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*Iowa State Highway Commission*

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ROAD MATERIALS FROM THE DES MOINES SERIES  
OF THE PENNSYLVANIAN SYSTEM OF  
SOUTH-CENTRAL IOWA

L. W. WOOD

INTRODUCTION

In connection with the extensive program of road improvement now in progress in Iowa, the State Highway Commission has conducted a rather detailed survey of the resources of road material within the state. In the southern half of Iowa, where such materials are most scarce, the survey has been most intensive. Not only have the superficial deposits been investigated, but the indurated rocks have also been carefully studied, both from their natural outcrops, and from the records of wells, mine shafts, etc.

It is a well-known fact that the strata of the Des Moines Series of the Pennsylvanian System in Iowa consist predominantly of shale. At first glance, therefore, it would seem that this group of rocks offers but little hope to the road builder. However, a careful survey reveals that the situation is by no means hopeless; there are available limited deposits of limestone, sandstone, conglomerate, and furthermore, under certain conditions, much of the shale is usable. The purpose of this paper is to mention briefly certain occurrences of road material within the Des Moines Series which have come to the writer's attention, in connection with his work with the Highway Commission in conducting this material resource survey.

ROAD MATERIALS

Road materials, as used in this state, fall almost entirely into two classes; those which may be used as aggregate in Portland Cement concrete, and those which may be used for surfacing of earth roads. The term "Concrete Aggregate" includes all of the dry materials, except cement, which enter into the concrete mixture. Surfacing materials are spread in a uniform coating of several inches thickness on the earth road, and under the compacting action of traffic, aided by the binding action of some cement, either in the material itself or obtained from the subgrade, become

consolidated into something very similar to a water-bound macadam.

Materials used for concrete aggregate must be clean, hard and sound, with particles uncoated by any substance which may prevent the cement from binding to them, and containing no substances which may exert a harmful effect upon the surrounding concrete, either by chemical or mechanical action. Materials in Iowa which meet these specifications are gravel (principally of glacial or fluvio-glacial origin) or crushed stone. Crushed stone is in this state principally limestone or dolomite, but may include such other rocks as sandstone, quartzite, or conglomerate.

Road surfacing work is of a more temporary nature than paving, and materials used in it need not be of such good quality as are concrete aggregates. However, the material used for road surfacing should be hard enough and sound enough to resist the abrasive action of traffic.

#### STRATIGRAPHY OF THE DES MOINES SERIES

This will be mentioned only very briefly, as a comprehensive discussion requires space beyond the limits of this paper.

It may be said that the beds of the Des Moines Series are in general inconstant and lens-like in character, and that the detailed stratigraphy has not been worked out. However, three stages are recognized, in ascending order, the Cherokee, Henrietta, and Pleasanton. These stages are not divided by well-marked lines, nor is it necessary for the purposes of this paper to describe and delimit each stage accurately. In general it may be said that the Cherokee Stage consists in the lower part principally of shale, with lenses of sandstone and discontinuous thin coals and limestones. The upper portion of the Cherokee also consists principally of shale, but includes two or three persistent coal beds, and a few thin but persistent limestones, well developed in Lucas and Appanoose Counties. The deposits of the Henrietta Stage are noticeably basin-like or lens-like in character, and consist principally of shale, with some coal, very little sandstone, and a few fairly persistent thin limestones. Like the Henrietta, the Pleasanton Stage shows lens-like beds and a predominance of shale, with a few very thin discontinuous limestones, a few coal seams, and a considerable proportion of sandstone which may locally vary to conglomerate.

## USE OF THE SHALES

Shale, in its original condition is of little or no value to the road builder; in fact some of the poorest roads which the writer has seen are built on the soft clay resulting from the weathering of shale. However, the burning of shale and the crushing of the product as was formerly practiced by the C. B. & Q. Railroad in Monroe and other counties, gives a material which can be used in road surfacing.

Most of the Iowa coal contains a varying percentage of sulfur. On the waste piles at coal mines, which are composed principally of the shale and slate removed in mining the coal, there is found a varying proportion of coal, depending upon the efficiency of the mining methods. The sulfur present in the coal causes spontaneous combustion when exposed to the air, and there is usually enough coal in the waste pile so that the whole pile burns completely, though very slowly. The temperature on the inside of the pile usually reaches that in the ordinary brickkiln and the shale and slate are burned to a red color and a hardness approximating that of common brick. Such material, when crushed to the proper size is satisfactory for road surfacing work on roads with light or moderate traffic. Wherever, in Iowa, there are mines of large capacity, there are large potential supplies of this type of surfacing material. It has been used extensively and successfully in the vicinity of Centerville, Albia, Oskaloosa, and Des Moines, and to lesser extent in nearly all of the counties of the coal mining area.

## LIMESTONES OF THE DES MOINES SERIES.

Limestone of this age is nearly always found to be suitable for road surfacing work, and in many cases is of satisfactory quality for concrete aggregate, though usually not available in sufficient quantity to justify the erection of a plant for that purpose.

The upper portion of the Cherokee Stage furnishes in Lucas, Appanoose, and eastern Wayne Counties a number of very persistent limestones. These are usually from 1 foot to 5 feet thick, but one (known to miners as the 50-foot limestone, from its position at that interval above the most important coal seam), outcropping frequently in the vicinity of Centerville, is from 6 feet to 10 feet thick. It is available in limited quantity by stripping at several points in the central part of Appanoose County. At other points it is available by tunneling from the outcrop, though lack of a satisfactory roof above it makes such a procedure rather expensive.

A limestone of about 10 feet thickness appears at a few points in the northeast part of Adair County and has there been utilized for road surfacing work. The best information now available assigns this ledge to the Henrietta Stage of the Des Moines Series, though, in the writer's opinion, such a correlation is not yet positive.

#### SANDSTONES OF THE DES MOINES SERIES

These, where well developed, occupy well-defined channels cut into the shale, upon which they lie (unconformably.) Such channels are of large size, one in Marion and Jasper Counties having been traced for 11 miles length and 3 miles width, with a maximum thickness of at least 100 feet. Such sandstones are as a rule of too fine a grain to be useful as road material when broken down to their component particles, and not well enough indurated to be crushed and handled as are other crushed rocks. However, to this generalization there are exceptions, which are mentioned briefly below.

The sandstone in the above-mentioned channel in Marion County is well exposed at the town of Red Rock, at which place a considerable portion of it is well enough indurated to be usable, when crushed, for surfacing work. In the same channel are a few outcrops in southern Jasper County, which show a small amount of road material. A few miles northwest of Knoxville, there appears a bed of hard (almost quartzitic) coarse-grained sandstone, from 8 feet to 15 feet thick, and available by stripping in perhaps as much as 50,000 Cu. Yds. quantity. This stone is suitable for surfacing material, and may in part be usable for concrete aggregate. Similar material, grading locally into a calcareous conglomerate, outcrops at numerous points in Pleasant Twp. of Lucas County, and is apparently available there in large quantity (100,000 Cu. Yds. or more) by stripping. A limited outcrop of about 10 feet of hard quartzitic sandstone is known about 6 miles west of Fairfield.

#### CONGLOMERATES

The above-mentioned sandstones show veins which grade locally into conglomerate, and conglomerates of such origin become important enough in some cases to deserve separate mention. These rocks are in nearly all cases suitable for road surfacing work and in at least one case are known to be usable for concrete aggregate.

Near Melcher, in the southwest part of Marion County, there

may be seen a 12-foot ledge of hard and very firmly-cemented conglomerate, which is available in considerable quantity under light stripping. The component rock fragments are prevailingly of limestone, up to 6 inches in breadth, though sand grains occur with them. The matrix is siliceous and ferruginous. The material appears to be of suitable quality for concrete aggregate.

Conglomerates with a more ferruginous and clayey matrix, and therefore not usable as concrete aggregate, but yet of satisfactory quality for road surfacing work, appear and are available in limited quantity at the following points: two miles west of Knoxville; a few miles east of Moravia, Appanoose County; and at a few points south of Centerville. At these points the thickness of exposed conglomerate is 6 feet to 15 feet.

#### CONCLUSION

In concluding, it may be pointed out that the Des Moines Series, though not a source of abundant road materials, yet has possibilities for development. It is admitted that in nearly all cases, material usable for concrete aggregates is not available; on the other hand, the formation has already yielded considerable quantities for road surfacing work, and may easily yield a still larger amount. The trunk roads of Iowa are rapidly becoming paved, and there is every reason to believe that highway improvement will continue with the surfacing of the feeder roads, of rural mail routes, and of the farm-to-market roads. Consequently, any source of surfacing material, especially in southern Iowa, is worthy of careful investigation.

IOWA STATE HIGHWAY COMMISSION,  
AMES, IOWA.

