RETREATING NATURAL EARTH ROADS WITH ASPHALT

THESIS FOR THE DEGREE OF B. S.

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Roads
Asphalt

Retreading Natural Earth Roads With Asphalt

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INTRODUCTION

Owing to the fact that in not a few states there is an absence of standard aggregate meterials for the building of hard surfaced roads, these tests have been made to determine the advisability of using asphalt with natural earth for road building purposes. The high cost of transporting standard aggregates to such districts make their use prohibitive.

It is the purpose of this thesis to ascertain the advisability of using asphalt, either in a hot or cold mix form, with natural earth to make a hard wearing surface.

The States of Massachusetts and North Carolina are using dune and beach sands in the construction of wearing surfaces and some of the western states are experimenting with a sand, clay, and asphalt mixture.

HISTORY

In 1920 the Borough of Queens, New York City, r surfaced some of its earth streets by placing a layer of from 4" to 6" of stone on the dirt base and opening the road to traffic for a few days. Cold road oil was then put on at a rate of ½ to 1/5 gallon per sq. yd. and the road was rolled with a 5 ton roller. This gave very satisfactory results.

A number of roads in Long Island have been built of about 50% sand, 30% silt, and 20% clay. This was graded to a low crown and then oil was applied cold with a pressure distributor at a rate of about 1/3 to 2/5 gallon per sq. yd. This was immediately covered by broadcasting sand on the surface.

In 1922 the State of North Carolina improved their topsoil roads by scarifying and then rolling in broken stone about 2" in size.

It was then opened to traffic for a short time. When the stone was worked in in good shape, a layer of heavy oil was put on. These roads were carrying from 400 to 800 vehicles a day.

Jackson County, Missouri, graded some of its earth roads to a low crown and then sprayed oil on with a gravity system. This oil was used as a dust preventitive and to turn the water. This method met with fair success.

Illinois has experimented with oiled earth road with varied success.

North Carolina has recently constructed a hot mixed pavement in Dare County having a base composed of one part beach sand to four parts dune sand, and 7½% Asphalt. The wearing surface was made up of one part beach sand to three parts dune, 10½% asphalt, and 7½%

filler dust.

The results of this road have been so satisfactory that more of the same are being planned.

PROCEDURE AND DATA

Three samples of soil were taken from road sides in different localities, one each of sand, loam, and clay.

An analysis of these samples gave the following results:

Moisture Equivalent

Clay	20.12%
Loam	19.19%
Sand	10.27%

Mechanical Analysis

	Sand	Clay	Loam
Retained on No. 10	0.4 gm.	0.7 gm.	0.9 gm.
20	1.8	0.7	1.5
50	74.3	11.3	12.0
100	14.1	17.6	17.2
200	2.2	3.7	19.9
Silt	3.7	19.5	25.5
Clay	3.5	46.5	23.0
	100.0 gm.	100.0 gm.	100.0 gm.

Capillary Moisture

Clay	48.4%
Sand	36.0%
Loam	31.3%

Hot Mix

A sample of each soil was heated and mixed with hot Bermudez asphalt in different proportions by weight and molded into 3" cubes under 10,000 lbs. pressure, and subjected to the following tests.

Absorption

90% Clay + 10% Asphalt	5.85%
90% Sand + 10% Asphalt	2.08%
95% Sand + 5% Asphalt	1.93%
96% Sand + 4% Asphalt	2.00%
92.5% Sand + 7.5% Asphalt	2.27%

Loam would not mold.

Compression (Temp. 80° F)

A.	90% Clay + 10% Asphalt	186 lbs. per sq. in.
B.	90% Sand + 10% Asphalt	262 lbs. per sq. in.
C.	92.5% Sand + 7.5% Asphalt	194 lbs. per sq. in.
D.	95% Sand + 5% Asphalt	172 lbs. per sq. in.
E.	96% Sand + 4% Asphalt	161 lbs. per sq. in.

A standard shear test was also made with these results:

Shear (Temp. 80° F.)

A.	90% Clay + 10% Asphalt	839 lbs. per sq. in.
B.	90% Sand + 10% Asphalt	1653 lbs. per sq. in.
C.	92.5% Sand + 7.5% Asphalt	1061 lbs. per sq. in.
D.	95% Sand + 5% Asphalt	409 lbs. per sq. in.
E.	96% Sand + 4% Asphalt	325 lbs. per sq. in.

Loam would not mold.

Cold Mix

A box 4" deep and containing six compartments, each 12" square, was made. In each compartment was packed 1/3 cu. ft. of soil mixed with 1/4 gallon of kerosene cut back asphalt. A mixture of 50% sand and 50% pea gravel was used as a standard. These samples were allowed to cure three weeks before a test was made on them.

A ball weighing 7½ pounds was dropped from a height of 10 feet on each of the samples and the standard. A stream of water was then sprayed onto the samples and the test was repeated. There was no difference in the penetration of the wet and dry samples of the same material.

A similar test was made on a pavement known as Abbot Road. This pavement is about one year old and was made of standard aggregate mixed with cut back asphalt.

Penetration

F.	Standard	17/32"
G.	100% Sand	1 1/64"
H.	100% Clay	13/32"
I.	100% Loam	51/64"
J.	25% Loam + 75% Sand	51/64"
K.	25% Clay + 75% Sand	51/64"
	Abbot Road Pavement (1 year old)	11/32"

CONCLUSION

Hot Mix

While the tests which the samples were subjected to were purely of a laboratory nature and not under actual weather and load conditions, it appears that results for the most part indicate the advisability of proceeding with a trial section of road of each type of soil tested and subject the road to actual service conditions.

Sample "A" indicates the possibility of using clay in the hot mix for light loads if covered with a seal coat.

Sample "B", the sand with 10% asphalt appeared to be the best and produced results comparable to those of sheet asphalt.

The strength of the rest of the sand samples varied with the amount of asphalt used.

The loam would not mold and therefore no tests could be made upon it. The assumption is made that it is unsatisfactory.

Cold Mix

The results of the cold mix can hardly be taken as final for the reason that the samples were not exposed to the weather, and not under the pressure of traffic.

Sample "H", 100% clay, gave the best results. However, it should have a seal coat to withstand erosion.

Sample "G", 100% sand, in this case gave the poorest results. If given a little more time to volatilize, it would possibly improve.

The other three samples gave fair but favorable results, and leave little doubt as to the feasibility of putting them to actual road tests.

The writer wishes to call attention to the possibility of further investigation as to the best mixture of sand and clay, or sand and loam, to be used with the cold mix.

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