Investigation of Aggregate Occurrence in Logan County, Kentucky

George R. Laughlin
Kentucky Highway Materials Research Laboratory
MEMO TO: Henry Ward
Commissioner of Highways

As requested in your memorandum of September 12, we have conducted an extensive series of tests on the natural sand produced by Kapco Construction Company in Logan County. There was some question regarding the classification of the sand -- whether it would be termed a manufactured, a crushed conglomerate, or a natural sand. I had Mr. George R. Laughlin, Geologist of the Research Division, visit and inspect the pit. A copy of Mr. Laughlin's report to me is attached for your file. He reports that the material being produced is a washed, natural sand and similar in production procedure to pits operating in Carroll, Gallatin and Boone Counties.

We have made two series of concrete mixes in addition to the routine tests on the sand. We find that the Logan County natural sand has somewhat higher water requirements than the Ohio River sand with which we were making our comparison mixes. For the Class A, Type A (non-air-entrained) an additional 0.45 gals. of water per sack of cement was used. For the Class A, Type D (air-entrained) 0.33 gals. of water per sack of cement was added. Both mixes were within our specification requirement of six gallons of water per sack of cement.

Regarding your question as to the reasons for increased water requirements, there are several possibilities that may be noted:

1. The Logan County sand has a somewhat longer size distribution range within the specification limits. The Ohio River sand has the majority of particles between the No. 16 and No. 50 screens.

2. The Ohio River sand particles appear to be somewhat more rounded than the Logan County sand.
3. The surface texture of the Logan County Sand particles appears to be somewhat rougher than the Ohio River Sand.

We have made a series of concrete beams for freeze-and-thaw durability testing. These beams are still under test and are not showing any signs of deterioration. We see no reason to question the sand on this basis.

On the basis of all tests performed, it appears that the Kapco, Logan County, natural sand would be satisfactory to use in Class A concrete and meets all the requirements for natural sand for cement concrete, Section 7.3.2, 1956 Standard Specifications. I am attaching a copy of Mr. R. D. Hughes' memorandum report to me on the sand evaluation.

Respectfully submitted,

W. B. Drake
Director of Research

WBD:dl
Encs.
cc: A. O. Neiser
    J. A. Bitterman
MEMORANDUM

TO: W. B. Drake
   Director of Research

FROM: George R. Laughlin
       Research Engineer Associate

SUBJECT: Investigation of Aggregate Occurrence
         in Logan County, Kentucky

On November 7, 1962, granular aggregate deposits in northern Logan County were investigated by Mr. David Arnall of the Division of Materials and Mr. George R. Laughlin of the Division of Research.

The granular deposit has a thickness up to fifty feet. It occurs from 150 to 200 feet above the Mud River basin and caps the hills surrounding this basin. The aggregate is overlain by soil overburden up to eight feet thick. It is underlain by five or more feet of light green plastic clay. Whether this aggregate deposit is the result of fresh water deposition or marine deposition was not established due to a lack of fossils. If marine deposited, it represents erosional remnants of basal Pennsylvanian deposition. If fresh water deposited, it represents abandoned channel fill or flood plain deposits similar to granular deposits in the Purchase Area or glacial outwash deposits bordering the Ohio River.

This deposit consists of sand and gravel lenses with the fine aggregate content ranging from thirty percent to seventy percent of the whole. The class limits range from very fine sand size up through material retained on the 1/2-inch sieve. This is a mature deposit in that the material in all the class limits consists wholly of quartz grains.

For comparison with Ohio River sand and Rockcastle County sand, the dry bulking test determining the characteristics of fine aggregate was performed (See "Limestone Fine Aggregates in Portland Cement Concrete" by George R. Laughlin). The Ohio River sand had a void content of 45; the Logan County sand has a void content of 48; and the Rockcastle County sand had a value of 52. The highest recommended value for use in Portland cement concrete is 53, and 45 is the ideal value.
As stated in the Department of Highways' Standard Specification, Section 3, Article 7.3.1: Natural sand shall be the fine granular material resulting from the natural disintegration of silicious rock. Since this aggregate deposit is composed of quartz which is the unaltered product of natural disintegration of silicious rock (igneous parent rock in this case), this material is classed as natural sand.

The operations in this material at present consists of removing the overburden with a tractor-dozer. Excavating and loading are accomplished with the tractor-dozer and a tractor-loader. The "Eagle" sand plant is composed of a spiral screw, water scalping-classifying tanks, and a screen to remove material above the sand size. Three ponds supply water for the washing and classifying operations. The finished product consists of clean granular quartz grains which are sub-rounded to rounded in shape.

George P. Laughter