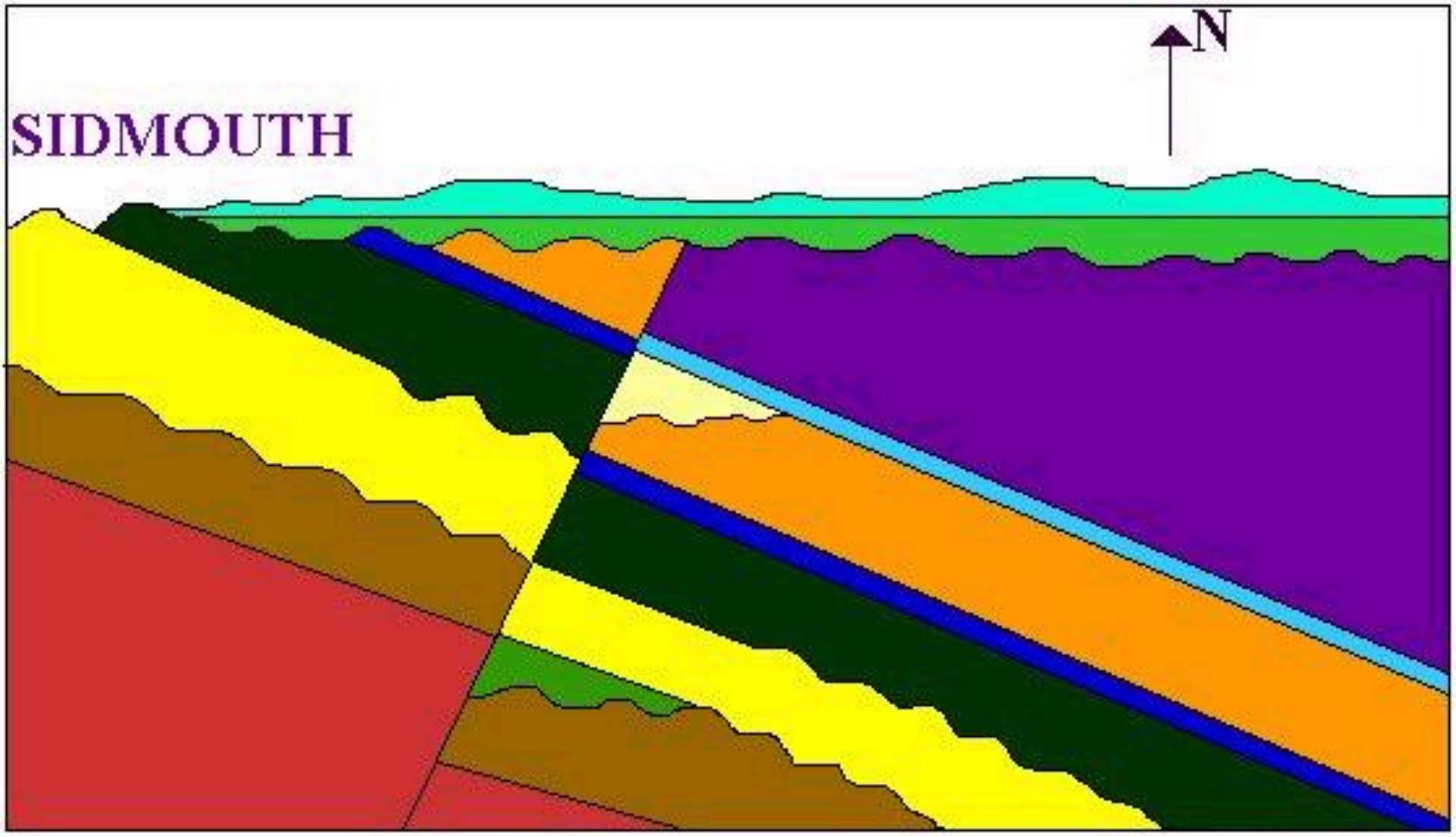


Aggregate Prospecting

- **Subsurface Profiles**

Aggregate Prospecting

- **Subsurface Profiles**



Aggregate Prospecting

- **Existing Sources**

- **Shallow Deposits**
- **A similar procedure is required**

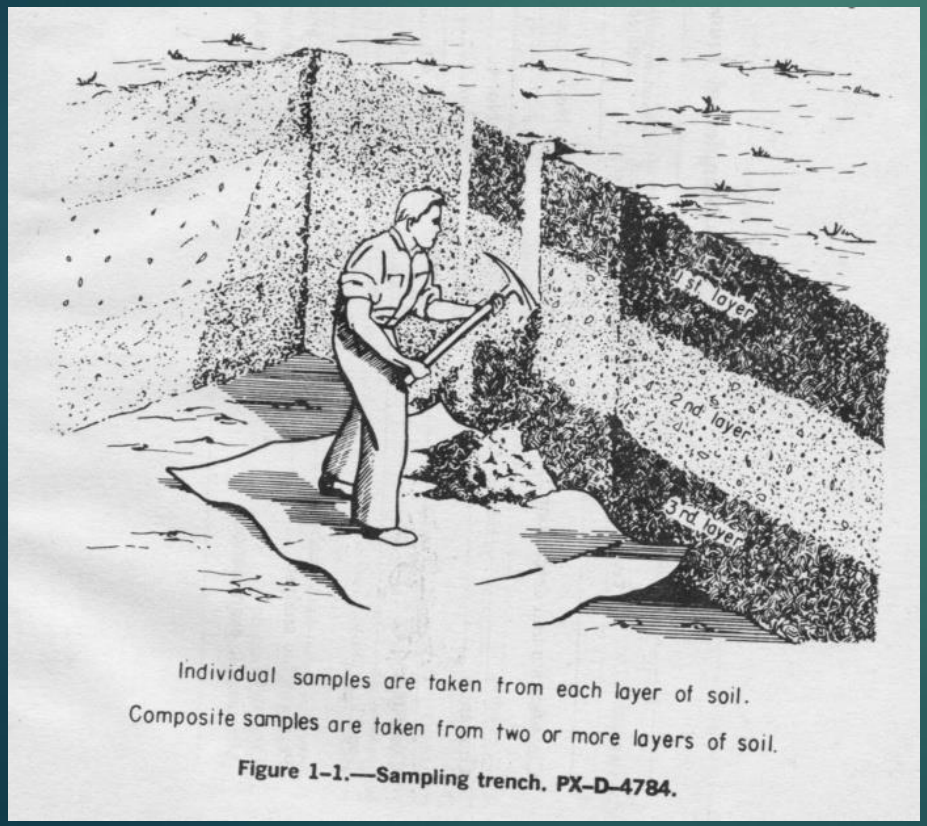


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Figure 1–1.—Sampling trench. PX–D–4784.

Aggregate Sampling

- **Deep Deposits**
- **visual inspection through cuts**

Aggregate Sampling

- **Deep Deposits**
- **sampling from stockpiles**

Aggregate Sampling

- First and foremost, it needs to be emphasized that the repeatability and reproducibility of test results depend primarily on the **SAMPLING.**
- A laboratory sample is obtained from a bulk sample collected, either in a number of increments or in one go, from a batch or a stockpile.
- Samples are normally collected using a sampler which is in the form of metallic tube or a scoop whose Opening is 3 times the maximum aggregate size.
- Sampling of aggregates is sometimes done at various production sources in order to avoid the segregation which occurs in stockpiles, Some of the sampling procedures followed are :
- 1. Sampling from stationary conveyor belt
- 2. Sampling at belt and chute discharge points
- 3. Sampling from stockpiles
- 4. Sampling from railway wagons, transporting dumpers/trucks etc.

Aggregate Sampling

- **Sample Quantity**
- **Minimum Quantity depends on the testing desired**

Table 3.2 Minimum Mass of Samples for Testing (BS 812: Part 102:1989)

Maximum particle size present in substantial proportion *mm*	*Minimum mass of sample dispatched for testing* *kg*
28 or larger	50
Between 5 and 28	25
5 or smaller	13

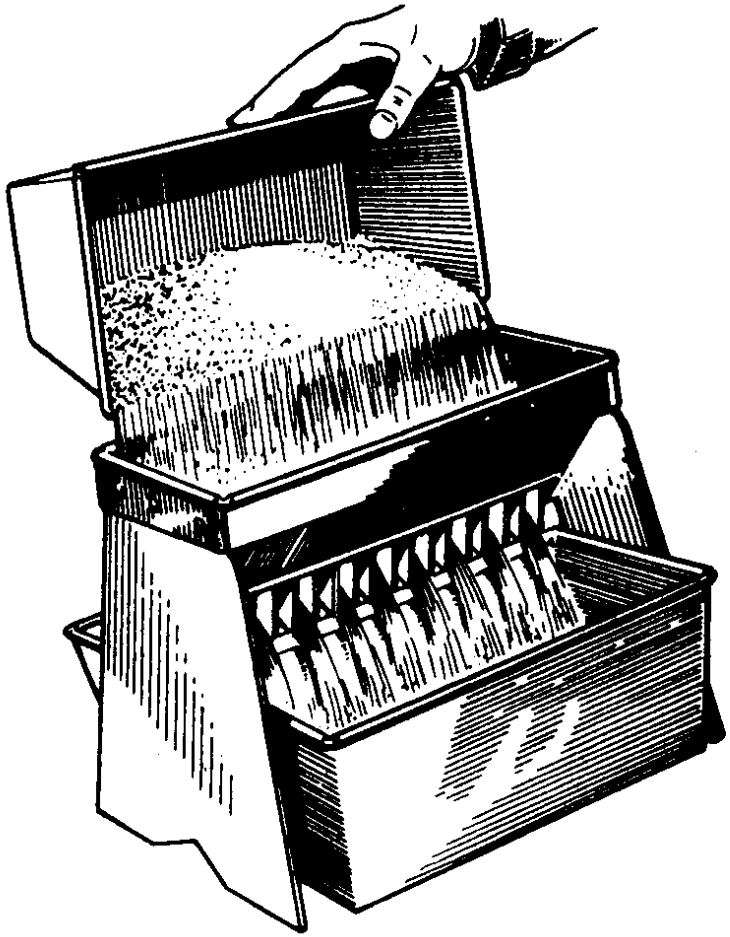
ASTM D 75

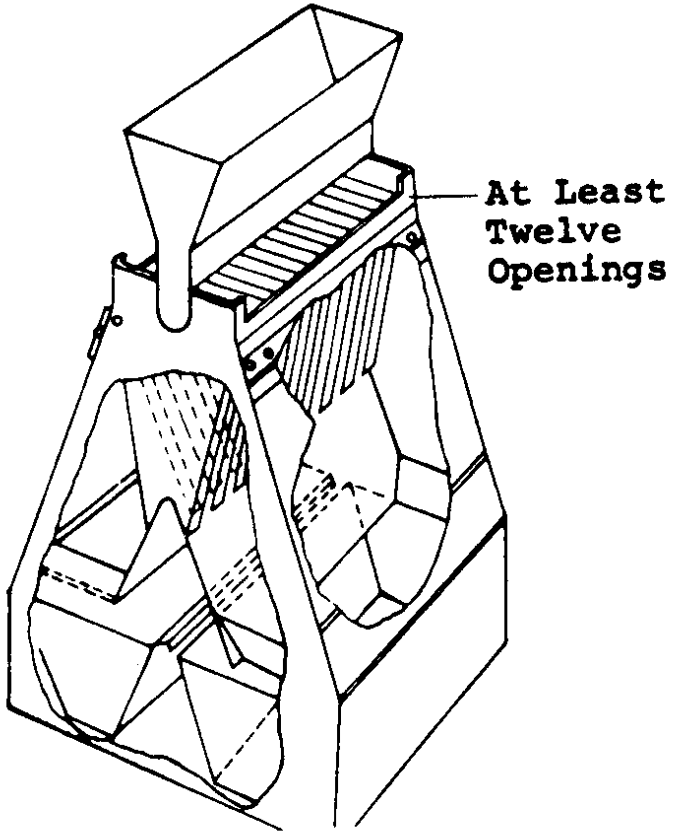
Aggregate Sampling

- **Sample Reduction for Laboratory Testing**
- **The main sample is made up of a number of portions drawn from different parts of the whole.**
- **Two Methods are available**
- **Riffling**
- **Quartering**

Aggregate Sampling

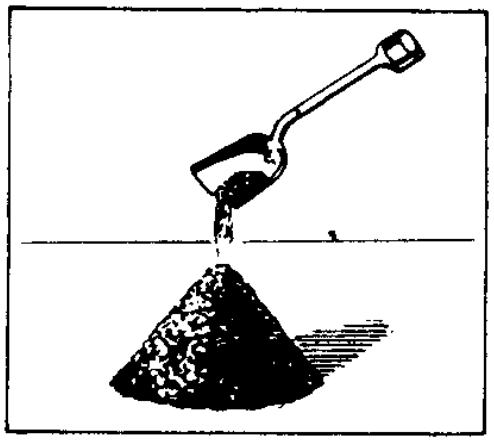
- **Riffling**



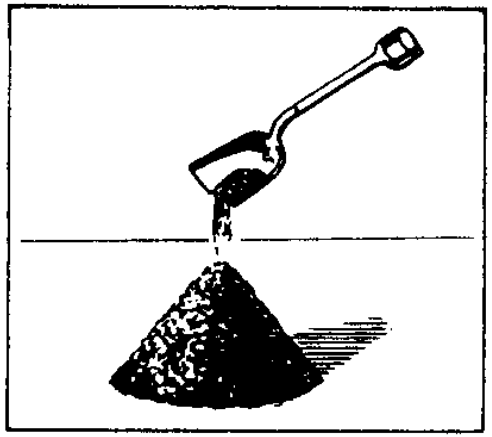


Aggregate Sampling

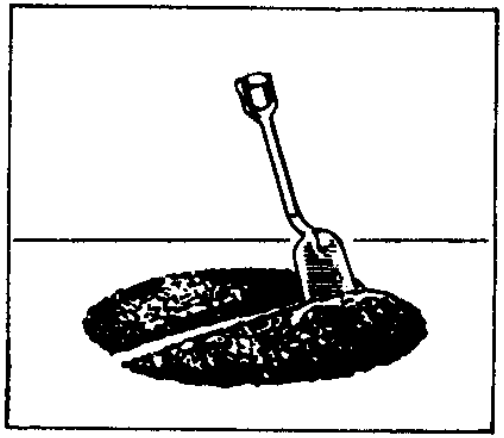
- **Quartering**



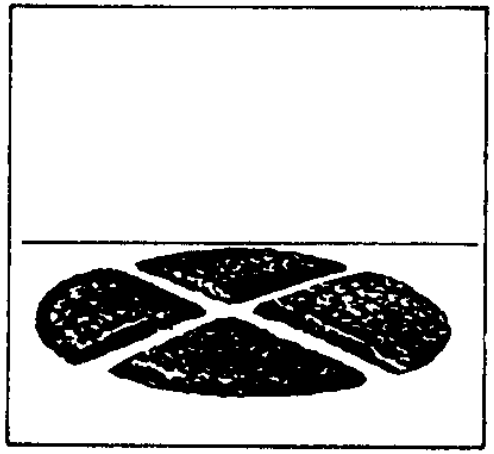
Cone Sample on Hard Clean Surface



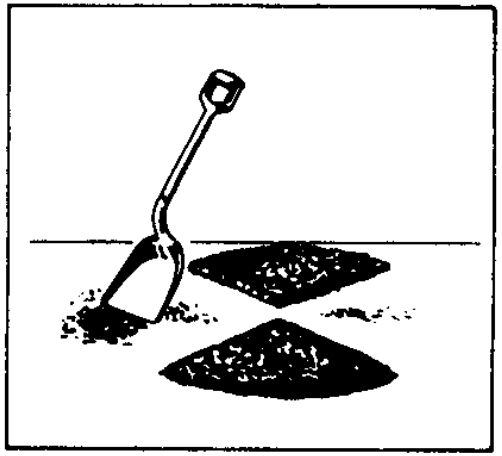
Mix by Forming New Cone



Quarter After Flattening Cone



Sample Divided into Quarters



Retain Opposite Quarters
Reject the Other Two Quarters

Laboratory Evaluations

Laboratory Evaluations

- ***The tests required to be conducted on representative samples of aggregates depend on the Specific Use in a road pavement, so as to ensure that they meet the Specified Requirements laid down for that specific use.***

- **Subbase**
- **Base**
- **Surface Course**

Laboratory Evaluations

- ***Forces on Unbound Layers***
- **Traffic Forces**
- **Environment (Moisture)**
  - ***Degradation, Crushing***
- **Compaction Forces**
  - ***Disintegration, Volume Change***
  - ***Crushing, Degradation***

Laboratory Evaluations

- **Strength**
- **Stiffness**
- **Stability**

- **Factors Affecting….**

- ***Mineralogical Properties***
- ***Physical Properties***
- ***Chemical Properties***

Strength

- **Angle of Internal Friction**

- **Individual Particles**
  - **Crushing Strength of Parent Rock**
  - **Surface Texture**
  - **Shape (Flakiness, Elongation, and Angularity)**
- **Compacted Mass**
  - **Gradation**
  - **Aggregate Crushing Value (ACV)**
  - **Aggregate Impact Value (AIV)**
  - **Triaxial Compression Test**

Strength

- **Individual Particles**

Rock	* Compressive, psi Range	* Tensile, psi Range
Granite	5,250-54,000	425-2,300
Quartz monzonite	10,000-14,000	320-1,250
Gabbro	34,000-52,800	1,800-3,320
Andesite	19,500	235-1,250
Sandstone	1,565-35,800	75-1,140
Limestone	865-51,000	300-1,470
Slate	8,550-44,500	3,560
Marble	4,420-37,300	425-1,280
Gneiss	11,500-46,500	2,100-3,270
Serpentine	8,950-17,500	855-1,550

Dynamic Stiffness

- **California Bearing Ratio (CBR)**
- **Resilient Modulus (M_r) Test**
- **Los Angeles Abrasion Test**

Stability

- **Individual Particles**
  - Durability
- **Compacted Layer**
  - Stability

- **Individual Particles**
  - Specific Gravity
  - Water Absorption
  - Soundness
- **Compacted Layer**
  - Gradation
  - Plasticity
  - Sand Equivalent
  - Deleterious Material

Selection

- **Specifications** ***(MIX)***

- **Coarse aggregates (ASTM D 692)**
- **Fine aggregates (ASTM D 1073)**
- **Mineral Filler (ASTM D 242)**
- **Combined coarse and fine aggregates (ASTM D 3515)**

- *In addition, specifications also contain general statements calling for*

- ***Clean, Hard, Tough, and Durable Aggregate***

Thank You