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AN INVESTIGATION OF SANDS ON THE UPLANDS ADJACENT TO THE SANGAMON RIVER FLOODPLAIN: POSSIBILITIES AS A "BLEND SAND" RESOURCE

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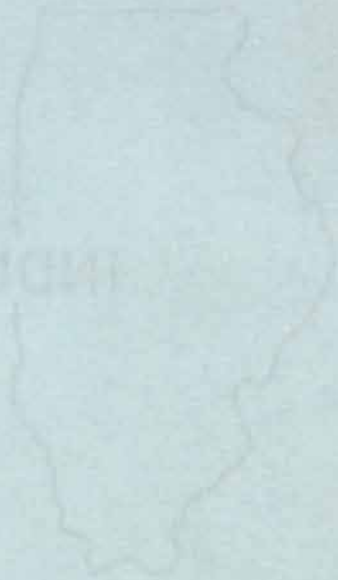
ABSTRACT

An investigation of the sands on the uplands adjacent to the Sangamon River floodplain in Macon and Christian counties was made to determine the possibility of their use as a "blend sand." "Blend sand" specifications require that 30-90 percent pass the U. S. Standard number 80 sieve. With the exception of sands from one locality, the samples tested do not have adequate material passing the number 80 sieve to meet specifications; in the other localities, the amount of material passing the number 80 sieve ranges from 9 to 37 percent.

The distribution of these sands both north and south of the river and detailed size analyses suggest that most of these sands were initially deposited by water and later reworked by wind. Redistribution by wind, which tends to concentrate fine sand, has apparently been most effective on the south side of the river, where some "blend sand" has been found. Further exploration for material of "blend sand" quality in this area should be concentrated on the upland south of the Sangamon River floodplain, in particular on conspicuous topographic highs and in general on ridges and hills away from the edge of the upland.

Previously published Illinois State Geological Survey reports on feldspar-bearing sands in Illinois show that many of the localities described in them may serve as sources of "blend sand."



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INTRODUCTION

"Blend sand," FA-10 in the "Standard Specifications for Road and Bridge Construction" (State of Illinois, 1968), is one of the important constituents of bituminous mixtures ("asphalt") used in road surfacing. The grade of sand actually used in making this material for paving must meet FA-3 specifications. Because this grade, which includes particle sizes from approximately .07 mm to 5.0 mm, does not occur as a natural deposit, it must be produced by mixing "blend sand," FA-10, with "torpedo sand," FA-1. The size specifications for the three sands are given in Table 1.

TABLE 1—SPECIFICATIONS OF SANDS USED IN BITUMINOUS MIXTURES

U. S. Standard Sieve Number	"Blend sand" FA-10	"Torpedo sand" FA-1	"Asphalt sand" FA-3
	Percent passing		
3/8		100	100
4		94-100	94-100
10	100		65-95
16		45-85	
40	80-100		30-70
50		3-29	
80	30-90		10-40
100		0-10	
200	0-14		0-6

The sand and gravel producers operating in the Sangamon River valley-train deposits rarely encounter material with more than 5 percent

in the fraction finer than that which passes the U. S. Standard number 80 sieve, and it is rare that more than 30 percent passes the U. S. Standard number 40 sieve. On the other hand, the aggregate from most of the pits has a natural gradation that is frequently very close to that required for "torpedo sand" (table 2). Because all the finer size fractions (less than U. S. Standard number 40 sieve) at the pit are needed to produce "torpedo sand," there is little sand remaining to produce FA-10, "blend sand." Because of an accelerated road building program in the area of study, located between Decatur and Springfield (figure 1), a heavy demand for "blend sand" exists there; thus, it would be desirable to locate in this area readily accessible materials that meet the FA-10 specifications.

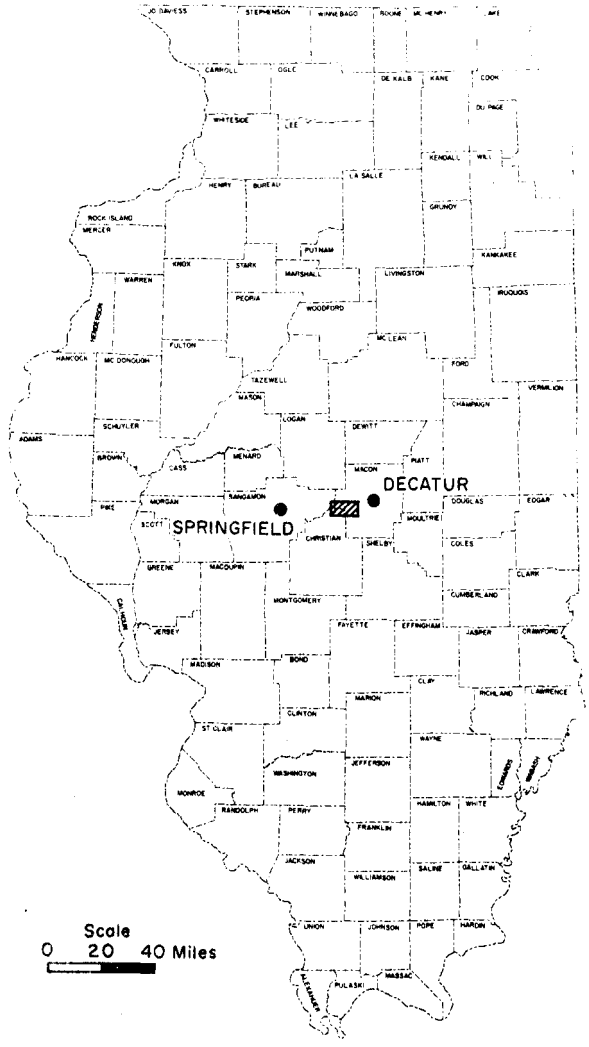


Fig. 1—Location map of "blend sand" study area.

An abundant supply of clean sand occurs on the uplands proximal to the Sangamon River floodplain in Macon and Christian counties west of the Shelbyville Moraine. For this study, these sands were mapped, sampled, and analyzed for the purpose of determining the feasibility of their use as a "blend sand."

Up to the present, there have not been any published reports pertaining directly to "blend sand" in Illinois; however, Littlefield (1925) and Willman (1939), in reporting on molding sand resources of Illinois, described sands that have size characteristics similar to those specified for "blend sand." In a report on feldspar in Illinois sands, Willman (1942) presented size analyses which indicate that many localities may serve as resources for "blend sand." The "blend sand" producers presently operating in Illinois are listed in "Sources and Producers of Aggregates for Highway Construction in Illinois" (State of Illinois, 1970).

Methods of Study

The sand deposits in Macon County were originally mapped by Hester and Anderson (1969) by using topographic maps and a hand auger. To determine

TABLE 2—PARTICLE-SIZE ANALYSES OF LESS THAN 4-MESH FRACTION FROM LOCALITIES IN THE SANGAMON RIVER VALLEY IN MACON AND SANGAMON COUNTIES

U.S. Standard Sieve No.	Sangamon Valley Sand and Gravel		Springfield Sand and Gravel		Clear Lake Sand and Gravel		Buckhart Sand and Gravel		Macon County Sand and Gravel		Johnson Sand and Gravel	
	A*	B*	A	B	A	B	A	B	A	B	A	B
8	12.6		8.2		11.0		15.7		7.8		14.6	
10	6.3		4.8		6.8		9.1		4.0		7.3	
16	6.0	75.1	5.3	81.7	7.9	74.3	10.4	64.8	13.8	74.4	20.0	58.1
40	30.8		32.5		29.7		39.4		27.6		32.7	
50	20.3	24.1	19.8	29.4	17.1	27.6	10.8	14.6	24.4	22.4	15.4	10.0
80	16.6		20.7		21.6		9.6		14.6		5.4	
100	2.3	5.2	4.3	4.4	3.2	2.8	1.7	3.3	2.6	5.2	1.1	3.5
200	2.6		2.9		1.8		1.5		2.6		1.3	
Pan	2.6		1.5		1.0		1.8		2.5		2.1	
Total	100.1		100.0		100.1		100.0		99.9		99.9	

* The percent retained is given in column A under the name of each locality. The percent passed, presented in column B, illustrates the adaptability of the aggregates to "torpedo sand," FA-1 ("Standard Specifications for Road and Bridge Construction," State of Illinois, 1968).

the "blend sand" possibilities along the Sangamon River for this study, samples were collected with the Illinois State Geological Survey's Giddings drill. Relatively undisturbed in-place sand was obtained with a 2-inch inside diameter soil-coring tube. A hand-operated 3-inch inside diameter sand sampler was used in areas inaccessible to the drill rig. The samples were dried, weighed, and screened on U. S. Standard 8-inch sieves. Only the numbers 10, 40, 80, and 200 sieves are needed to determine the usefulness of these sands as "blend sands."

DESCRIPTION OF THE AREA

The study area lies along the Sangamon River approximately 10 miles west of Decatur (figure 1). The sand deposits, of Wisconsinan age, occur as irregular hills and ridges on the uplands adjacent on both the north and south to the Sangamon River floodplain (figure 2). Power-auger test holes show that the material on the uplands is thickest adjacent to the river and that it becomes thinner away from the river. Six auger test holes bored into the hill in the SW¼ of sec. 15 and the NW¼ of sec. 22, T. 16 N., R. 1 W. (figure 3), illustrate the thinning of the deposit in a northerly direction away from the river. The cross section of this area (figure 3) demonstrates that the thickness of the sand corresponds in general to the difference between the elevation of the hill (615 feet) and the elevation of the plain to the north (approximately 600 feet. See figure 2.) The maximum thickness of sand penetrated in sec. 22 was about 20 feet (figure 3).

The power-auger hole 1 near the center of sec. 30, T. 16 N., R. 1 E., starting at an elevation of approximately 595 feet, showed 2 feet of silt overlying a total thickness of 12 feet of sand. Test hole 2, hand-augered in the same section, started at an elevation of 610 feet and revealed 5 feet of silt overlying sand of a thickness greater than 4 feet. Although this locality was inaccessible for a deep test with the drill rig, the total thickness of sand is believed to be at least 20 feet.

On the south side of the Sangamon River, sand in varying thicknesses was encountered in all of the test holes. Hole number 8, NE¼ SW¼ sec. 27, T. 16 N., R. 1 W., was power-augered in a topographic high which stands 10-15 feet above the surrounding land surface (figure 2). The presence of 8 feet of sand underlying 3 feet of silt illustrates that the sand and overlying silt thickness reflect the hill's topographic relief. Test hole 4, NW¼ NW¼ NW¼ sec. 22, T. 16 N., R. 1 W., was made in a hill that stands approximately 25 feet higher than the general level of the upland to the south. The total sand thickness at the test hole site is 23 feet. In general, we believe that the thickness of sand in a hill known to contain sand is the difference between the elevation of the hill and the elevation of the surrounding plain.

SIZE ANALYSIS

Sand samples for textural analysis were collected from twelve localities (figure 2). The data appear in table 3. Logs on all test holes appear in the index. The specifications outlined for "blend sand" require that 100 percent of the material pass the U. S. Standard number 10 sieve, 80-100 percent pass the U. S. Standard number 40 sieve, 30-90 percent pass the U. S. Standard number 80 sieve and 0-14 percent pass the U. S. Standard number 200 sieve. All 19

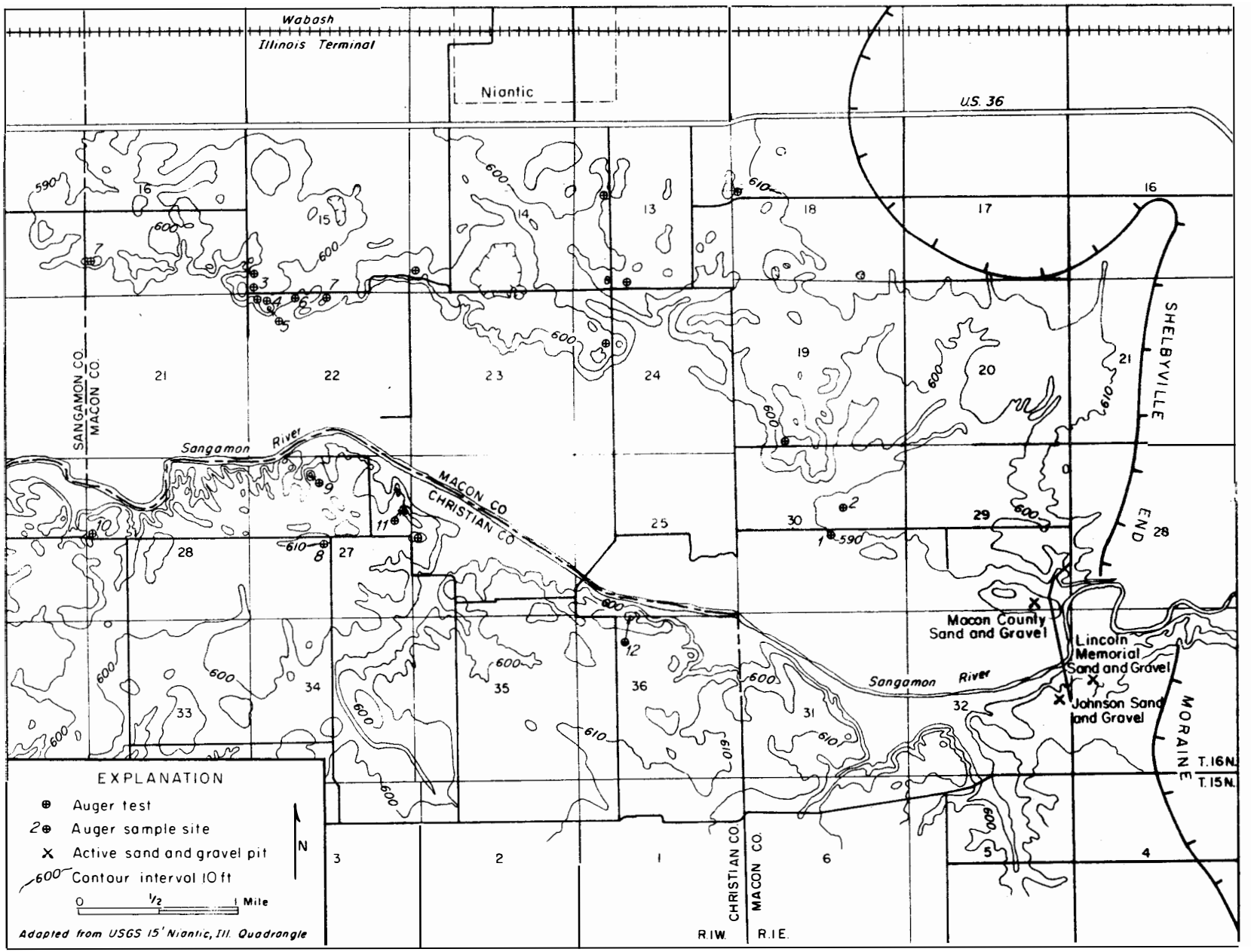
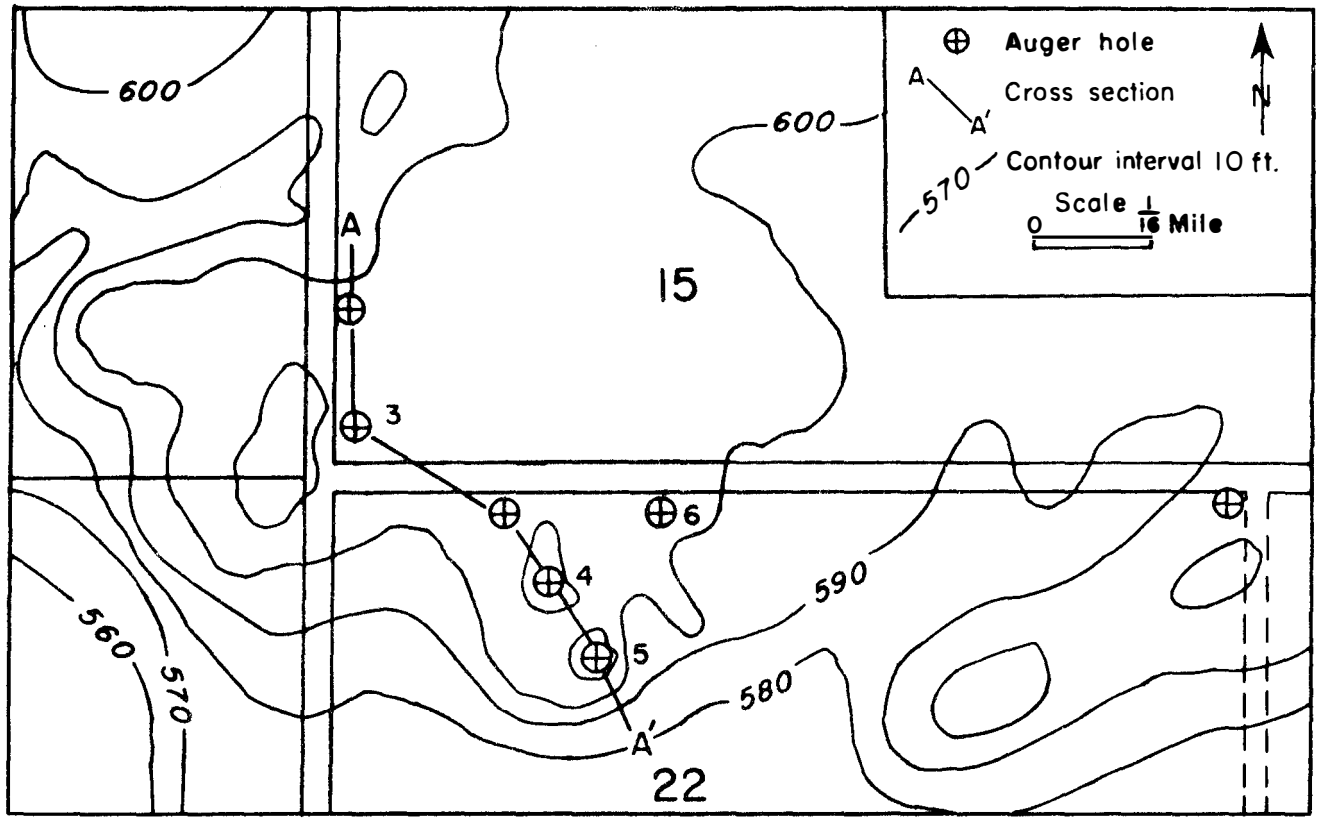


Fig. 2. Topographic map of study area locating hand-auger and power-auger tests and sample sites. Logs of the auger tests are given in the index, p. **10**.



Cross section A–A'

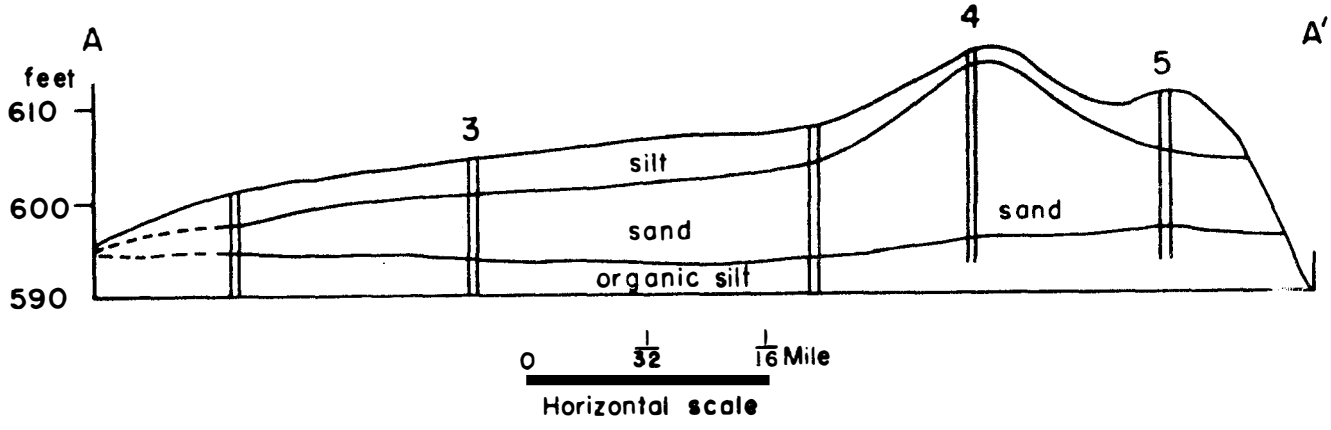


Fig. 3. Detail of sand hill in secs. 15 and 22, T. 16 N., R. 1 W., including test-auger locations and cross section A-A'.

samples analyzed meet the requirements for the U. S. Standard sieves, numbers 10, 40, and 200. However, in most of the samples, less than 30 percent passed through the U. S. Standard number 80 sieve; the amount passing ranged from as little as 9 percent to a maximum of 37 percent.

DISCUSSION

Sand in varying thicknesses was encountered in nearly every test hole along the river uplands. Generally, sand of the greatest thickness was associated with the topographic highs on the uplands adjacent to the Sangamon River floodplain. An overburden of 1 to 5 feet makes the sands easily accessible for exploitation. However, the sands in nearly every area tested are too coarse to meet the present requirements for "blend sand." Only site number 9 (table 3) on the south side of the river meets the size specifications.

Material of "blend sand" quality is present in the area; however, it obviously does not occur commonly. As an aid to further exploration for this material, an understanding of the mode of deposition of the upland sands would be advantageous. There are two alternative initial depositional agents, wind or water. From observations made on the distribution of this material, it is not readily apparent which is the medium of deposition. However, the presence of sand in hills on the uplands both to the north and south of the river floodplain, a paucity on the north of sand deposits showing preferred orientation, and the occurrence of very coarse sand in the lower portion of many of the sand hills suggest that water rather than wind was the main initial depositional agent.

A possible explanation of the origin of these sands is that a much larger volume of water came from melting glaciers on the east than could be passed by the constriction 10 miles west of the Sangamon-Macon County border in the Sangamon River valley near Roby, Christian County, sec. 23, T. 15 N., R. 3 W., which caused the Sangamon River to overflow its banks. This condition allowed the fine- to medium-grained sand that was carried by floodwaters as a traction and suspension load to be deposited on the uplands immediately adjacent to the river. The formation of natural levees by this mechanism is quite common on many of the large rivers, for example, the lower Mississippi. Although some of the sand may have been initially carried to the uplands by wind, water is considered to be the depositional agent responsible for most of the sand found in this area.

Subsequent reworking of these deposits by wind, blowing mainly from the northwest, has been an effective mechanism for the final distribution of the sand, particularly on the south side of the river. The wind has developed higher hills, reoriented some ridges, and shifted finer sand to the south and southeast, generally away from the river. It is therefore suggested that further exploration for "blend sand" be concentrated on the upland south of the Sangamon River floodplain, in particular on the conspicuous topographic highs like the hill sampled in sec. 27, T 16 N., R. 1 W. (figure 2), and in general on ridges and hills away from the edge of the upland.

TABLE 3—SIEVE ANALYSES OF SANDS FROM MACON AND CHRISTIAN COUNTIES

(Site numbers appear on figure 2.)

Site Number	Sample Number	Location ¼ ¼ ¼ Sec.	T.	R.	Depth in feet	U. S. Standard Sieve No. wt % passing 10	40	80	200
1	1a	NW NW SE 30	16N	1E	5-6	100	93	23	3
	1b				8-10	100	95	29	4
	1c				10-12	100	90	27	7
2	2	NE SW NE 30	16N	1E	6½-7½	100	86	21	1
3	3a	SW SW SW 15	16N	1W	4-6	100	81	19	4
	3b				10-11	100	90	21	6
4	4a	NW NW NW 22	16N	1W	1-4	100	76	9	2
	4b				4-7	100	81	12	2
	4c				7-9½	100	87	16	2
	4d				10-12	100	93	22	2
	4e				12-15	100	93	25	6
	4f				15-17	100	87	18	5
	4g				17-19	100	92	23	8
5	5	NE NW NW 22	16N	1W	3-4	100	90	10	2
6	6a	NW NE NW 22	16N	1W	6-8	100	89	11	2
	6b				8-10	100	91	16	3
	6c				10-12	100	88	13	3
7	7a	NW SW SW 16	16N	1W	3-5	100	91	21	4
	7b				5-7	100	90	22	2
	7c				7-9	100	94	24	4
	7d				11-12	100	87	13	3
8	8	NE NE SW 27	16N	1W	6-8	100	88	18	2
9	9a	NE NE NW 27	16N	1W	3-6	100	89	19	5
	9b				6-9	100	94	37	14
	9c				9-12	100	92	30	5
	9d				12-15	100	94	30	5
	9e				15-18	100	93	29	6
	9f				18-21	100	94	28	5
	9g				21-23	100	97	50	24
10	10a	SW SW NW 28	16N	1W	5-6	100	84	16	2
	10b				9-10	100	82	15	3
	10c				12-13	100	86	25	5
	10d				14-15	100	96	22	2
11	11	NE SE NE 27	16N	1W	3-4	100	84	10	1
12	12	NW NE NW 36	16N	1W	3-4	100	82	12	1

CONCLUSIONS

This investigation has found that there is an abundant supply of clean medium-grained sand in this area. A thin overburden averaging 3 feet and an adequate number of roads in the area make it easily available for exploitation, and an immediate need of "blend sand" in the Decatur-Springfield area provides a ready market. However, the sand does not meet the present specifications for "blend sand," FA-10, outlined in "Standard Specifications for Road and Bridge Construction" (State of Illinois, 1968). In general, the sand is too coarse in that not enough material is retained on the U. S. Standard number 80 sieve. If further exploration for "blend sand" is carried out, it is suggested that the investigation be concentrated on the upland south of the Sangamon River floodplain, in particular on the conspicuous topographic highs and in general on the ridges and hills away from the edge of the upland.

REFERENCES

Hester, N. C., and R. C. Anderson, 1969, Sand and gravel resources of Macon County, Illinois: Illinois Geol. Survey Circ. 446, 16 p.

Littlefield, M. S., 1925, Natural-bonded molding sand resources of Illinois: Illinois Geol. Survey Bull. 50, 183 p.

State of Illinois, Dept. of Public Works and Buildings, Div. of Highways, 1968, Standard specifications for road and bridge construction: State of Illinois, Dept. of Public Works and Buildings, Div. of Highways, 334 p.

State of Illinois, 1970, Sources and producers of aggregates for highway construction in Illinois: State of Illinois, Dept. of Public Works and Buildings, Div. of Highways, Bull. 23, 87 p.

Willman, H. B., 1939, Fine-grained molding sand resources of northern Illinois: Illinois Geol. Survey Rept. Inv. 57, 53 p.

Willman, H. B., 1942, Feldspar in Illinois sands; a study of resources: Illinois Geol. Survey Rept. Inv. 79, 87 p.

INDEX OF AUGER HOLES

Location ¼ ¼ ¼ Sec. T. R.	Sample site number	Total thickness (in feet) overburden	sand
SW SW NW 18 16N 1E		no sand	
SE SE SW 19 16N 1E		6	3
NE SW NE 30 16N 1E	2	5	4+
NW NW SE 30 16N 1E	1	2	12
SE SW NW 13 16N 1W		no sand	
NW SW SW 14 16N 1W		5	4
NW SW SW 15 16N 1W		3	3
SW SW SW 15 16N 1W	3	0	11
NW SW SW 16 16N 1W	7	0	13
NW NE NW 22 16N 1W	6	3	12
NE NW NW 22 16N 1W		9	7
NW NW NE 22 16N 1W		no sand	
NW NW NW 22 16N 1W	4	1	18½
NE NW NW 22 16N 1W	5	6	8
NW NE NW 24 16N 1W		4	3
NW SE NW 24 16N 1W		6	3
NW NW SW 26 16N 1W		5	4
NE NE SW 27 16N 1W	8	3	8
NE NE NW 27 16N 1W	9	0	23
NE SE NE 27 16N 1W	11	0	9+
SW SW NW 28 16N 1W	10	3	11
NW NE NW 36 16N 1W	12	3	3+

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