

TABLE 2  
DEFLECTIONS IN INCHES

Site	Number of Passes						
	0	1	5	8	13	20	31
1	0	0	0	1/8	1/8	1/8	3/8
2	0	0	0	0	1/8	1/8	1/2
3	0	1/8	1/8	1/4	1/2	5/8	5/8
4	0	1/4	3/8	1/2	1/2	5/8	7/8
5	0	0	1/4	1/4	1/4	1/4	5/8
6	0	0	1/4	1/4	1/2	1/2	7/8
7	0	0	1/8	1/4	5/8	3/4	1-1/8
8	0	0	1/8	1/8	1/4	3/8	3/8
9	0	0	1/8	1/8	3/8	3/8	5/8
10	0	0	1/8	1/4	3/8	1/2	3/4
11	0	1/8	1/4	1/4	5/8	5/8	3/4
12	0	1/8	1/4	3/8	3/8	3/8	1/2
13	0	0	1/8	1/4	1/4	3/8	3/4
14	0	0	1/4	3/8	5/8	5/8	5/8
15	0	1/8	3/8	3/8	1/2	1/2	1
16	0	0	1/4	1/4	1/2	5/8	7/8
17	0	1/8	3/8	3/8	3/8	1/2	3/4
18	0	3/8	3/4	7/8	7/8	7/8	7/8
19	0	1/8	3/8	3/8	3/8	1/2	5/8
20	0	0	1/4	3/8	1/2	1/2	5/8
21	0	0	1/4	1/4	3/8	3/8	1/2

TRAFFIC TEST on STABILIZED SHOULDER and on UNSTABILIZED TURF

The site chosen for the test is on Camp Road, S.H. 1067, Route 75, 200- to 500 ft. south of Soules Road in Erie County near the City of Buffalo. This site was chosen because of a wide shoulder where it is possible to contrast a bare well-compacted silt-clay with a trace of gravel shoulder, with a turf silt-clay uncompacted backslope.

The tests were run on April 16, 1953. The weather was rainy for the previous day and night and rain continued before and during the test. The shoulder area was very wet and had taken up all the moisture its degree of density would permit.

Four test locations were chosen as indicated on the accompanying sketch. Sites T.H. 1 and T.H. 4 were on the bare compact silt-clay shoulder with a trace of gravel; sites T.H. 2 and T.H. 3 were in the sodded silt-clay backslope.

A Federal truck with 10:00 x 20 tires, inflated to 80-lb. pressure, was loaded and checked with a loadometer to provide an 18,000-lb. rear-axle load. This truck had dual rear tires.

Photographs were taken before, during, and after the successive passages of the loaded truck in the same track over this area.

Four rigid bridges were built as measuring devices to span the ruts made by the truck after successive passages. Deflections of the soil in the ruts were measured after 0 run, 1 run, 4 runs, and 10 runs. These deflections were as follows:

Site		Deflections			
		0-Run	1-Run	4-Runs	10-Runs
T.H. 1	Bare compact shoulder	0	1/4 in.	3/8 in.	1/2 in.
T.H. 2	Sod backslope	0	5/8 in.	1-1/8 in.	2-5/8 in.
T.H. 3	Sod backslope	0	3/8 in.	5/8 in.	1-3/8 in.
T.H. 4	Bare compact shoulder	0	1/8 in.	3/8 in.	3/4 in.

After 10 passages of the truck a chuck hole developed in the backslopes at Station 2 + 75, 19 ft. right, between T.H. 2 and T.H. 3. This mud hole was about 10 in. deep, and further passage would have resulted in the truck becoming mired. Therefore, it was considered that the backslope had failed at 10 passages, but no sign of failure was evident in the bare compact silt-clay with-trace-of-gravel shoulder after 10 runs.

After completing the test runs and taking final photographs, soil-density tests were made at the four test locations, and soil samples were taken for laboratory testing. These test results follow:

Field Moisture Contents at  
Indicated Depths and Locations

Location	% Moisture in Soil Layer 1-to-3-in.	% Moisture in Soil Layer 3-to-5-in.	% Moisture in Soil Layer 5-to-7-in.
	T.H. 1	15.3%	17.4%
T.H. 2	23.2%	26.3%	24.3%
T.H. 3	28.3%	30.3%	22.2%
T.H. 4	10.8%	17.0%	21.1%

The top 1 in. was removed in each case to remove vegetation, free rain water, etc., and moisture contents were run on the successive 2-in. layers.

DENSITY TESTS

At each location density tests were made on the soils from 1 in. to 7 in. in depth. The top inch was removed to remove vegetation and free rain water.

Location	Wet Density Lbs. C.F.	Average Field Moisture Content	Dry Density Lbs. C.F.
T.H. #1	128.8	19.6%	107.6
T.H. #2	121.3	26.2%	96.2
T.H. #3	106.5	29.2%	82.5
T.H. #4	125.8	15.0%	109.4

NOTE: All tests were run in soil in its normal field condition and not in deformed and compressed truck tire tracks.

#### SOIL LIMIT TESTS

The following limit tests were run on soils from each site at depth from 1 to 7 in.

Test Location	Station	Offset ft.	Liquid Limit %	Plastic Limit %	Plasticity Index
TH 1	2+00	4 Rt.	34.9	26.6	8.3
TH 2	2+50	19 Rt.	34.2	27.1	7.1
TH 3	3+00	19 Rt.	35.2	27.2	8.0
TH 4	4+00	6 Rt.	27.2	20.1	7.1

#### SPECIFIC GRAVITY

Specific gravity at depth from 1 to 7 in.

Location	Specific Gravity Minus 4.76 MM	Specific Gravity Plus 4.76 MM
TH 1	2.70	2.64
TH 2	2.71	2.61
TH 3	2.69	2.63
TH 4	2.72	2.62

Equivalence - 4.76 MM = #4 U. S. standard sieve

#### GRAIN-SIZE DETERMINATION

Grain size was determined by sieve and hydrometer analysis.

Description	Grain Size	TH 1	TH 2	TH 3	TH 4
		%	%	%	%
Fine gravel	1-in. - 2.00 MM	13%	11%	7%	21%
Coarse sand	2.00 MM - 0.42 MM	11%	14%	8%	15%
Fine sand	0.42 MM - 0.074 MM	13%	13%	22%	19%
Silt	0.074 MM - 0.002 MM	42%	48%	45%	35%
Clay	0.002 MM - finer	21%	14%	18%	10%

Equivalents - 2.00 MM = #10 U.S. standard sieve  
0.42 MM = #40 U.S. standard sieve  
0.074MM = #200 U.S. standard sieve

## APPRAISAL

On this site providing similar soils, the uncompacted turf backslope was unsatisfactory by comparison. The lower density and high moisture content caused failure after 10 passes of the loaded truck while no appreciable distress was observed in the compact bare shoulder, owing to its higher density and lower field moisture content.

This test would indicate that greater density of soil provides greater stability.



"Before"



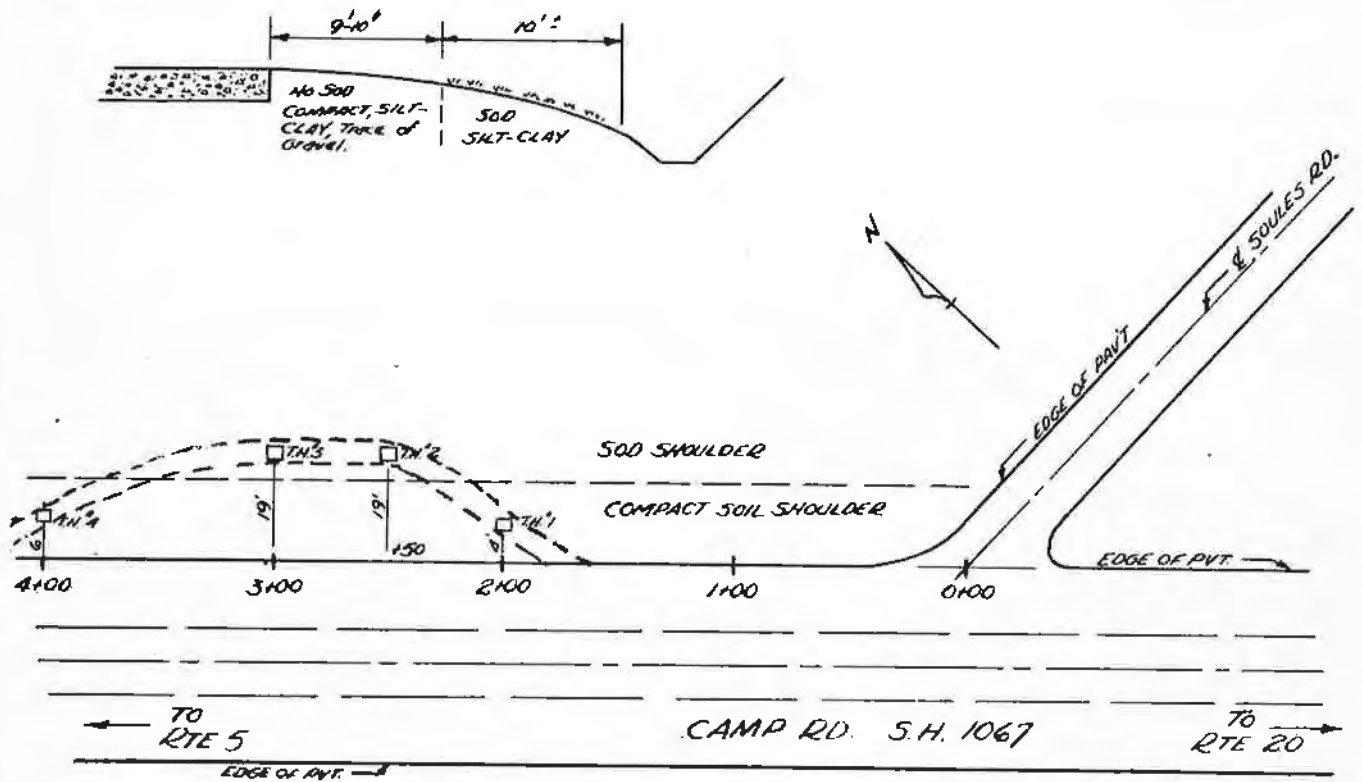
Starting first run.

First run.

After four runs.



After 10 runs.



Bureau of Public Roads Shoulder Test

SOIL ANALYSIS of TURF SHOULDERS

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Although no controlled tests were run, continued observation, during bad weather, of the sections of highway shoulders represented by the following analyses indicate that they have a satisfactory degree of stability as well as a satisfactory turf cover.

PENDER COUNTY

NEW HANOVER COUNTY

	<u>SAMPLE 1</u>	<u>SAMPLE 2</u>	<u>SAMPLE 3</u>	<u>SAMPLE 4</u>
Depth	0-4 in.	4-8 in.	0-4 in.	4-8 in.
Soil type	Hyde Loam	Hyde Sandy Loam	Norfolk Sand	Norfolk Sand
Subgrade class.	A-4	A-4	A-3	A-3
Coarse agg. (Ret. #10)	0	2	0	0
Coarse sand	2	12	29	27
Fine sand	43	43	66	67
Silt	39	34	2	3
Clay	16	11	3	3