

Aggregate

“Aggregate plays a critical role in the design and construction of the nation’s infrastructure. Aggregate is the largest single cost item used in pavement construction materials ... Therefore, the properties of aggregate and aggregate-binder mixtures are very important to the life of the system”

Base

Portland Cement

Asphalt



Properties of Aggregate

A property is a quality that is indicative of a specific characteristic of a material



Properties of Aggregate

A property is a quality that is indicative of a specific characteristic of a material

Physical Properties

- Particle Shape
- Maximum Size
- Surface Texture
- Pore Structure
- Absorption
- Thermal Volume Change
- Permeability
- Specific Gravity
- Particle Grading
- Integrity During Heating
- Porosity
- Thermal Conductivity
- Voids in Aggregate Mixture
- Electrical Conductivity
- Reflection
- Glare
- Color
- Volume Change
- Resistance to Wetting
- Resistance to Freezing-Thawing
- Deleterious Substances



Properties of Aggregate

A property is a quality that is indicative of a specific characteristic of a material

Chemical Properties

- Solubility
- Slaking
- Resistance to Attack by Chemicals
- Coatings
- Oxidation Reactivity
- Base Exchange
- Chemical Compound Reactivity
- Chloride Content
- Surface Charge
- Hydration Reactivity
- Organic Material Reactivity



Properties of Aggregate

A property is a quality that is indicative of a specific characteristic of a material

Mechanical Properties

- Particle Strength
- Particle Shape of Abraded Fragments
- Wear Resistance
- Resistance to Degradation
- Particle Stiffness
- Mass Stability
- Resilient Modulus



Deleterious Substances



Deleterious Substances

- ④ “Those substances present in an aggregate that are harmful to the desired properties of an aggregate-binder system”



Deleterious Substances

- ④ “Those substances present in an aggregate that are harmful to the desired properties of an aggregate-binder system”
- ④ This includes:
 - Clay and other types of surface coatings



Deleterious Substances

- ④ “Those substances present in an aggregate that are harmful to the desired properties of an aggregate-binder system”
- ④ This includes:
 - Clay and other types of surface coatings
 - Organic materials



Deleterious Substances

- ④ “Those substances present in an aggregate that are harmful to the desired properties of an aggregate-binder system”
- ④ This includes:
 - Clay and other types of surface coatings
 - Organic materials
 - Structurally soft and/or weak particles



Deleterious Substances

- ☉ “Those substances present in an aggregate that are harmful to the desired properties of an aggregate-binder system”
- ☉ This includes:
 - Clay and other types of surface coatings
 - Organic materials
 - Structurally soft and/or weak particles
 - Aggregate particles, such as chert, which exhibit disruptive expansion



Deleterious Substances

- ④ “Those substances present in an aggregate that are harmful to the desired properties of an aggregate-binder system”
- ④ This includes:
 - Clay and other types of surface coatings
 - Organic materials
 - Structurally soft and/or weak particles
 - Aggregate particles, such as chert, which exhibit disruptive expansion
 - Aggregate particles which react chemically



ODOT Supplement Specification 1029

- Identifies the following materials as being deleterious substances

Chert	Expansive & Reactive
Shale	Coating, Organic, Soft, & Expansive
Limonitic Concretions	Soft, Expansive, & Reactive
Clay Lumps	Coating & Soft
Coal & Lignite	Organic & Soft



Coal & Lignite



Coal is a black organic rock consisting of greater than 50% carbon; it forms from the buried and altered remains of plant material

Lignite is low-rank coal that consists of 50% carbon

Key Features

- Black in color
- Moderately soft and brittle
- May appear laminated



Clay Lumps



Clay lumps are a form of unconsolidated sediment which retains plastic properties and is formed from microscopic and submicroscopic particles

Key Features

- No visible grains
- Behaves plastically when wet
- Leaves a powdery streak



Limonitic Concretions



Limonitic Concretions are compact masses of minerals or clay surrounded in a hydrous iron oxide shell

Key Features

- Peanut-butter M&M
- Smooth, hard shell
- Soft, powdery clay center

****Note:** It must contain a soft clay center to be considered a limonitic concretion.

So crack them open!



Limonitic Concretions



Limonitic Concretions are compact masses of minerals or clay surrounded in a hydrous iron oxide shell

Key Features

- Peanut-butter M&M
- Smooth, hard shell
- Soft, powdery clay center

****Note:** It must contain a soft clay center to be considered a limonitic concretion.

So crack them open!



Chert



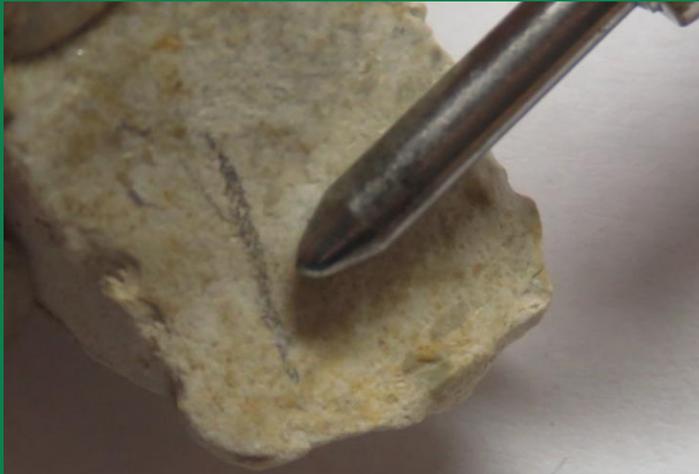
Chert is a very fine-grained siliceous rock composed of crypto-crystalline quartzs, chalcedony, or opal – or any combination of the three

Key Features

- Very hard, hardness near 7
- Conchoidal fracture
- Waxy luster in dense varieties
- Chalky surface in porous varieties



Chert



Hardness

- A steel knife blade or nail will not scratch chert and will usually leave some metal on the surface of the aggregate
- Chert will scratch a piece of glass



Conchoidal Fracture

- When broken, dense chert will display smoothly curving, clamshell-shaped surfaces



Shale



Shale is very fine-grained sedimentary rock that breaks into thin sheets

Key Features

- Relatively soft
- Fissile “platy” appearance
- Various colors: gray, black, green, red



Shale



Shale is very fine-grained sedimentary rock that breaks into thin sheets

Key Features

- Relatively soft
- Fissile “platy” appearance
- Various colors: gray, black, green, red



Shale



Hardness

- When pressure is placed on the particle and pulled across a “streak-plate” a powder is left behind



Fissile appearance

- The appearance of layers



Shale A vs. Shale B



Shale A:

703.02, 703.04, 703.11

50% or more of the particle visually is comprised of shale

Shale B:

703.05, 703.12

Consists of 100% shale, has shale adhering to it, or contains stringers within it



Shale B



“Has shale adhering to it”

Particles that are stained on the surface due to being in contact with a shale seam or a stringer shale not be counted as deleterious shale if there is no actual shale present



Shale B



“Has shale adhering to it”

Particles that are stained on the surface due to being in contact with a shale seam or a stringer shale not be counted as deleterious shale if there is no actual shale present.

“Discernable thickness”



Shale B



“Contains stringers within it”

Stringers do not have a defined thickness, but should be a flat layer within the aggregate that can be traced across multiple sides of the particle



Shale B



“Contains stringers within it”

Stringers do not have a defined thickness, but should be a flat layer within the aggregate that can be traced across multiple sides of the particle

Wetting the particle helps



Questions

