SCREENING AND CRUSHING PLANTS

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Under the heading of screening and crushing plants, we usually think of localized plants wherein materials are excavated, crushed, screened, and washed for commercial purposes.

I wish, however, to discuss screening and crushing plants of the portable type. In this type of plant, the operation of preparing the material, less the washing, is brought directly into the locality where the processed material is to be used. In some counties, road builders, through necessity, must depend entirely upon commercial gravel producers for their material. Mother Nature, during the glacial period, was kind to some of us and not so kind to others in the matter of gravel deposits. LaGrange County was favored by an ample deposit of gravel throughout the county. The presence of this gravel deposit, containing varying quantities of sand, covered with a thin layer of clay, enables us to carry on localized processing operations for the preparation of surfacing materials with minimum costs of transportation to the point of application.

There are a number of crushing and screening plants on the market today. Most of these plants meet the requirements demanded by their users, if care and good judgment are used in their manipulation. You know that we select equipment largely on fancy. Almost any piece of equipment, built for a purpose, will fulfill that purpose under proper manipulation.

The ideal plant is one which, after the excess sand and clay have been removed, will uniformly mix the materials consisting of certain specified amounts of crushed rock, sand, and clay. Last year, a Pioneer plant was in our county and processed gravel at three different locations to the amount of approximately 18,000 cubic yards. During the season, I had ample opportunity to learn something about the workings of a modern crushing plant, and I shall attempt to describe briefly its operation.

Material was furnished to the hopper of the machine by a 3/4-yard, gasoline-operated shovel. It was then elevated to a point above the jaw-crusher, where a shaker screen removed the rock which was over 3/4 of an inch in size. The oversize then passed through the jaw-crusher, after which the crushed metal was passed through the roll-crusher, wherein all metal was reduced to 3/4-inch size as maximum. The crushed metal was then mixed with the fine aggregates removed by the first screening operation and discharged into trucks for hauling to the road or placing in a stock pile. This type of crusher was capable of crushing and processing approximately 700 to 900 cubic yards of material during a ten-hour period.
It is my understanding that this plant costs about $19,000. The cost of operation is approximately $100.00 per day, excluding breakage.

With the proper care in excavating, the sand, clay, and gravel can be combined in a homogeneous mass. The crushing operation avoids waste, since all rocks under six inches go into the metal aggregate in a crushed condition. This crushed and processed material makes a very suitable material for a gravel road surface. It is a well-known fact that in simple screening operations, wherein excess sand and oversize only are removed, the resulting aggregate when placed on the roadbed is slow to compact under traffic, whereas if plenty of metal with maximum oversize of three-quarters of an inch is mixed with fines and a proper percentage of clay content, quick compaction results under traffic, and a hard, flinty surface with greater resistance to wear is obtained. As a matter of fact, our experience has been that gravel from a pit of low clay-content unprocessed compacts less readily than the same gravel processed.

Maintenance costs on processed gravel surfaces will be less and a smoother surface will be secured. It is an established fact that surface corrugations are caused partially by too much oversize material. In the past, where this condition existed, we have tried scarifying and removing the oversize stone by raking. This is a temporary cure, for as long as oversize stones exist all through the road, they will continue to work to the surface. A processed gravel surface tends to shed the water better and offers less opportunity for frost upheavals during freezing and thawing periods.

It would be quite difficult for a manufacturer to build a plant that would be able to produce a uniform mixture of the proper proportions of clay, sand, and stone according to any specifications by the operators, unless care and diligence are observed in getting the several materials into the machine for the proper mix. An ideal plant would be one in which separate feeding devices are provided for feeding, from individual stock piles, the several components of the finished product.

With the increased usefulness to the public provided by a smoother roadway with less maintenance expense, the processed gravel at 60 cents per cubic yard is much cheaper than bank-run gravel at 30 to 40 cents per cubic yard. As compared to commercial crushed and screened gravel at 60 cents a ton at the plant, plus freight and/or trucking costs to the place of use, I would say that gravel, processed from a local pit near the point of usage, would be much cheaper.

The screening and crushing equipment can be so adjusted that the fines may be separated from the coarse aggregate for use in bituminous mixes. This presupposes that pits must be worked wherein the clay content is at a minimum. In LaGrange County, we have constructed several miles of oil mat which is holding up well, by using processed gravel free
from clay. This particular type of crushed stone aggregate works very well with either cut-back asphalt or road oil.

In the early days of gravel road building, there was little need of being so particular about the maximum size that went into a road surface; but with the increased traffic of high speed automobiles and trucks, the smoother we keep our road surfaces, the better satisfied will be the traveling public and the less will be the expense to our counties. The modern methods of screening and crushing road materials have gone a long way towards solving our gravel road problems.

Requirements for our processing program in 1937 include the following specifications for bidding:

(a) All rock up to 6 inches in diameter shall be crushed and screened.
(b) None shall be retained on a \( \frac{3}{4} \)-inch screen.
(c) Not less than 35% of the crushed content shall be retained on a No. 4 screen.
(d) Fifty-five to 80% shall be retained on a No. 10 screen.
(e) The clay content shall not exceed 12%, as indicated by a water gravity test.

USES OF THE MOTOR GRADER

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In Johnson County, we have used motor graders for eleven years. We now have six, and our experience has taught us that this unit type lends itself to our road-maintenance problems, and has proved by all odds the best and cheapest kind of road machine we can use. We have 580 miles of county roads, including 80 miles of black-top.

For gravel or stone road maintenance, the motor grader has no equal. Surfaces which have become badly corrugated and pitted under heavy traffic can readily be reshaped and restored to original crown and grade. In this operation, the hard-packed surface is first scarified so that the base may be planed absolutely smooth with the blade. In planing the base, the material is usually windrowed to the sides, then respread on the smooth base. Where the surface is not too hard, the material can be bladed without scarifying, thus saving time and enabling the machine to cover many miles per day.

Another interesting operation, which is favored in many localities, consists of windrowing the surface material to the center of the road, then cleaning and reshaping the ditches. Earth from the ditches is spread over the base from which the gravel or stone has been bladed; then the surface material is replaced over the earth. Ditches are thus restored for proper drainage, and the entire road is reshaped with smooth base and best use of the original surface material.