REPORT OF SUBCOMMITTEE
USE OF PORTLAND CEMENT IN SOIL STABILIZATION

W. H. MILLS, JR., *Chairman*

CONDITION SURVEY OF SOIL-CEMENT ROADS

SYNOPSIS

The Subcommittee on the Use of Portland Cement in Soil Stabilization circulated a questionnaire to all State highway departments designed to yield information on the design, construction, maintenance and serviceability of soil-cement base courses with bituminous wearing surfaces Special attention was given to the following items·

(1) Climatic conditions, (2) Design of roadway, (3) Types of soil in base and subgrade, (4) Cement content, (5) Construction methods, (6) Weather condition during construction, (7) Type and condition of wearing surface; and (8) Traffic and maintenance

Replies were received from 46 States, 23 reporting on a total of approximately 200 miles. The other 23 States did not construct any soil-cement projects Mississippi reported the longest project which is 23 8 mi long but most of the projects are less than 2 mi in length

Cement quantities varied between 3 5 and 14 per cent depending on the type of soil, the best soils required low cement factors and it is increased with the clay content In a few instances, however, high cement factors have been used with fine sandy material probably due to the organic matter in the soil

All projects under traffic have been surfaced with some type of bituminous wearing course These courses vary considerably but generally they are an armor coat type or mixed-in-place type approximately ½ in to ¾ in thick Tar has been most extensively used as the prime material and several States report scaling where no prime has been used

The soil-cement bases are rated as follows: "Excellent" 44, "Good" 17, and "Fair" 3. None is rated as "Poor" The wearing surfaces are, in general rated lower than the bases and on 4 projects the surfacing is classed as "Poor".

The sub-committee on the Use of Portland Cement in Soil Stabilization has had for its major project during 1940 a condition survey of soil-cement projects constructed by highway departments. The data were collected by means of questionnaires sent to individual states by members of the sub-committee.

As the serviceability of a project is determined by many factors which are variable on each project the questionnaire asked for very comprehensive information on the following items:

1. Climatic Conditions
2. Design of Roadway
3. Types of Soil Treated
4. Types of Subgrade Material
5. Construction Methods
6. Weather Conditions During Construction
7. Type of Wearing Surface
8. Condition of Wearing Surface
9. Maintenance
10. Traffic

The primary purpose of the survey was to determine the conditions of the soil-cement bases but it is impossible to separate entirely the condition of the base and the condition of the wearing surface. Base failures will cause failures in the surface course but an inadequate or poorly constructed wearing surface may give a general impression that the project is bad when in reality the base may be giving excellent service. For these reasons an attempt was made to obtain information on the condition of the base and wearing course separately.

The conditions of the projects were divided into the following classifications: Excellent, good, fair, poor and very poor. In most instances the condition is ex-

pressed as a percentage of the total area of the project and where such data could be obtained the following limits were used for the various classifications:

	Percentage of Total Area
Excellent	Less than 1
Good	1 to 5
Fair	5 to 15
Poor	15 to 30
Very Poor	Over 30

The committee realizes that these percentage ratings are purely arbitrary and are open to any amount of argument. Some engineers will no doubt believe that a project having 1 per cent defective areas should not be rated as in "excellent" condition. There are probably others who would judge a project to be in "excellent" condition with considerably more trouble present than is indicated by this figure. The figures were set to conform with the ratings by a number of engineers of several projects which have been under traffic for sometime

It is necessary, of course, to arrive at an "Overall" rating of a project which contains several types of defects. For instance, an area that has failed completely so that it must be removed or rebuilt is far more serious than an area from which the surfacing has scaled off but where the base is firm and intact. In order to arrive at an "Overall" rating of a project, failed areas were assigned a value of 80 per cent, areas of deep ravel or softening to a depth of $\frac{3}{4}$ in. to $2\frac{1}{2}$ in. were considered at 15 per cent and areas of very thin ravel or surface scale were considered at 5 per cent. For instance, if a project contains 1 per cent failed areas, 10 per cent areas of deep ravel or softening and 20 per cent of surface ravel or scale, the "Overall" rating of the project would be obtained by multiplying the per cent of defective area by the assigned value and adding these results. In the example just quoted the sum is 3.3 per cent and the rating of "Good" would apply. In addition to the numerical ratings, data were also collected on the workmanship because many of the projects were constructed by personnel having their first experience with soil-cement work. Very often defects can be traced directly to improper or inadequate procedures during construction. Reports were not requested on projects less than one year old as it is believed that such projects have not been in service long enough to give worthwhile information.

SUMMARY

Replies to the questionnaires have been received from 46 states, 23 reporting a total of 68 projects aggregating approximately 200 miles. The other 23 states have not constructed any soil-cement projects. Mississippi reported the longest project, 23.8 miles, but most of the projects are less than 2 miles in length.

Cement quantities have varied between 3.5 and 14 per cent depending on the type of soil; the best soils required low cement factors and it is increased with the clay content. In a few instances, however, high cement factors have been used with fine sandy material probably due to the organic matter in the soil.

All projects under traffic have been surfaced with some type of bituminous wearing course. These courses vary considerably but generally they are an armor coat type or mixed-in-place type approximately $\frac{1}{2}$ to $\frac{3}{4}$ in. thick. Tar has been most extensively used as the prime material and several states report scaling where no prime has been used.

Of the 68 projects on which complete reports were received the soil cement bases are rated as follows: "Excellent" 44, "Good" 17, "Fair" 3, and 4 lacked information for proper rating. None was rated as "Poor". In general, the rating of the bituminous wearing surface was lower than the rating of the base.

MATERIALS DATA ON SOIL-CEMENT PROJECTS

1/ Number	State & County	Official Designation	Length of Project Miles	Age of Project Years	Soil Data for Soil Processed: PI	LL	Gradation: % Retained on Sieve No 4	% Retained on Sieve No 10	Sand Coarse %	Sand Fine %	Silt %	Clay %	Data on Soil-Cement Mixture: Cement Content by Volume %	Cement Content by Weight %	Density Laboratory #/cu ft	Density Field* #/cu ft	Moisture Lab Optimum %	Moisture Field** %	Moisture Surface***	Type of Soil in Subgrade
ARK 1	ARK WOODRUFF CO.	HI63 RT#33	1.877	1.25	16	32	23	28	22	16	26	36	10	9.6	106.8	103	13.5	13.0	13.5	A-4
					26	45	17	22	–	–	–	–	12	13.3	106.2	97.5	16.0	18.5	16.0	A-7
					5	22	16	25	31	16	29	24	8	7.1	113.3	106	12.0	13.7	12.0	A-2
					6	28	0	6	5	23	51	15	11	10.9	108.4	–	17.0	–	17.0	A-4
ARK. 2	ARK - MISSISSIPPI CO	10225 RT#77	2.745	1.50	0	17	0	0	53	36	8	3	10	9.2	111.6	119	12.5	12.0	12.5	A-3
					0	18	24	34	29	40	20	11	8	8.9	112.0	114	12.7	12.6	12.7	A-3
ARIZ. 1	ARIZ - COCHISE CO	VS 666 114G	1.52	0.5	1	24	–	–	28	44	18	–	10 12	9.2-11.1	114.0	107	14.0	14-16	11-16	A-2
CAL 1	CAL. - SISKIYOU CO.	II SIS 72B	3.00	2.5	0	22	0	5	31	49	9	4	9	8.6	115	106	13.5	14-16	10-15	A-2
					–	–	0	2	28	59	7	2	9	8.6	115	106	13.5	14-16	10-15	A-2
					–	–	0	3	25	59	8	3	9	8.6	114	106	13.5	14-16	10-15	A-2
					–	–	6	2	32	46	12	3	9	8.6	115	106	13.5	14-16	10-15	A-2
CAL 2	CAL - CONTRA COSTA CO.	IV CC 108C	3.35	1.25	1	20	0	1	17	57	17	4	8	–	117	110	10.5	10-12	10-18	A-2
					12	37	21	22	3	24	33	9	8	–	110	95	16.0	18-20	10-18	A-5
					9	30	0	0	2	63	28	7	8	–	111	95	15.0	16-20	10-18	A-2
					4	21	0	2	17	42	21	10	8	–	123	109	10.0	10-13	10-18	A-2
CAL. 3	CAL - KERN CO.	VI KER 33 A	1000	3.00	16	38	42	46	5	24	13	6	–	5.1	129	121	12	12	13	A-4
					–	–	51	59	6	14	18	6	–	5.1	129	121	12	12	13	A-4
					–	–	49	57	7	20	7	5	–	5.1	129	121	12	12	13	A-4
CAL-4	CAL - KERN CO	VI KER 139A	1000	2.75	–	–	0	1	23	58	12	4	9	7.7	118.5	110	12	12-14	12	–
					–	–	0	1	17	62	13	4	9	7.7	118.5	110	12	12-14	12	–
					–	–	0	1	15	54	16	6	9	7.7	118.5	110	12	12-14	12	–
GA. 1	GA. - CLARK CO.	1502A	2.000	2.33	1	51	0	0	36	24	15	25	10	–	104	–	16	16	–	A4-5
					0	47	0	0	37	24	17	22	10	–	94	–	21	21	–	A4-5
					0	58	0	0	48	25	9	18	10	–	107	–	17	17	–	A4-5
					3	37	0	0	42	21	9	28	10	–	103	–	17	–	–	A4-5
GA 2	GA - JEFFERSON CO	1648	3.725	1.00	12	28	0	0	28	39	5	28	10	–	117.3	123	12.5	15.0	–	A2-4
					23	44	0	0	18	41	10	33	10	–	102.4	104	18.5	14.4	–	A2-7
					15	31	0	0	18	32	15	35	10	–	103.9	106	17.4	14.4	–	A-4
GA. 3	GA. - CALHOUN CO.	1517	11.732	2.25	–	–	2	2	41	43	8	9	10	–	118.5	118	9.0	9.0	–	A-2F
					–	–	2	2	43	39	8	10	10	–	118.6	113	11.0	9.6	–	A-2F
					–	–	0	0	35	38	8	19	8	–	115.0	113	12.3	10.5	–	A-2F
					–	–	2	2	30	32	10	28	8	–	117.3	122	9.2	9.0	–	A-2P
					–	–	0	0	35	35	7	23	8	–	113.5	–	13.3		–	A-2F
					–	–	0	0	48	40	6	8	8	–	114.7	–	11.0	–	–	A-3
ILL. 1	ILL. LOGAN & MENARD CO.	RTE 36(15)-SEC(1)	2.9	1.25	18	34	0	0	0	13	54	33	14	13.9	106	98	17	18-20	VARIED	A-6-4
					16	35	0	0	0	14	52	34	14	14.5	108	93	18	22-24	"	A-6
ILL. 2	ILL. - WINNEBAGO CO.	RTE 26-SEC 26(F)	1.14	4.08	5	22	0	0	5	54	24	17	10	9.12	112	120	16	15	13-16	A-2
					0	14	0	0	9	72	10	9	10	8.19	124	120	10	15	13-16	A-2
IA. 1	IA. - CASS CO. SEC.16	F.N 594	0.90	2.00	19	36	16	24	← 19 →		44	18	8	–	122	108	11.6	15.9	>OPT	A-7
					18	35	21	29	← 15 →		41	15	8	–	122	109	11.7	–	" "	A-7
IA 2	IA. - CASS CO. SEC.17	F.N 594	0.72	2.00	22	42	15	18	← 10 →		49	23	12	–	111.7	99	16	–	" "	A-7
					18	38	4	7	← 7 →		63	23	12	–	112.3	98	16	–	" "	A-7
IA 3	IA - CASS CO SEC.18	F.N 447	0.55	2.00	25	42	7	10	← 23 →		37	30	10	–	118.6	105	10.1	14.5	" "	–
IA 4	IA - CASS CO. SEC 19	F.N 447	0.55	2.00	24	41	10	14	← 22 →		35	29	12	–	118	104	13.8	13.5	" "	–
					22	40	10	15	← 20 →		36	31	12	–	117.4	103	14.4	13.5	" "	–
					25	43	10	13	← 23 →		28	36	12	–	118.6	104	12.0	–	" "	–
IA 5	IA - WAYNE CO.	F.N 918	1.64	3.15	20	36	15	28	20	5	28	19	10	10	110	104	13.6	14	" "	A-7
					13	26	18	32	31	10	18	11	10	10	125	108	11.0	13.6	" "	A-7
					17	33	23	35	26	5	20	16	10	10	120	106	11.5	13	" "	A-7
KAN-1	KAN - STAFFORD CO.	F.A.462F	1.233	2.16	5	22	0	3	38	46	8	5	8	–	121	115	10	10	–	A-1
					2	21	0	1	44	44	6	4	8	–	119.5	114.3	9	10	–	A-1
					5	23	0	1	32	50	10	5	8	–	120.5	115	8.5	10	–	A-1
					6	23	0	1	35	40	15	6	10	–	119.0	–	10	–	–	A-1
KY-1	KY. - DAVIESS CO.	STATE 12A	6.335	0.66	2	20	30	41	6	15	31	7	8	7.86	115.5	113	11.7	–	–	A-4
													10	8.84	115.5	118	12.5	–	–	A-4
MD 1	MD. - WORCESTER CO	STOCKTON TO LITTLE MILLS	2.66	2.25	0	13	0	0	24	50	17	9	10	8.29	122	113	10	10 TO 12	11±	A-2
													10	9.16	112	113	11	10 TO 12	11±	A-2
MD-2	MD. - CARROLL CO.	MANCHESTER TO PA. STATE LINE	1.1	1.33	11	31	25	11	16	15	21	12	8	6.78	118.4	121.2	13.5	12-18	12-18	A-4
					13	36	20	12	21	16	17	14	8	7.21	111.9	121.2	16.1	12-18	12-18	A-4
													10	9.26	110.8	121.2	17	12-18	12-18	A-4
MICH 1	MICH. - CHEBOYGAN CO.	Mc16 17C3	1.35	3.50	3	–	7	4	← 71 →		18	11	7.8	6.4	130.7	125.9	8.6	8.6	ABOUT OPT.	A-2
					0	–	2	1	← 76 →		17	8	9.6	7.9	123.7	120.6	9.8	9.8	" "	A-3
					0	–	0	10	← 86 →		12	2	9.6	7.8	121.5	–	11.8	11.8	" "	A-3
					0	–	2	2	← 90 →		7	4	9.2	8.0	112.5	115.6	11.5	11.5	" "	A-3
					0	–	0	3	← 75 →		17	7	9.7	8.2	117.9	119.0	11.1	11.1	" "	A-3

1/ THIS NUMBER USED FOR IDENTIFICATION ON OTHER TABULATIONS

– NOT SHOWN

* AVERAGE DENSITY OF COMPLETED WORK

** MOISTURE CONTENT AT TIME OF COMPACTION

*** MOISTURE CONTENT OF SURFACE DURING FINISHING

FIGURE 1

MATERIALS DATA ON SOIL-CEMENT PROJECTS

1/ NUMBER	STATE & COUNTY	OFFICIAL DESIGNATION	LENGTH OF PROJECT MILES	AGE OF PROJECT YEARS	SOIL DATA FOR SOIL PROCESSED								DATA ON SOIL-CEMENT MIXTURE							TYPE OF SOIL IN SUBGRADE
							GRADATION						CEMENT CONTENT		DENSITY		MOISTURE			
					PI	LL	% RETAINED ON SIEVE NO		SAND		SILT %	CLAY %	BY VOLUME %	BY WEIGHT %	LABORATORY #/CU FT	FIELD* #/CU FT	LAB OPTIMUM %	FIELD** %	SURFACE***	
							4	10	COARSE %	FINE %										
MICH 1	MICH-CHEBOYGAN CO.	Mc16 17C3	1.35	3.50	24	40	0	0	←12→		52	37	—	—	—	—	—	—	ABOUT OPT.	A 6
					0	—	0	4	←93→		4	3	11.8	10.5	113.6	115.3	11.3	11.3	" "	A 3
					0	—	8	3	←78→		14	7	9.3	8.1	117.8	*111.6	11.1	11.1	" "	A 3
MISS.-1	MISS. CHICKASAW & PONTOTOC CO.	SPIS 1269 A.C.D	23.776	1.17	0	23	0	0	77	17	3	3	9.5	7.5	119	115	11	11	11	A 3
					6	27	0	0	73	12	6	9	9.5	7.5	115	115	11	11	11	A-1,2
					17	47	0	0	67	6	8	19	9.5	7.5	110	115	13	13	13	A 2P
MO.-1	MO.-NODAWAY CO.	SK 1 5	4.435	2.16	16	48	0	0	0	17	67	16	9	—	109.5	98	17.0	—	>OPT	SILT LOAM
					23	50	0	0	0	15	61	24	9	—	103.5	—	19.7	19	" "	SI CLAY LOAM
					28	56	0	0	0	11	56	33	9	—	103.5	—	19.5	—	" "	SILT CLAY
					32	61	0	0	0	20	37	43	9	—	102.5	—	20.0	—	" "	CLAY
MO. 2	MO. FRANKLIN CO.	RTE 100	0.982	3.16	20	41	0	0	0	7	59	34	6	—	107	101	15.5	16.2	—	SILT LOAM
					17	38	0	0	0	6	56	36	6	—	103	99	14.0	15.2	—	" "
MO. 3	MO. FRANKLIN CO.	RTE. 100	1.0	3.00	20	42	0	0	0	7	60	35	6	—	109	—	17.5	18.1	—	A 5-7
													6	—	105.5	—	18.0	17.4	—	A-5 7
													6	—	104.1	—	16.7	19.3	—	A 5 7
NEB. 1	NEB.-LANCASTER CO.	33-98A	5.2	1.08	(b) 20	45	0	0	0	12	50	38	10	—	109	105	15.8	17	16-19	A 4 TO A 7
					—	—	0	2	80	15	3	2								
N.Y.-1	N.Y.-LEWIS CO	FAS-33-38-33	1.14	1.25	—	—	—	—	—	—	—	—	—	—	—	—	—	112	—	—
O.-1	O.-FRANKLIN CO. (LAMBERT RD.)	CO. RD. NO. 291	2.9	1.33	10	26	45	48	17	11	16	5	6	4.5	132	135	8.8	8.6	8.4	A 2
O.-2	O.-MORROW CO	SA(1939)16-FASP 35A(1)	5.009	0.56	6	21	34	12	24	12	11	7	8	9.16	128	121.1	11.0	11.4	10.0	A 4
					11	27	18	4	9	19	30	20	8	8.14	117	106.8	14.0	16.7	13.0	A 4
					25	41	11	8	11	23	25	22	10	10.30	110	110.2	16.8	18.3	15.8	A 7
OKLA. 1	OKLA.-CADDO CO.	SAP656C	5.804	0.25	9	28	0	0	0	46	39	15	8 9-10	—	108	117.5	16	16.7	VAR.	A 2,4
					15	32	0	0	0	30	48	22	9-10-11	—	108	114.4	17	17.4	VAR.	A 2,4
N.C.-1	N.C.-BEAUFORT CO	2 9 15-113	1.5	2.08	0	15	0	0	7	78	6	9	12.0	10.6	118	117.6	11.7	11.5	9.7	A-2
					2	19	0	0	2	77	10	11	7.0	6.0	119	108.6	12.7	12.5	10.7	A 2
N.C. 2	N.C.-ALAMANCE CO.	5-4-42	2.4	1.08	31	55	0	1	7	29	28	36	12	12.1	104.5	98.9	18.8	18.6	19.3	A 7
					6	29	0	4	15	49	25	11	8	7.0	115.1	107.7	15.5	13.4	16.0	A 2
					11	31	0	5	10	36	25	29	10	9.0	114.2	106.8	15.0	16.3	15.5	A 4
					30	56	0	0	4	24	23	49	12	12.7	100.3	93.0	19.0	19.0	19.5	A 7
N.C. 3	N.C.-WAKE CO.	4-7 38-60	2.1	2.33	21	58	0	4	20	25	17	38	12	13.7	93.6	92.4	25.6	22.4	26.1	A 7
					37	73	0	7	17	15	13	55	12	11.7	107.8	109.1	15.5	17.4	16.0	A 7
					16	41	0	2	28	35	14	25	12	11.8	107.0	—	17.9	—	18.4	A-4 7
					20	44	0	4	26	29	12	33	12	10.9	114.6	—	14.4	—	14.9	A-7
N.C.-4	N.C. CARTERAT CO.	2-7 16-5	1.06	3.00	0	17	0	0	2	80	7	11	11.8	11.0	111.8	110.7	13.4	13	13.9	A 2
					0	16	0	0	2	78	7	13	11.8	11.4	108.8	112.4	14.0	14.9	14.5	A 2
PA.-1	PA. LEBANON CO.	38050	1.97	3.00	4	21	64	54	36	22	23	19	10	—	—	123	—	15.6	VARIED	A 2
					7	22	86	19	21	25	21	21	10	—	—	123	—	15.2	"	A-4
					15	36	38	32	38	16	23	23	10	—	—	123	—	14.2	"	A-4
					0	18	81	83	33	29	23	15	10	—	—	123	—	—	"	A 2
S.C.-1	S.C.-LEXINGTON CO.	CAYCE EXP. STATE 578	0.3	6.5-7.0	10	27	—	3	53	—	4	22	10	8.1	NO TEST	NO TEST	NO TEST	NO TEST	NO TEST	—
					17	32	—	3	52	—	5	24	10	8.1	" "	" "	" "	"	" "	—
					9	17	—	4	57	—	4	19	10	8.1	" "	"	" "	" "	" "	—
S.C. 2	S.C.-CHESTER CO.	STATE 815 B 669 REOP	13.8	2.25	28	73	—	3	6	—	22	54	12	10	111	102	19.5	90-115% OF OPT.	—	—
					8	31	—	15	22	—	18	25	9	7	123	108	11	"	—	—
					24	50	—	7	29	—	18	38	9	7	125	107	10.5	"	—	—
					8	29	—	18	43	—	15	15	9	7	128	—	10	"	—	—
S.C.-3	S.C. GEORGETOWN CO.	STATE 414 A	6.76	2.00	15	30	0	0	1	—	10	44	9	6	110	—	15.6	"	—	—
					—	—	0	0	12	—	7	8	9	7	115	111	11.2	"	—	—
					—	—	0	3	16	—	9	17	9	7	118	109	12.4	"	—	—
					7	21	0	1	27	—	5	19	8	6	119	107	12.6	"	—	—
S.C. 4	S.C. McCORMICK CO.	STATE 125	0.3	5.84	0	25	0	—	9	—	44	31	10	8	NO TEST	NO TEST	NO TEST	NO TEST	NO TEST	—
					—	—	—	—	5	—	45	35	7.6	6.6	" "	" "	" "	" "	" "	—
S.C.-5	S.C.-HORRY CO	NRH-350C	2.12	4.00	6	19	0	0	41	—	16	17	10.8	8.0	127	123	9.0	11	—	—
					6	21	0	0	40	—	20	19	10.8	7.7	131	124	9.5	9.5	—	—
					0	17	0	0	58	—	10	14	10.8	7.7	126	—	10.5	—	—	—
					0	18	0	0	38	—	5	12	11.1	8.0	130	119	9.5	9.7	—	—
S.C. 6	S.C.-ABBEVILLE CO	STATE 805	4.5	2.0	16	38	0	1	11	—	38	21	9	7	108	94	17.2	90-115% OF OPT.	—	—
					16	38	0	1	20	—	37	22	9	7	108	94	17.2	"	—	—
					20	48	0	4	21	—	23	33	10	9	104	100	20.4	"	—	—
					33	62	0	0	5	—	27	55	11	10	97	—	25.2	"	—	—
S.C. 7	S.C. WILLIAMSBURG CO.	NRH N326 380	1.48	4.86	0	19	0	0	70	—	11	19	8.3	6	131	120	10.0	13.5	—	—
					24	32	0	0	69	—	3	28	8.3	8	131	—	10.0	—	—	—
					3	25	0	0	77	—	3	20	9.6	7	125	118	9.0	11.8	—	—
					0	21	0	0	83	—	6	11	6.8	5	127	118	6.5	15.0	—	—

1/ THIS NUMBER USED FOR IDENTIFICATION ON OTHER TABULATIONS (b) 60% SELECTED SOIL PLUS 40% COARSE SAND

— = NOT SHOWN

* AVERAGE DENSITY OF COMPLETED WORK

** MOISTURE CONTENT AT TIME OF COMPACTION

*** MOISTURE CONTENT OF SURFACE DURING FINISHING

FIGURE 2

MATERIALS DATA ON SOIL-CEMENT PROJECTS

[1] Number	State & County	Official Designation	Length of Project Miles	Age of Project Years	Soil Data for Soil Processed: PI	LL	Gradation: % Retained on Sieve No. 4	% Retained on Sieve No. 10	Sand: Coarse %	Sand: Fine %	Silt %	Clay %	Data on Soil-Cement Mixture: Cement Content: By Volume %	By Weight %	Density: Laboratory #/cu ft	Field* #/cu ft	Moisture: Lab Optimum %	Field** %	Surface***	Type of Soil in Subgrade
S.C.-8	S.C.-GREENWOOD CO.	STATE 293	2.0	2.25	13	26	0	17	25	–	19	33	9	7	115	–	14.6	10.6	–	–
					11	30	0	6	24	–	12	40	9	7	117	–	13.6	–	–	–
					11	28	0	5	16	–	17	38	9	7	116	–	15.0	13.9	–	–
					14	31	1	7	17	–	21	41	9	8	114	–	15.2	12.6	–	–
S.C. 9	S.C.-GREENWOOD CO.	STATE 603	2.0	2.66	10	24	1	6	20	–	20	26	8	6	130	–	9.6	90-115% OF OPT	–	–
					12	28	1	6	19	–	21	29	8	6	130	–	9.6	-	–	–
					5	24	5	16	4	–	55	34	8	6	124	–	11.6	-	–	–
					8	27	12	24	10	–	43	36	8	6	124	–	11.6	-	–	–
S.C.-10	S.C. HAMPTON CO	STATE 872	0.89	3.00	–	–	2	8	54	–	7	8	9	7	129	–	7.0	–	–	–
					–	–	0	4	37	–	9	13	8	6	131	–	8.4	–	–	–
					–	–	0	1	34	–	11	10	8	6	132	–	7.2	–	–	–
					–	–	1	9	35	–	10	11	11	8	132	–	7.2	–	–	–
S.C. 11	S.C.-McCORMICK CO.	STATE 602 B	0.1	5.88	28	50	–	5	3	–	28	59	10	8	NO TEST	NO TEST	NO TEST	NO TEST	NO TEST	–
					22	50	–	3	–	–	28	58	10	8	- -	- -	- -	- -	- -	–
S.C.-12	S.C. FLORENCE CO.	KINGSBURG EXPERIMENT	0.3	5.92	–	20	0	2	39	–	6	15	10	8.1	- -	- -	- -	- -	- -	–
					10	27	0	0	14	–	12	25	10	8.1	- -	- -	- -	- -	- -	–
					–	21	–	0	11	–	14	19	10	8.1	- -	- -	- -	- -	- -	–
S.C.-13	S.C. UNION CO. *	STATE 83 B FA 464	7.79	2.66 TO 2.75	8	28	3	14	56	–	8	11	8	6	124	109	10.8	90-115% OF OPT	–	–
					10	41	1	10	37	–	16	19	6	5	116	103	14.4	-	–	–
					10	34	1	9	42	–	12	18	8	7	116	108	14.4	-	–	–
					14	42	0	18	33	–	18	24	8	7	105	–	18.0	-	–	–
S.C. 14	S.C. LANCASTER CO.	EXP DOC 5715.6 55	6.0	1.88	14	31	2	7	19	–	34	38	4	3	111	–	16.0	–	–	–
					29	54	1	2	5	–	32	56	8	7	105	101	19.6	19.5	–	–
					21	51	0	2	4	–	40	50	11	10	105	103	17.2	19.0	–	–
					11	38	0	2	10	–	44	51	8	7	106	106	11.2	–	–	–
S.C. 15	S.C. OCONEE CO	STATE 919	0.25	2.0	27	59	0	2	21	–	12	50	–	7	97	–	24	90-115% OF OPT	–	–
					–	–	0	1	39	–	13	16	–	4	105	–	16	-	–	–
S.C. 16	S.C.-HAMPTON CO	STATE 368	10.5	3.25 TO 3.50	–	–	0	0	13	–	3	5	8.2	7.0	109	110	8	8	APPR. OPT	–
					–	–	0	0	13	–	3	26	9.1	7.3	116	–	13.5	12	- -	–
					–	–	0	0	4	–	8	14	7.8	6.4	115	114	9	10	- -	–
					–	–	0	1	20	–	12	20	8.4	6.1	129	–	9	–	- -	–
S.C. 17	S.C.-GREENVILLE CO.	STATE 316-A	0.6	2.75	17	35	1	2	22	–	11	49	9	8	114	–	15.6	90-115% OF OPT	–	–
					–	–	1	7	31	–	12	31	9	7	123	–	11.2	-	–	–
					9	24	6	13	24	–	13	29	9	7	123	–	11.2	-	–	–
					–	–	1	10	38	–	10	32	9	7	123	–	11.2	-	–	–
S.C. 18	S.C. ABBEVILLE CO.	STATE 594 AND 805	6.4	1.9	17	48	0	1	4	–	34	48	11	10	100	103	7.2	-	–	–
					3	18	3	5	17	–	27	16	8	6	118	111	12	-	–	–
					12	28	5	18	19	–	26	25	9	7	120	118	13.2	-	–	–
					5	21	1	4	19	–	25	24	8	7	121	–	12.4	-	–	–
S.C. 19	S.C.-OCONEE CO.	868-5	0.483	2.88	39	61	1	3	31	–	6	49	9	7	117	108	14	-	–	–
					16	33	1	5	41	–	9	28	8	6	118	102	13	-	–	–
					19	36	0	4	36	–	8	35	8	6	120	102	13	-	–	–
					–	–	1	4	33	–	11	32	–	–	–	–	–	-	–	–
TEX. 1	TEX.-HARRIS CO	LWRM 211 & 4	0.34	0.42	7	18	17	40	–	–	–	–	4.8	–	–	–	–	NEAR OPT	NEAR OPT	A-2
TEX. 2	TEX.-DONLEY CO.	M-42-1-8	0.245	1.75	15	36	9	11	5	45	22	10	8	–	106.2	106.3	–	15.7	APPR. OPT.	A-2
TEX. 3	TEX.-BURLESON CO.	M-186-2-5	0.151	2.00	4	–	0	1	–	–	–	–	3.45-7.5	–	–	–	–	–	–	A-2
TEX. 4	TEX.-LYNN CO.	CHR 297-6-5	3.00	1.2	5	21	0	0	0	75	14	8	–	9.10.11	115.3	99.4	13	11.0 TO 15.6	NEAR OPT	A-2
					5	21	0	0	0	70	18	7	–	9.10.11	114.6	99.4	13	11.0 TO 15.6	- -	A-2
TEX. 5	TEX.-MADISON CO.	CO LOCAL RD	0.026	1.25	–	–	–	NO TEST	–	–	–	–	–	–	–	–	–	–	–	CLAY
TEX.-6	TEX.-DALLAM CO.	M-40-1-8	0.777	1.00	10	31	20	–	–	–	–	–	6.6	7	106.5	102.6	–	18.3	OPT ±2%	A-2
					13	32	20	–	–	–	–	–	6.6	7	101.9	102.6	–	18.3	- -	A-2
TEX. 7	TEX. RED RIVER CO	FAS 2A(2)	4.003	1.00	0	17	0	0	0	67	26	5	8.55	7.22	119.5	111.1	6.0	12.6	- -	A-2
					8	22	0	0	0	64	24	3	8.55	7.52	115	106.9	8.0	15.6	- -	A-2
					18	36	0	0	0	48	30	4	8.55	7.90	114	105.0	8.0	16.8	- -	A-7
TEX. 8	TEX. GALVESTON CO	US 75, STATE 58	0.5	0.58	OYSTER SHELL AND BEACH SAND MIXTURE								–	6.6	120	120	–	12.5 TO 14.5	APPR 15%	A-6
TEX. 9	TEX.-KENNEDY CO	327-2-3	3.693	2.33	11	28	0	0	0	76	8	3	10	–	112.5	110	–	12.5	–	A-2
					4	22	0	0	0	92	3	2	10+15% SILT	–	116.1	112	–	14.5	–	A-3
					13	30	0	0	0	68	11	8	6	–	105.5	111	–	13.0	–	A-2
VA. 1	VA.-YORK CO.	1177-D E	2.75	1.08	6	18	0	0	7	48	27	18	8	–	119	111	11	10	OPT LESS 1%	A-2
					12	28	0	0	6	51	18	25	8	–	116	113.5	12.6	15	- - -	A-2.4
					0	19	0	0	9	67	12	12	8	–	118	115.5	10.5	9.5	- - -	A-2
VA.-2	VA. NEW KENT CO.	1177	2.0	2.25	22	44	0	0	3	22	39	36	10	–	108	103	17.5	15.4	- - -	A-7
					11	28	0	0	17	49	11	23	8	–	115	110	14	12	- - -	A-4
WASH. 1	WASH. WHITMAN CO	SC 99	1.0	2.0	10	32	53	–	11	9	21	6	7.4	6.9	130	101.6 #4	11.2	16.2 #4	16.2 #4	A-4
MASS.	MASS. MIDDLESEX CO	LOWELL	0.86	1.0	–	–	44	53	36	11	0	0	10	7	117	135	–	5.7	5	A-2

[1] THIS NUMBER USED FOR IDENTIFICATION ON OTHER TABULATIONS

– = NOT SHOWN

* AVERAGE DENSITY OF COMPLETED WORK

** MOISTURE CONTENT AT TIME OF COMPACTION

*** MOISTURE CONTENT OF SURFACE DURING FINISHING

FIGURE 3

METEOROLOGICAL AND DESIGN DATA

NUMBER	METEOROLOGICAL DATA: RAINFALL: AVERAGE ANNUAL INCHES	RAINFALL: DURING * CONSTRUCTION INCHES	SNOW FALL INCHES	TEMPERATURE: AVERAGE ANNUAL °F	TEMPERATURE: MINIMUM °F	TEMPERATURE: DAYS OF FREEZING	DESIGN DATA: WIDTH OF BASE COURSE FT	WIDTH OF SHOULDERS FT	DEPTH OF DITCHES FT	CROWN INCHES	COMPACTED THICKNESS OF SOIL CEMENT INCHES	TRAFFIC: TRUCK OVER 5 TON	TRAFFIC: PASSENGER CARS	TRAFFIC: TOTAL	REMARKS
												VEHICLE PER DAY			
ARK-1	48	—	49	623	532	39	22	4	1.0	3	6	—	—	300	ONE DAY OF RAIN DURING CONST
ARK-2	50	—	97	618	498	—	20	4	1.0	3	6	—	—	900	65 DAYS RAINFALL DURING CONST.
ARIZ-1	15	0.5	6	60	29	60	22	0	2.5	—	6	10	240	250	
CAL 1	9	0	25	68	5	60	22	8	VARIABLE	2.5	6	—	—	—	
CAL 2	12	0	0	62	25	0	24	7	"	2.5	5.5	—	—	—	
CAL 3	66	6	0	63	25	5(EST)	23	10	"	2.5	10 12	—	—	—	
CAL 4	58	4.5	0	63	26	5(EST)	22	8	2	2.5	6	—	—	—	
GA -1	—	—	—	—	—	—	20	6	2	2	8	—	—	—	OLD GRADE
GA -2	—	—	0	—	—	—	30	CURB & GUTTER	CURB & GUTTER	2.5	8	—	—	—	NEW GRADE
GA -3	—	—	0	—	—	—	21	5.5	2	1.5	6	25(EST)	175	200	OLD GRADE
ILL 1	36	BELOW NORMAL	20	52	44	92	20	5	1.5	2	8	10-20(EST)	80-90(EST)	100(EST)	" "
ILL-2	38	NORMAL	35	48	37	—	18	5	—	2	6	—	—	—	" " CONSTRUCTION DELAYED BY RAIN TWICE
IA - 1	31	2.9	30	49	-16	—	26	5	2.0 3.0	5	5	—	—	150	" "
IA 2	31	2.9	30	49	-16	—	26	5	2.0-3.0	5	5	—	—	150	" "
IA 3	31	—	30	49	16	—	26	—	2.0-3.0	5	5	—	—	450	2 HEAVY RAINS NEAR END OF CONSTRUCTION OLD GRADE
IA 4	31	—	30	49	16	—	26	5	2.0-3.0	5	5	—	—	450	" " " " " " " " " "
IA 5	32	—	30	50	-15	—	26	5	2.0-3.0	5	5	—	—	450	4 RAINS DURING CONSTRUCTION PERIOD
KAN 1	28	3	16	55	44	126	20	0	2.0	2	8	25	774	799	3" RAIN ON COMPLETED BASE BEFORE ARMOR COAT APPLIED
KY -1	46	—	18	57	—	—	20	4	1.5	3	6	150	450	600	OLD GRADE
MD-1	40	3	12	55	35	95	16	10	1.5 3.0	2	6	—	—	50	GRADE 1 YEAR OLD - 3" RAIN WHILE OPEN TO TRAFFIC
MD. 2	44	4.2	30	54	27	125	18	7	1.0 4.0	2	6	0-50	50-100	100	" " " " -TRUCK TRAFFIC SEASONAL
MICH 1	26	SOME RAIN	72	43	37	159	20	8	—	—	6	0	< 5	< 5	NEW GRADE
MISS 1	52	FAIRLY HEAVY	1	68	50	20	22	5	2.0	1½	6	10	390 440	400-450	OLD GRADE
MO 1	36	LIGHT RAINS	17	58	44	106	22	1	2.0	4	8	—	—	602	" "
MO. 2	38	INTERMITTENTLY	—	55	—	111	22	5	2.0	4	6	—	—	814	" "
MO 3	38	NONE	—	55	—	111	22	5	2.0	4	6	—	—	914	" "
NEB 1	32	SOME RAIN	30	50	15	80	24	4	1.5	3	5	100±	420±	520	GRADE 1 YEAR OLD
NY -1	60	LIGHT SHOWERS	56	41	-30	120	10	7	1.5	1¼	6	52	752	802	NEW GRADE
O -1	—	—	—	—	—	—	18	8	1.0-2.0	2	6	—	—	—	OLD GRADE
O -2	40	SEVERAL SHOWERS	32	52	41	107	18	6	2.0	2	6	—	—	185	60% NEW GRADE
OKLA 1	—	" "	—	—	—	—	25	5.5	2.0	1½	6	—	—	—	NEW GRADE
N C -1	53	—	—	62	11	—	18	6	1.5	1½	6	2	155	157	" "
N C 2	45	SEVERAL RAINS	—	59	—	—	20	5	1.5	1½	6	—	—	310	" "
N C -3	43	" "	—	60	-2	—	20	5	1.5	1½	6	0	—	172	II OF 30 DAYS DURING CONSTRUCTION RAIN FELL
N C -4	51	—	16	64	4	—	20	5	1.5	1½	6	0	43	43	2 DAYS RAIN DURING CONSTRUCTION
PA-1	40	RAIN & SNOW	23	54	47	79	14	5	1.0	3½	6	3	47 97	50 100	OLD GRADE - 3 DAYS RAIN DURING CONSTRUCTION
SC-1	44	—	2.5	64	54	32	20	4.5	1.5	2	6	76	248	324	OLD GRADE
SC-2	42	OCCASIONAL RAIN	0.5	62	49	40	21	5.5	1.5	2	6	77	185	262	NEW GRADE
SC-3	43	SOME RAIN	1.0	63	55	15	21	6	1.5	2	5	152	224	376	" "
SC-4	49	—	1.1	64	54	36	20	5	1.5	2	6	98	198	296	OLD GRADE
SC-5	45	SOME RAIN	1.8	64	53	20	22	6	1.5	2	6	185	647	702	" "
SC-6	34	OCCASIONAL RAIN	1.3	62	49	40	21	3	1.5	2	4	30	220	250	NEW GRADE - 1 DAY CONSTRUCTION WETTED BY RAIN - COMPACTED FOLLOWING DAY, GOOD COND
SC-7	44	SOME RAIN	1.7	64	53	20	22	5.5	1.5	2	4 6	57	348	405	OLD GRADE
SC-8	44	OCCASIONAL RAIN	2.4	62	51	40	21	3	1.5	2	6	108	266	374	RAIN WETTED 100' UNCOMPACTED MATERIAL FINISHED FOLLOWING DAY, EXCELLENT CONDITION
SC-9	44	" "	2.4	62	51	40	21	3	1.5	2	6	173	569	742	OLD GRADE
SC 10	52	SOME RAIN	0.4	65	53	15	30	CURB & GUTTER	CURB & GUTTER	4	6	120	199	319	OLD GRADE - TWO SECTIONS WETTED BY RAIN - COMPACTED 2 AND 3 DAYS LATER
SC-11	49	—	1.1	64	—	36	20	5	1.5	2	8	—	—	—	
SC 12	44	OCCASIONAL RAIN	1.7	64	53	20	20	5.5	1.5	2	6	64	380	444	
SC-13	43	" "	0.6	62	50	40	22	2.0 3.0	1.25	2½	6	44	280	324	NEW GRADE
SC-14	38	SOME RAIN	2.5	61	51	40	21	5.5	1.5	2	4 6	30	218	248	" "
SC-15	45	1 DAY RAIN	3.3	61	50	50	22	5	1.5	2	4 5 6	—	—	—	VERY HEAVY TRUCK TRAFFIC 400' WAS LEFT UNCOMPACTED FOR 3 DAYS
SC-16	54	SOME RAIN	0.4	65	53	15	22	5	1.5	2½	6	100	170	270	OLD GRADE
SC 17	38	—	5.3	60	40	50	9	CURB & GUTTER	CURB & GUTTER	SLOPE 1 16	5	452	2155	2607	NEW GRADE
SC 18	44	—	2.4	62	51	40	21	3	1.5	2	6	138	185	218	" "
SC-19	45	OCCASIONAL RAIN	3.3	61	50	50	22	CURB & GUTTER	CURB & GUTTER	2½	6	12	68	100	FIRST NEW GRADE
TEX-1	21	NONE	0	70	—	17	18	8	2.0	2	3 14	—	800	800	OLD GRADE VERY FEW TRUCKS
TEX-2	17	"	2.4	66	-7	82	24	8	2.0 6.0	2	6	200	800	1000	OLD GRADE
TEX-3	41	"	—	70	25	51	24	5	1.0 2.0	2	9(LOOSE)	150 200	450 600	700 800	" "
TEX-4	17	"	1.0	62	-1	99	24	6	1.0	2	6	8 25	592 1115	600-1140	NEW GRADE
TEX 5	41	"	—	68	25	51	23	4	2.0	2	8	10	190 290	200 300	OLD GRADE
TEX 6	17	SOME RAIN	1.9	65	-7	145	22	0.6	1.0 2.0	3	6	54	486	540	" "
TEX 7	41	0	0	65	15	67	24	5	1.5	2½	8	15	285+	300+	" "
TEX-8	41	SOME RAIN	—	71	25	11	22.1024	7	1.0 4.0	2	8	684(EST)	6156	6840	NEW GRADE
TEX 9	21	NONE	—	72	20	—	22	9	0.5 1.0	2	6	—	150 200	150 200	" "
VA -1	—	—	—	—	—	—	20	6	—	2	8	—	—	—	" "
VA 2	—	—	—	—	—	—	20	6	—	2	8	—	—	—	" "
WASH 1	18	NONE	33	47	-12	151	20	4	2.0	—	8	45	255	300	OLD GRADE
MASS	41	—	55	48	38	110	24	3	NONE	4½	6	0	—	LIGHT TRAFFIC	

*COVERS PERIOD OF CONSTRUCTION AND ALSO PERIOD DURING WHICH PROJECT WAS OPEN TO TRAFFIC BEFORE SURFACING WAS PUT ON

— = NOT SHOWN

FIGURE 4

CONSTRUCTION DATA

NUMBER	SUBBASE TREATMENT	PULVERIZATION REQUIREMENT*	MIXING AND PULVERIZING EQUIPMENT USED	TYPE OF ROLLERS	TOTAL ELAPSED CONSTRUCTION TIME DAYS	WATER: METHOD OF APPLICATION	WATER: TIME HRS & MIN	METHOD OF APPLYING CEMENT	PROTECTION TYPE AND TIME	TIME BASE WAS OPEN TO TRAFFIC WITHOUT SURFACE DAYS	BITUMINOUS PRIME COAT: TYPE	BITUMINOUS PRIME COAT: QUANTITY GALS./SQ.YD	REMARKS
ARK 1	NONE	80% NO 4	1,2,3,4,6,7,T.P	A,B	14	P.D	2 23	TP-BARBER GREENE	WET STRAW	14	MC-1	0.22	½" MULCH AT FINISHING ½" WASTED, PULVERIZED 80% < #4
ARK 2	"	" "	1,2,3,4,6,7,T.P	A,B	39	P.D.	2 25	" " "	" "	60 TO 150	NONE		" " " " " " " 100% " "
ARIZ 1	"	—	3,4,6 TP GARDNER	(8T) A,B	9	T.P	4 30	HAND	MOIST EARTH	11	SC-2	0.24	
CAL-1	—	100% NO 4	1,2,3,4,5	B,C (6T)	20	P.D.	—	HAND & BLADE	" "	21	SC-1A	0.25	1½" 2" MULCH AT FINISHING NONE WASTED, PULVERIZED 100% < #4
CAL 2	—	" "	2,3,4,5,6	(8T) A,B	18	P.D	—	" " "	SPRINKLING 3 DAYS	0	E.A.	0.25	" " " " " " " " 99% " "
CAL 3	—	—	1,2,3,4,5	(12T) A,B	16	P.D	—	HAND	MOIST EARTH 7 DAYS	180	—	—	2" MULCH AT FINISHING - NONE WASTED
CAL-4	NONE	100% NO 3	2,3,4,5	(12T) A,B	5	P.D.	—	HAND & BLADE	TRAFFIC AFTER 24 HRS.	180	SC-2	—	" " " " " " , COMPACTION PLANES NEAR SURFACE
GA 1	"	80% P #4	1,2,3,5,6	A,B	—	T.T.	—	HAND	WET EARTH - 7 DAYS	7	RT-2	—	½" " " " " " , PULVERIZED 65% < #4
GA 2	"	" "	1,2,5,6	B,C	—	T.T	—	"	WET SAWDUST 7 DAYS	60	RT-2	—	" " " " " " " " " "
GA 3	"	" "	1,2,4,6 T P	A,B,C	—	P D	—	TP BARBER GREENE & FLYNN	WET EARTH 7 DAYS	—	RT-2	—	" " " " " " " " " "
ILL 1	"	" "	1,2,4,5,6,8 SEAMAN	(5T) A,B,C	14	P D	2 30	HAND	WET STRAW - 7 DAYS	425	MC-1	0.2 TO 0.3	1" " " " " " " 58% " "
ILL 2	"	" "	1,2,4	(8T) A,B,C	16	P.D.	4-00	"	MOIST EARTH 7 DAYS	330	TC-1	—	" " " " ½" " " 90% " "
IA. 1	"	60% "	2,3,4,5,6	A,B,C	—	T.T	—	BUCKEYE SPREADER	TAR PRIME	0	TAR	0.2	1" 1½" " " " ⅛" " " 70% "
IA. 2	"	" "	2,3,4,5,6	A,B,C	—	T.T.	—	" "	" "	0	"	0.2	" " " " " " " " 70% " "
IA. 3	"	"	2,3,4,5,6	A,B,C	—	T.T.	—	SPREADER	" "	0	"	—	" " " " " " " " 60% " "
IA 4	"	" "	2,3,4,5,6	A,B,C	—	T.T	—	"	" "	0	"	0.2	" " " " " " " " 61% " "
IA 5	"	70% "	2,3,4,6	A,B,C	12	P.D.	4 15	BUCKEYE SPREADER	" "	0	"	0.2	
KAN 1	"	95% < 1", 80% < #4	1,2,3,5,6	A,B,C	—	P.D.	4-00	HAND	SPRINKLING 2 DAYS SC-4	22	SC-3	0.4	1" MULCH AT FINISHING, PULVERIZED 95% < 1", 80% < #4
KY. 1	200' FARM TILE	80% < #4	1,2,4,5,6	(10T) A,B	69	—	1-30	HAND, HARROW	WET STRAW 7 DAYS	60	—	—	1½" " " " , - ½" WASTED, PULVERIZED 90%, 95% < #4
MD. 1	NONE	"	1,2,3	(10T) A	19	P.D.	3-00	HAND	WET EARTH 4-7 DAYS	30	NO PRIME		1" " " " NONE " " 90% < #4
MD. 2	"	" "	1,2,3	(10T) A,D	12	P.D.	3 30	"	EARTH 5 10 DAYS	46	MC 1	0.3	" " " FINAL FINISHING - NONE WASTED, PULVERIZED 80% < #4
MICH.-1	"	100% "	1,2,4	(15T) A,B	57	P.D.	0-30	"	7 DAYS	NO SURFACING	NONE	NONE	" " " FINISHING NONE WASTED, PULVERIZED 100% < #4
MISS.-1	A 2, 15"	80% "	1 TP (FLYNN RD. BLDR.)	C	90±	T P	—	"	SISALKRAFT 3 DAYS	0-5	RT 2	—	½" " " " ½" " " " " "
MO-1	NONE	70% < ½"	2,4,5,6	(10T) A,B,C	60	P.D.	3-30	"	RT 3 - 0.2 GAL	21	RT-3	0.2	1" " " " ½" " " 70% < ½"
MO-2	"	" "	1,2,3,4,6	(10T) A,B,C	—	P.D.	4 20	"	MC-1 4 WEEKS	28	MC 1	—	" " " " ½" " " " " "
MO. 3	"	" "	1,2,3,4,5,6,T P	(10T) A,B,C	—	T.R.	—	TP BARBER GREENE	" " "	26	MC 1	0.2	1"-1½" " " " " " " " " "
NEB.-1	"	80% < #4	2,3,4,5,6,8 SEAMAN	(7T) A,B,C	—	P.D.	—	HAND	WET STRAW 7 DAYS	3-14	MC-1	0.25	" " " " " ½" " " 80%-90% < #4
N.Y. 1	"	" "	2,3,4,5	(14T) A,B	4	P.D	4 10	"	WET HAY - 7 DAYS	14	TAR	0.2	¾" " " " NONE "
O.-1	"	" "	1,2,3,4,5,6	(10T) A,B	24	P.D	3 00	"	WET STRAW 7 DAYS	15	MC 1	0.2	1"-1½" " " " " " PULVERIZED 87% < #4
O.-2	"	" "	1,4,6,TP FLYNN	(8T) A,B	17	P.D.	0-01	"	" "	14	RT 2	0.2	1" " " " " " " " 90% " "
OKLA-1	"	" "	2,3,4,5,6,8 ARIENS	A,B,C	48	—	2 47	"	—	45	NONE	NONE	½" " " " , PULVERIZED 83% < #4
N.C.-1	"	" "	1,2,3,4	B,C	12	P.D	—	"	EARTH - 7 DAYS	—	RT 2	0.3	1½" " " " NONE WASTED, PULVERIZED 80% < #4
N.C.-2	"	" "	1,2,3,4,	A,B,C,D	30	P.D	—	"	" "	330	RT LMC LMC 1B	0.3	" " " " " " " " " "
N.C. 3		"	1,2,3,4	A,B	28	P.D.	4 20	"	" "	—	RT 2	0.3	1" " " " " " " " " "
N.C. 4	"	" "	1,2,3,4	B,D	8	P.D.	1 30	"	" "	—	RT 2	0.25	1½" " " " " " " " " "
PA.-1	"	" "	1,2,3,4,6	(10T) A,B	16	P.D.	3 15	"	NONE	30	CB TAR	0.25	" " " " " " " 75%-90% < #4
S.C. 1	"	—	1,2,4,5	(5T) A,D		T.T.	2 00	SAND SPREADER	130 CANVAS NONE	180	TC 1	0.2	
S.C-2	"	—	1,2,4 TP-BARBER GR.	B,C	56	P.D.	—	TP-BARBER GREENE	NONE	2 TO 10	RT 2	.25-.30	1"-1½" MULCH AT FINAL FINISHING - ½" WASTED
S.C. 3	"	—	1,2,4	B,C	68	P.D.	2 00	HAND	NONE	42 (LOCAL TRAFFIC)	RT 2	0.2 0.28	" " " " " " " "
S.C.-4	"	—	1,2,4,5	D	—	P.D.	2 00	SAND SPREADER	"	60		0.15	
S.C-5	"	—	1,2,4	B,D	22	P.D.	2 00	BUCKEYE SPREADER	"	14 (LT LOCAL TRAFFIC)	TC 1	0.25	1"-1½" MULCH AT FINAL FINISHING - ½" WASTED
S.C 6	"	—	1,2,4 TP-BARBER GR.	B,C	18	P.D.	4 30	TP BARBER GREENE	"	—	—	0.2 0.3	" " " " " " " "
S.C-7	"	NONE	1,2,4	B,D	47	P.D.	2 45	SAND SPREADER	"	365	RT 1	0.2-0.4	½" MULCH WASTED
S.C. 8	"	—	1,2,4	B,D	27	T.T.	2 00	TRUCK TAIL GATE	"	—	RT 2	0.28	1"-1½" MULCH AT FINAL FINISHING - ½" WASTED
S.C. 9	"	—	1,2,4	B,C	—	P.D.	2 30	BUCKEYE SPREADER	"	—	RT 5	0.25 0.30	½" MULCH WASTED
S.C 10	"	—	1,2,4,6	B,C,D	10	P.D.	—	SAND SPREADER	"	—	—	0.25 0.30	
S.C 11	"	—	1,2,4,5	D	1	—	2 40	" "	"	—	RC	0.2	
S.C 12	"	—	1,2,4,5	D	—	P.D.	2 00	" "		120	NONE		
S.C 13	"	—	1,2,4 TP BARBER-GR.	B,C	76	P.D.	—	TP-BARBER GREENE	NONE	—	RT 2	0.25 0.30	1"-1½" MULCH AT FINISHING - ½" WASTED
S.C 14	"	—	1,2,4,6	B,D	47	P.D.	3 00	SAND SPREADER	NONE ON 4 MI.	60	RT 1	0.2	1" " " " " " , CURED 1ML RT2 & 1ML E. ASPHALT
S.C 15	"	—	1,2,4	B,C	3	P.D.	2 30	BUCKEYE SPREADER	NONE	7	RT 2	0.25	½"-¾" MULCH WASTED
S.C 16	"	—	1,2,4 TP-BARBER GR.	B,D	180±	T P	—	TP BARBER GREENE	"	60 (LOCAL TRAFFIC)	RT 2	0.25	1" MULCH AT FINAL FINISHING - ½" WASTED
S.C 17	"	—	1,2,4	B,C	8	P.D	2 00	BUCKEYE SPREADER	"	10	RT 5	0.25	
S.C 18	"	—	1,2,4,6 TP-BARBER-GR.	B,C	17	P.D	—	HAND	"	14	RT 2	0.20-0.35	1"-1½" MULCH AT FINAL FINISHING - ½" WASTED
S.C. 19	"	—	1,2,4	B,D	—	P.D.	1 00	BUCKEYE SPREADER	"	14	RT 1	0.25	" " " " " " " "
TEX 1	"	—	1,2,4	B,D	98	T.T.	1 00	HAND	SPRINKLING 3 DAYS	14	RC 2	0.12	" " " " " " ½" " , PULVERIZED 100% < #4
TEX 2	"	80% < #4	2,3,4,5	(5T) A,B,C	7	P.D.	4 00	HAND & BLADE	DAMP EARTH 7 DAYS	22	RC 2	0.2	½" " " " " ½" " " 80% " "
TEX 3	"	100% < 4 OBTAINED	PUGMILL AT PLANT 4	EQUIPMENT	—	P.D.	60-00	PUGMILL	NONE	7	RC 1M	0.5	" " " " NONE "
TEX 4	"	75% < ¼"	1,2,3,4,5,6,7	A,B,C	23	P.D.	4-00	HAND & BLADE	EMULSION	0	E.A.-H-M	0.2	0" " " " " , PULVERIZED 75% < #4
TEX 5	"	—	CONCRETE MIXER	(10T) A	—	AT MIXER	—	AT MIXER	MOIST BURLAP 5 DAYS	0	RC 1	0.3	
TEX 6	"	80% < #4	1,2,3,4,5,6	(5T) A,B,D	7	P.D.	3 30	HAND	DAMP EARTH 7 DAYS	0	RC 2	0.2	½" MULCH AT FINAL FINISHING - ½" WASTED, PULVERIZED 64% < #4
TEX 7	"	" "	1,2,4,6 TP-JAEGER	(5T) A,B,C	39	P D	—	"	COTTON MATS 7 DAYS E.A.	14	E.A. H-M	0.3	½"-1½" " " " " ½"-¾" " " 90% " "
TEX 8	"	NONE	2,3,4,6	A,B,D	180±	—	1 30		COTTON MATS 5 DAYS	0	RC 2	0.2	1" " " " " NONE " " 65% " "
TEX 9	"	—	4 TP FLYNN	(10T) A,B,D	32	P.D.	—	"	VARIOUS	VARIOUS	VARIOUS	VARIOUS	
VA 1	(a)	NONE	1,2,3,4,5	(5T) A,B	25	—	1 00	"	EARTH 7 DAYS	—	RC 2	0.25	1" MULCH AT FINAL FINISHING - ½"-¾" WASTED, PULVERIZED 80% < #4
VA. 2	(a)	"	1,2,3,4	(5T) A,B	14	—	1 00	"	"	60	RT-4	0.6	" " " " " " " " " " " "
WASH 1	NONE	—	—	(10T) A	—	—	3 00	"	WET STRAW 7 DAYS	30	NONE	NONE	
MASS.	SAND & GRAVEL 12"	—	2,3,5	A,B	15	P.D.	1 00	"	WET HAY 7 DAYS	210	RT 3	0.25	0" MULCH WASTED

* PERCENT PASSING AND SIEVE SIZE SHOWN IN THIS COLUMN
(a) FRENCH DRAINS CD 1 & CD 2 38 & 48 12" STONE 20 & 30

1 - SCARIFIER
2 DISC HARROW
3 FIELD CULTIVATOR
4 MOTOR PATROL OR BLADE GRADER
5 - GANG PLOW
6 SPIKE TOOTH HARROW
7 TEAM & FRESNO
8 - TILLER

A SELF PROPELLED SMOOTH ROLLER
B - SHEEPSFOOT
C RUBBER TIRE
D TRUCKS

P.D. - PRESSURE DISTRIBUTOR
TT - TANK TRUCK
TP TRAVELING PLANT
— " NOT SHOWN

FIGURE 5

CONDITION OF SOIL-CEMENT AND BITUMINOUS COVER

NUMBER	PERCENT OF TOTAL AREA OF SOIL-CEMENT WITH				FINAL OVERALL RATING %	FINAL OVERALL RATING	BITUMINOUS COVER		NOTES ON SOIL-CEMENT AND BITUMINOUS COVER DEFECTS
	COMPLETE LOSS	DEEP RAVEL ⅜"-2½"	THIN RAVEL 0"-⅜"	TOTAL			THICKNESS INCHES	CONDITION	
ARK. 1	5	50	24	79	12.7	FAIR	0.6	GOOD TO FAIR	LOW CEMENT CONTENTS INADEQUATE CONTROL OF SURFACE COMPACTION
ARK. 2	0	100	–	100	15.0	FAIR	0.5	POOR	INADEQUATE CONTROL OF SURFACE COMPACTION
ARIZ. 1	–	–	–	–	–	GOOD	0.5	GOOD	" " "
CAL. 1	0	8	10	18	1.7	GOOD	0.5 TO 2.0	–	SURFACING LESS THAN 1" THICK SKIPS ON BASE
CAL. 2	0	0	0	0	0	EXCELLENT	3	GOOD	
CAL. 3	0	10	50	60	4.0	GOOD	1.5	EXCELLENT TO GOOD	
CAL. 4	1	5	20	26	2.55	–	1.5	–	SLIPPING WHERE SURFACE TREATMENT <1" ALSO CRACKING
GA. 1	0	0	0	0	0	EXCELLENT	⅜" TO ½	EXCELLENT TO GOOD	
GA. 2	0	0	0	0	0	–	–	" "	
GA. 3	0	0	0	0	0	–	–	" "	
ILL. 1	1	2	30	33	2.60	GOOD	⅜"	EXCELLENT	NO FAILURE 1" MULCH AT SOUTH END WORE AWAY UNDER TRAFFIC
ILL. 2	25	6	25	52.5	4.00	–	APPROX ⅜"	–	ORIGINAL SURFACE RATED GOOD LIGHT PATCH COAT PLACED 1940-EXCELLENT
IA. 1	0	0	0	0	0	EXCELLENT	⅜"	GOOD TO FAIR	MAINTENANCE ONLY TO IMPROVE RIDING QUALITIES
IA. 2	0	0	0	0	0	"	"	" "	" " " " "
IA. 3	0	0	0	0	0	"	"	FAIR TO GOOD	15% TOTAL AREA PATCHED IN MAINTENANCE
IA. 4	0	0	0	0	0	"	"	GOOD TO FAIR	" " " " " "
IA. 5	0	0	0	0	0	"	"	" "	PATCHING TO IMPROVE RIDING AND AREAS WHERE SNOW PLOWS INJURED SURFACE TREATMENT
KAN. 1	0	0	0.5	0.5	0.03	"	½"	FAIR	
KY. - 1	0.1	0.3	1.1	1.1	0.096	"	"	–	222 SQ YDS CAUSED BY INADEQUATE SUBGRADE DRAINAGE OR SUPPORT
MD. 1	0	0	0	0	0	"	"	EXCELLENT TO GOOD	AGGREGATE ¼"-⅜"-2.3 #/SQ YD CONDITION OF WEARING SURFACE AFTER 2ND TREATMENT
MD. 2	0	0	0	0	0	"	"	" " " "	" " " " " " - 2.8 #/SQ YD - REPORTED AFTER 2ND TREATMENT
MICH. 1	0	15	20	35	3.75	GOOD	NONE	–	BASE EXPOSED SINCE CONSTRUCTION NO SURFACE TREATMENT
MISS. 1	1	15	25	41	4.30	–	⅜	GOOD TO FAIR	INADEQUATE CONTROL OF SURFACE MOISTURE AND COMPACTION
MO. 1	0	0	0	0	0	EXCELLENT	½"	EXCELLENT TO GOOD	
MO. 2	0.9	0	11.3	12.2	1.3	GOOD	½"	" "	
MO. 3	4.9	0	5.0	9.9	4.17	"	"	GOOD TO FAIR	UNSATISFACTORY COMPACTION, INADEQUATE SUBGRADE DRAINAGE AND SUPPORT
NEB. 1	1	5	30	36	3.05	"	¼" TO ½"	–	EXCESSIVE MIXING TIME LAMINATIONS DURING COMPACTION
N.Y. 1	1	5	10	16	2.05	"	½	EXCELLENT TO GOOD	EXCESSIVE LONGITUDINAL CRACKS CLAIMED TO HAVE BEEN CAUSED BY SEVERE WINTER
O. 1	0	1	10	11	0.65	EXCELLENT	½" TO ⅝"	–	FAIR
O. 2	9.5	2.5	2.0	13.6	8.0	FAIR	½"	GOOD TO VERY POOR	INADEQUATE DRAINAGE AND SUPPORT
OKLA. 1	0	0	0	0	0	EXCELLENT	1½	–	
N.C. 1	0	0	50	50	7.5	GOOD	½"	EXCELLENT TO GOOD	
N.C. 2	0	4.8	88	92.8	6.96	"	¾"	" "	WHERE TWO COURSE CONSTRUCTION WAS USED SOME FAILURE TO BOND OBSERVED
N.C. 3	0	0	15	15.0	0.75	EXCELLENT	½"	" "	SCALING ATTRIBUTED TO INTERFERENCE WITH FINAL COMPACTION BY RAINS
N.C. 4	0.1	0	0	0.1	0.008	"	"	EXCELLENT	SOFT SPOT IN SUBGRADE CAUSING INADEQUATE COMPACTION
PA. 1	0	0	0	0	0	"	"	–	
S.C. 1	0	0	0	0	0	"	"	EXCELLENT	
S.C. 2	35	6	13	20.5	41	GOOD	½"	FAIR TO POOR	HEAVY SOIL, INSUFFICIENT CEMENT, BIRDER GREENE GIVE POOR DISTRIBUTION OF CEMENT
S.C. 3	0	0.4	0.3	0.7	0.08	EXCELLENT	–	EXCELLENT	SOME FAILURES ON GUMBO SUBGRADE. DRAINAGE POOR
S.C. 4	0	–	–	–	–	"	½" TO ¾"	"	"
S.C. 5	0.85	0.4	0.6	1.9	0.77	"	½"	"	FAILURE ON WET UNSTABLE SUBGRADE, ALSO WHERE % CEMENT LOWERED TO STUDY EFFICIENCY OF DURABILITY TEST
S.C. 6	0.8	–	0.3	1.1	0.81	"	¾"	"	TWO FAILURES IN CUTS ON VERY BAD SUBGRADE
S.C. 7	0.5	0	1.1	1.6	0.48	"	1½	"	MOISTURE - DENSITY CONTROL METHOD USED FOR FIRST TIME
S.C. 8	0	0	0	0	0	"	½"	"	
S.C. 9	0	–	–	0	0	"	–	"	
S.C. 10	0	0	1.9	1.9	4.0	GOOD	–	GOOD TO FAIR	POOR COMPACTION AT EDGES - SIDEWALKS IN EXCELLENT SHAPE
S.C. 11	–	–	–	–	–	EXCELLENT	⅜" TO ½"	–	"
S.C. 12	0	0	0	0	0	"	¾"	"	WEARING SURFACE PEELED OFF ON UNPRIMED SECTIONS
S.C. 13	–	–	–	–	–	"	½"	EXCELLENT	"
S.C. 14	0.1	1.6	–	2.5	0.84	"	¾"	EXCELLENT TO GOOD	150' THROUGH CUT, INADEQUATE SUPPORT AND DRAINAGE
S.C. 15	0	0	0	0	0	"	1	" " "	" " " " " "
S.C. 16	0.16	–	1.5	1.66	0.95	"	½"	EXCELLENT	BLOWUPS OCCURED AFTER SURFACE PRIMED SPRING 1937 - STEEL TIRED WAGONS CAUSED FAILURES
S.C. 17	0	0	0	0	0	"	¼	"	" " " " " "
S.C. 18	0	0	0.2	0.2	0.01	"	⅜" TO ½"	"	" " " " " "
S.C. 19	0	0	–	0	0	"	¾"	EXCELLENT TO GOOD	" " " " " "
TEX. 1	0	0	0	0	0	"	⅝"	" "	" " " " " "
TEX. 2	0	0	0	0	0	"	¾"	" "	" " " " " "
TEX. 3	0	0	0	0	0	"	–	EXCELLENT	" " " " " "
TEX. 4	0	0	20 TO 30	20 TO 30	5	GOOD	½	GOOD TO POOR	MUCH DILUTED EMULSIFIED ASPHALT OVERWETTED TOP OF SOIL-CEMENT BASE AND IT SPALLED OFF ON FREEZING
TEX. 5	0	0	0	0	0	EXCELLENT	¾"	EXCELLENT TO GOOD	" " " " " "
TEX. 6	0	0	0	0	0	"	–	" "	" " " " " "
TEX. 7	0	0	100	100	5	GOOD	½"	GOOD TO FAIR	" " " " " "
TEX. 8	0	0	0	0	0	EXCELLENT	¾"	EXCELLENT TO GOOD	" " " " " "
TEX. 9	0	0	0	0	0	"	–	" "	" " " " " "
VA. 1	0	0	0	0	0	"	–	" "	" " " " " "
VA. 2	0.1	0.1	0.1	0.3	0.10	"	1½	" "	" " " " " "
WASH. 1	–	–	–	–	–	"	2 ½"	FAIR	" " " " " "
MASS.	0	0	0	0	0	"	¾	–	" " " " " "

- - NOT SHOWN

FIGURE 6

The report shows that the wearing surfacing on 4 projects was rated in "Poor" condition. All the others were more satisfactory.

The data tabulated from the questionnaires are shown in Figures 1–6. The condition ratings for a project in Missouri and one in Wisconsin were not shown in the questionnaires returned from those States and were, therefore, not included in the tabulation.

The most frequent defect reported in the soil-cement is that of scaling off of the wearing surface which is frequently accompanied by slight softening of the soil-cement base at the surface. Numerous explanations for this occurrence are reported but there does not seem to be any definite concensus. Among causes mentioned are: (1) Inadequate control of surface finish caused by dry mixtures (2) blading of excess material to edges (3) lack of compaction (4) displacement by compacting equipment (5) inadequate thick wearing surface. An absence of prime is mentioned as a probable cause of scaling of the wearing surface and several states mention that the prime appeared to soften the top of the soil-cement base.