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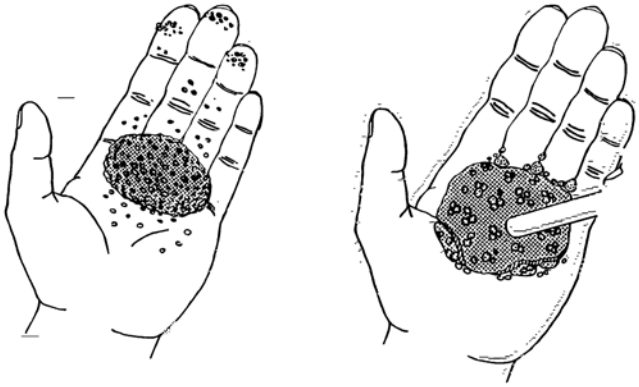
Gravel: Hand Tests

Cornell Local Roads Program
Tech Tips

Several simple hand tests can be used to determine the quality of a gravel. These tests do not guarantee a good quality, but are good indicators and can help determine if a material is worth testing. If a gravel, cannot pass these tests, it should not be used.

CLEAN HANDS

With experience, a highway superintendent may estimate the general suitability of a gravel mixture by "feel." A suitable technique is as follows.



Pick up two or three handfuls of the material and discard stones larger than about ¼ inch. Add enough water so that you can pack the material into a ball but not so much as to make it mushy. Pick up a handful of the moist material and squeeze it into a ball. It should contain enough sand to look and feel gritty. Look at your hand. For use in **gravel** roads, the mixture should contain enough silt and clay to have stained your hand slightly but not enough to leave it muddy. For use in **base** courses, the moist material should not stain your hand.

Another check is to compress a handful of the material into a flat cake. Try pushing the blunt end of a pencil into it. If the pencil does not penetrate easily, there is enough sand and gravel, as well as enough binder soil for a gravel road. If the pencil tends to split the cake, it may still be suitable as base course material if it is evident that the splitting is due to too little silt and clay rather than too much.

HAMMER TIME

Pick out a few of the ½" or larger particles from a gravel sample. Place them on a hard surface and hit them lightly with a hammer. If the particles break apart with a light hammer tap, they will not last long in a road. Develop your skill at this test by hitting some particles from a gravel you know is strong. A freshly broken face of a piece of gravel can help determine the parent rock.

- **Limestone** breaks into angular pieces, is usually gray in color, and fizzes when touched with a dilute acid such as muriatic acid. It is considered to be a good aggregate.

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- **Sandstone** breaks quite sharply when struck with a hammer. A fresh face clearly shows sand particles cemented together. Its suitability as aggregate depends on quality of cementation.
- **Crystalline rocks** break sharply when struck with a hammer. A fresh face shows particles of various sizes and usually of various colors. Suitability depends on reaction to the hammer.
- **Shale** breaks into flat, flaky pieces when struck with a hammer. A broken face usually shows some color banding. Shale is usually a poor aggregate.

THE SNAKE

Take a handful of gravel and remove any particles larger than •". Make a ball by adding water but not so much as to make the sample sticky. Try rolling into a thin snake. If you can roll a ¼" or thinner snake, the material may be too plastic and should not be used. If the snake is between ¼" and ½" it may be a good surface gravel. If you cannot make a snake, it is probably non-plastic, which makes a good base course.

DILATANCY (REACTION TO SHAKING)

Remove particles larger than No. 40 sieve size and prepare a pat of moist soil with a volume of about one-half cubic inch. Add enough water if necessary to make the soil soft, but not sticky.

Place the pat in the open palm of one hand and shake horizontally, striking vigorously against the other hand several times. A positive reaction consists of the appearance of water on the surface of the pat which changes to a livery consistency and becomes glossy. When the sample is squeezed between the fingers, the water and gloss disappear from the surface, the pat stiffens, and finally it cracks or crumbles. The rapidity of appearance of water during shaking and of its disappearance during squeezing assist in the character of the fines in a soil.

Very-fine clean sands give the quickest and most distinct reaction whereas a plastic clay has no reaction. Inorganic silts, such as a typical rock flour, show a moderately quick reaction.

DRY STRENGTH (CRUSHING CHARACTERISTICS)

Remove particles larger than No. 40 sieve size and mold a pat of soil to the consistency of putty, adding water if necessary. Allow the pat to dry completely. Then test its strength by breaking and crumbling between the fingers. This strength is a measure of the character and quantity of the colloidal fraction contained in the soil. The dry strength increases with increasing plasticity. High dry strength is characteristic for clays. A typical silt possesses only very slight dry strength. Silty fine sands and silts have about the same slight dry strength, but can be distinguished by the feel when powdering the dried specimen. Fine sand feels gritty whereas a typical silt has the smooth feel of flour.

Stop, look, listen

Look carefully at the material.

- Does it contain shale?
- Does everyone call the material “good enough for government work?”
- Has it failed in the past?
- Does the price seem too good to be true?

If the answer to any of these questions is *yes*, the gravel may not be adequate.

The value of the hand-feel evaluation increases with experience, but at best, the tests give only a general idea as to quality. It certainly does not give as clear a picture of quality as a laboratory tests, but if time is short, it is better than nothing.