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MINERAL RESOURCE SURVEY
Circular No. 7

A mineral resource survey of Texas has been started by the Works Progress Administration, the Bureau of Economic Geology of The University of Texas acting as sponsor. The purpose of the survey is to assemble information and make it available to the public. Through a separate project, sponsored by the State Planning Board, the results of the survey, as they are received in Austin, are being assembled for publication. The mineral resource survey is helping in the location of mineral products, from some of which it is reasonable to suppose industries of value to the State may be developed. The following report is based on work in Limestone County.

REPORT ON ROAD METALS INVESTIGATION AS A PART OF A MINERAL RESOURCE SURVEY IN LIMESTONE COUNTY, TEXAS
by I. J. Broman, Supervisor

Limestone County has immediate need for road-making materials, and for that reason a considerable part of the time of the mineral resource survey in that county has been devoted to the study of occurrence of road metals. The principal natural road materials available are gravel, crushed limestone, and sand-clay mixture. A large part of the cost of road materials is transportation, and a special effort has been made to locate road materials as close as possible to the roads that are to be built.

The following roads in this county are either contemplated or in process of construction:

Eastern part of the county: Thornton to Oletha; Kosse eastward; and Personville to Leon County line.

Western part of the county: Groesbeck to Mart; Mexia to Watt; Coolidge to Hubbard; and Ben Hur to Groesbeck-Mart highway.

The county has two well-defined soil areas, one in the western part, the other in the eastern part of the county. The soil of the western belt is black and crumbly when dry and is gummy and sticky when wet. The soil in the eastern part of the county is in places very sandy, being almost impassible for motor traffic in dry weather. This part of the county likewise has local outcroppings of clay in which areas the soils are very slippery in wet weather. Separating these two principal soil areas is a narrow belt which has some of the characteristics of both zones. This belt, which overlies the outcropping margin of the Midway formation, trends through the county in a direction approximately N. 20°E. The sandy soils in the eastern part of the county are derived from the Upper Cretaceous formations.

By reason of these differences in soil and geologic conditions, the western and eastern parts of Limestone County have each their own special road-building problems. The black-land belt is characterized by joint clays which have a tendency to crack in dry weather and to slip, slide, and heave in wet weather. Even in areas having a large supply of surfacing materials, it is difficult to keep these materials in place and prevent them from creeping and slipping. Permanent roads may be constructed, however, throughout the black-land belt if the road beds are well drained and heavily ballasted and if reinforced concrete is used. Roads of this type are the only ones that have lasted under heavy traffic.

Western Limestone County

Limestone County is fortunate in having an abundance of road ballasting material in the Tehuacana limestone. This limestone, which is in the Kincaid member of the Midway formation, extends through the central part of the county in a northeast-southwest direction. The limestone as seen on the Tehuacana-Waco road in the northwest side of Tehuacana Hill is grayish-white, in places stained yellow and in other spots brown by water saturated by ferruginous matter. The rock is composed of a great mass of small and highly fragmental shell material cemented by calcite to form a coquina. Many of the shells are microscopic so that the rock viewed from a distance of a few feet has the appearance of a rather solid and non-fossiliferous ledge. Viewed under the hand lens, the small fragments comprise a mixture of finely broken shells, small ostracods, minute pelecypods, foraminifera, and other material. The rock is variable in texture and hardness. The limestone quarried at the dam site south of Mexia is of a steel-blue cast and is of a compactness and hardness equal to that of the hardest of the best Cretaceous limestones. This limestone has very irregular bedding, which has the appearance of imperfectly shaped lenses with earthy material filling the interstices. The absence of bedding planes and joints in some localities makes the stone somewhat difficult to quarry. The limestone has rather a high specific gravity. Concrete made of this stone has a crushing strength of 4000 pounds per square inch, as determined by a United States building inspector in Groesbeck. This exceeded the Government requirements by about 2000 pounds.

The crushing strength of this stone compared with that of some other limestones is as follows:

	Pounds per square inch
Austin chalk	3933
Georgetown limestone	4790
Edwards limestone	6357
Tehuacana limestone	5700

The above test shows that the Tehuacana limestone can be used with good results in concrete, and if provided with a proper binder will make a good road-surfacing material.

Availability and occurrence.—The Tehuacana limestone outcrop forms a westward-facing escarpment along a line extending from Tehuacana on the north through Big Hill on the south and into Falls County. A second line of outcrop to the east extends south from Mexia to a point about 2 miles west of Groesbeck. This second line of outcrop is the result of an upthrow by faulting. The outcrop is about 25 miles long in Limestone County and extends in a northeast-southwest direction. The average width of the Tehuacana outcrop is about 2 miles. The thickness of the formation as measured in outcrop and as found in well logs is from about 25 to 200 feet. Several favorable quarry sites are present where the installation of a plant, operating on the gravity principle, could be utilized. The maximum hauling distance from the outcrop of this limestone westward is less than 20 miles.

Quantity.—On the basis of length, thickness, and width of outcrop, there is a minimum of 1 billion cubic yards of the Tehuacana limestone available for use for road ballast and general building purposes, concrete, and other purposes. Inasmuch as there are no gravels for road surfacing purposes in western Limestone County, the availability of this limestone answers the need of, and demand for, road building material for all time to come.

Eastern Limestone County

The eastern part of the county has a light sandy soil and rapid drainage, making the road building problem chiefly that of surfacing. In this part of the county, in addition to Tehuacana limestone, gravels, sands, and clays are available.

In Limestone County, gravels are very limited in quantity. Both banks of Navasota River were carefully explored, but only deposits of small size were discovered. The reason for this may be that Navasota River is a shorter river, rising in the northern part of the county, and does not reach inland to the Lower Cretaceous and older formations. Some evidence of a recently drained lake of considerable size is seen above the dam now being constructed west of Doyle. The facts that the river has its source within the county, that it is a short stream, and that it was represented in Pleistocene time by a very imperfectly developed drainage system may account for the absence of extensive gravel deposits.

The deposits of gravel found are the following:

Locality	Quantity—cubic yards
Jim McClintic farm, about 3 miles east of Groesbeck	5,000
Eva Anglin farm, about 2 miles east of Groesbeck	15,000
Bennett Jackson farm, about 2 miles east of Groesbeck	Very little
Big Creek, south of Personville	5,000
Jim Lindley farm, 2½ miles west of McKinzie Bridge	10,000
Total	35,000

In addition to the above mentioned deposits, a thin mantle of gravel covers the uplands in the vicinity of Big Creek south of Personville, as well as in the vicinity of the Anglin and Jackson pits. Fifteen thousand cubic yards of this gravel can be recovered if removal of the timber is not too expensive. The gravel ranges from a few inches to a foot in thickness.

The Bennett Jackson gravel is almost depleted, and on the Eva Anglin farm a large portion has been removed. The gravel is composed of chert with a considerable number of metamorphic pebbles, which indicates that they are of the same origin as the gravels of the streams farther south. The gravel in this section is usually imbedded in a clay matrix containing some sand. This clay matrix forms a natural cementing and binding material for the pebbles and the sand makes the mixture remain drier and harder, thus furnishing a very good surface dressing for roads. It is unfortunate that so little of this mixture is available for road material. It is estimated that enough gravel is present on the McClintic, Anglin, and Jackson farms to surface the streets of Groesbeck.

The proposed highway from Personville to the Leon County line is to be built on an abandoned railroad grade between Mexia in Limestone County and Jewett in Leon County. This will prove to be of great advantage since the railroad bed is in excellent condition and will require very little additional ballasting or surfacing. Gravel deposits on Big Creek south of Personville can be utilized for any additional material needed.

The proposed highways from Thornton to Oletha and from Kosse eastward are practically without gravel deposits from which to draw material. The natural soil which is of sand and clay will in a large measure compensate for this lack, if properly utilized. Near the mid-point of these proposed highways, there are extensive deposits of ferruginous clays from 10 to 15 feet thick. These clays mixed with the proper proportion of sands form a hard surface road passable under all weather conditions, and such a road can be maintained at a very low cost. If harder surfacing material is desired, a very good exposure of Tehuacana limestone is available about 4 miles west of Thornton. This rock could be crushed and hauled profitably since the maximum distance is not over 15 miles. The building of good secondary roads in the eastern half of the county is much less expensive than in the western half since utilization of the clays and sands native to the area gives satisfactory results.

Experiments should be conducted to determine the best admixture of sand and clay to use. Red clay mixed with a small amount of sand seems to make the best roads.