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Report No. 2 on the Skid Tests Performed on Experimental Federal Aid Project Number F-147(6)

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Recommended Citation
Holloway, F. M. *Report No. 2 on the Skid Tests Performed on Experimental Federal Aid Project Number F-147(6)*. Publication FHWA/IN/JHRP-56/17. Joint Highway Research Project, Indiana Department of Transportation and Purdue University, West Lafayette, Indiana, 1956. doi: 10.5703/1288284313507.

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REPORT No. 2 OF SKID TESTS PERFORMED ON EXPERIMENTAL FEDERAL AID PROJECT No. F-147(6)

APRIL, 1956
No. 17

by

F. M. Holloway

Joint Highway Research Project

PURDUE UNIVERSITY
LAFAYETTE INDIANA

PROGRESS REPORT NO. 2 ON THE

SKID RESISTANCE STUDY OF

EXPERIMENTAL FEDERAL-AID PROJECT F-147(6)

TO: K. B. Woods, Director
Joint Highway Research Project

April 19, 1956

File: 8-17
C-36-53H

FROM: Harold L. Michael, Assistant Director

Attached is a report entitled "Progress Report No. 2 on the Skid Resistance Study of Experimental Federal-Aid Project F-147(6)." This report is the second of a series of reports on the comparison of silica sand and bituminous concrete surfaces on U.S. 421 near Osgood, Indiana. The project was undertaken to conduct periodic skid tests and report the results to the State Highway Department of Indiana. The report has been prepared by Mr. F. M. Holloway, a Research Engineer on our staff.

The results of this series of tests indicate that the skid characteristics of silica sand are better than those of bituminous concrete under wet conditions at speeds of 30 and 40 m.p.h. The skid characteristics, in fact, approach those of rock asphalt. These results are similar to those noted during the first series of tests in November, 1954.

Additional copies will be furnished the State Highway Department for their use in reporting to the Bureau of Public Roads.

Respectfully submitted,

Harold L. Michael

Harold L. Michael, Assistant Director
Joint Highway Research Project

HLM:cjg

Attachment

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PROGRESS REPORT NO. 2 ON THE SKID RESISTANCE STUDY OF EXPERIMENTAL FEDERAL-AID PROJECT F-147(6)

by

Frank M. Holloway

Research Engineer

Joint Highway Research Project

C-36-53-H

Purdue University

Lafayette, Indiana

April 19, 1956

INTRODUCTION

This report summarizes the results of the second series of skid tests performed by the Joint Highway Research Project on Federal-Aid Project F-147(6). The project is located on Federal-Aid Route No. 23, U. S. Highway No. 421 in Ripley County between the West Junction of U. S. 50 and Osgood. Two different pavement surface types, Silica Sand and Bituminous Concrete, were tested and their skidding properties evaluated and compared.

METHOD OF TEST

The tests were performed using the skid equipment which was developed in 1954 for a comprehensive skid resistance study of pavement surface types. A standard 2-door 1951 Ford was used in the first series of skid tests conducted in November, 1954. Since then a standard 2-door 1955 Ford has been equipped with the same skid equipment and was used in this second series of tests.

PROCEDURE

The tests were run at two different locations on each of the 2 pavement types. At each of these locations both dry and wet tests were run at speeds of 30 and 40 m.p.h. For the original series of test speeds of 10 and 20 m.p.h. were also included, but because the higher speeds have more significance, as these are nearer actual traffic speeds, and previous investigators have expressed considerable doubt as to the validity and usefulness of skids taken at 10 and 20 m.p.h., these were not made for the present study.

Because it was impossible to make each skid test at exactly the designated speed of 30 or 40 m.p.h., it was necessary to adjust the skid distances to either 30 or 40 m.p.h. This was accomplished from an application of the physical relationship $F = \frac{V^2}{30\ S}$ where "S" is the skidding distance in feet, "V" the speed in m.p.h., and "F" the coefficient of friction for the road. An approximate "F" for each type of road both wet and dry was obtained by averaging all of the appropriate speeds and skid distances for that type and placing these average values in the above relationship. With a knowledge of this average coefficient of friction, it was possible to estimate the difference in skid distances resulting from 1/4 m.p.h. differences in speed. These estimated adjustments were applied to all skids with initial speeds other than 30 or 40 m.p.h. to render more comparable values. The average adjustment was about one foot for each 1/4 m.p.h.

Pertinent data relative to the present tests are shown in Table 1 and all the test data are shown in Table 2. The average skid distances and computed coefficients of friction for both the initial study of Nov. 10, 1954 and the present study are tabulated in Table 3.

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Table 1

Study Data

Date of Tests:	March 13, 1956
Driver:	Frank M. Holloway
Vehicle:	1955 Ford two-door
Locations:	1-Silica Sand Section
	1a - Between Sta. 213/00 and Sta. 215/00 Northbound
	1b - Between Sta. 192/00 and Sta. 195/00 Southbound
	2-Bituminous Concrete Section
	2a - Between Sta. 85/00 and Sta. 100/00 Northbound
	2b - Between Sta. 85/00 and Sta. 95/00 Southbound

Table 2

March, 1956 - Test Data

Silica Sand Pavement

Location 1-a				Location 1-b			
Dry		Wet		Dry		Wet	
Speed m.p.h.	Dist. feet	Speed m.p.h.	Dist. feet	Speed m.p.h.	Dist. feet	Speed m.p.h.	Dist feet
30.00	59.75	30.00	67.00	30.00	59.00	30.25	69.00
30.25	60.00	29.75	66.00	30.00	59.00	30.00	66.50
39.75	103.50	40.50	127.50	39.75	105.00	40.00	139.5
40.50	109.50	40.50	126.50	40.00	104.00	40.50	133.5

Bituminous Concrete Pavement

Location 2-a				Location 2-b			
Dry		Wet		Dry		Wet	
Speed m.p.h.	Dist. feet	Speed m.p.h.	Dist. feet	Speed m.p.h.	Dist. feet	Speed m.p.h.	Dist. feet
30.00	62.00	30.00	78.50	30.00	62.00	30.00	82.00
29.75	61.50	30.00	80.00	30.00	61.50	30.00	75.00
39.50	104.5	40.50	163.5	39.00	104.00	40.00	167.50
39.00	103.5	41.00	160.5	40.00	108.00	39.75	148.50

Note: Speeds and skid distances shown are actual values obtained. Skid distances are "corrected" for 30 and 40 m.p.h. in Table 3.

Table 3

Average Skid Distances and Coefficients of Friction

Dry Tests

Test Speed m.p.h.	Silica Sand				Bituminous Concrete			
	Average Skid Distance (Feet)		Average Coefficient of Friction		Average Skid Distance (Feet)		Average Coefficient of Friction	
	Nov. 1954	Mar. 1956	Nov. 1954	Mar. 1956	Nov. 1954	Mar. 1956	Nov. 1954	Mar. 1956
10	7.2	*	0.46	*	6.9	*	0.48	*
20	28.0	*	0.48	*	26.6	*	0.50	*
30	62.1	59.2	0.49	0.51	53.9	62.0	0.51	0.48
40	105.0	105.5	0.50	0.51	103.8	107.5	0.51	0.50
** Overall Averages =			0.50	0.51	**Overall Averages =		0.51	0.49

Wet Tests

Test Speed m.p.h	Silica Sand				Bituminous Concrete			
	Average Skid Distance (Feet)		Average Coefficient of Friction		Average Skid Distance (Feet)		Average Coefficient of Friction	
	Nov. 1954	Mar. 1956	Nov. 1954	Mar. 1956	Nov. 1954	Mar. 1956	Nov. 1954	Mar. 1956
10	7.6	*	0.44	*	8.5	*	0.40	*
20	30.6	*	0.46	*	35.5	*	0.37	*
30	70.5	67.1	0.43	0.45	80.4	79.9	0.33	0.38
40	129.1	129.9	0.42	0.41	163.1	158.5	0.32	0.34
** Overall Averages =			0.43	0.43	**Overall Averages =		0.33	0.36

* No tests were made at 10 and 20 m.p.h. during March 1956 tests

** Overall averages based upon 30 and 40 m.p.h. skid distances.

RESULTS AND CONCLUSIONS

It is evident from the tables that the difference between bituminous concrete and silica sand in the dry condition is small and probably of little significance. This is in agreement with the results of skid tests made during the last two years by the Joint Highway Research Project on a large number of roads where it has been found that there is very little difference in the skidding properties among all surface types in the dry condition at 30 m.p.h.

A comparison of these test results to those taken in November, 1954 shows that in the dry condition the average skidding distance for the silica sand was slightly less while the bituminous concrete was slightly greater than previously although for both types the difference is probably not significant.

The wet tests provide a much more striking contrast. The average coefficient of friction for the silica sand section is 0.43 compared with 0.36 for the bituminous concrete, a difference of 0.07. November, 1954 coefficients for these same sections were 0.43 and 0.33, respectively. For the wet condition, the average skidding distance for the silica sand at 30 m.p.h. was 3.4 feet less than for November, 1954 but for the bituminous concrete the average skidding distance was 10 5 feet less For 40 m.p.h. the average skidding for silica sand increased by 0.9 foot while for bituminous concrete it decreased by 4.6 feet.

In summary, it might be stated that the two sections of road tested do not have significantly different skidding properties in the dry conditions, but that the silica sand section has highly significantly better skidding properties than the bituminous concrete in the wet condition.

These are essentially the same conclusions which were made in the first study of these experimental sections.