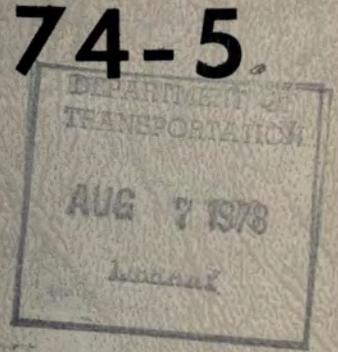


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MISSOURI COOPERATIVE HIGHWAY RESEARCH PROGRAM
FINAL REPORT



**AN INVESTIGATION OF THE DURABILITY OF
SKID RESISTANCE OF WIRE COMBED
PCC PAVEMENT SURFACES**

MISSOURI STATE HIGHWAY DEPARTMENT



TF

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ABSTRACT

This report involves pavements constructed with the following textures: AstroTurf Drag: Gomaco Roll-A-Groove, wire combs with 5" tine lengths with 1/4" and 1/2" tine spacings, 4" tine lengths with 1/4", 1/2", and 3/4" tine spacings, 3" tine lengths with 1/4" tine spacings, and 3" tine lengths with 1/2", 3/4" and 1" tine spacings both with and without a burlap drag preceding. Nominal wire tine dimensions of .0625" in width and .028" in thickness were used. One project had a nominal wire tine width of .125" as a variable. Under a previous study, which was incorporated into this report, the following textures were constructed: burlap drag, heavy nylon bristle broom, fine nylon bristle broom, natural bristle broom, and wire comb with 3" tine length and 1/4" tine spacing.

Included in this report is a brief description of each project and summaries of friction tests, sand patch texture depth tests and sound level measurements.

The 1/4" and 1/2" wire comb textures are more suitable than the burlap drag, AstroTurf Drag, and broom textures, however, the 1/2" wire comb provides only a slight advantage over the 1/4" wire comb.

Monitoring of the skid resistance and texture depths is being continued on wire comb textures.

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INTRODUCTION

In the past few years, there has been a growing concern about the characteristics of friction or skid resistance between the tires of vehicles and highway pavements. Much has been done by various agencies to improve these frictional characteristics. However, there still remains much to be learned in this area.

The Missouri State Highway Department has had three studies involving skid resistance. The report of an earlier investigation of skid resistance in Missouri was published in August, 1973. Two current studies are "An Investigation of Skid Resistant Asphaltic Mix Designs" and "An Investigation of the Durability of Skid Resistance of Wire Combed PCC Pavement Surfaces", which is the subject of this report.

Problem

In early 1970, a project was constructed to determine which experimental pavement textures, if any, were capable of producing better skid resistance properties than the then specified burlap drag texture. Experimental textures were constructed with the following devices: a heavy nylon bristle broom, a fine nylon bristle broom, a natural bristle broom, and a 3" x 1/4" wire comb. It was found in this study that PCC pavement textures constructed using a transverse wire comb were more effective in improving skid resistance than the other experimental textures.

Based on this study, the Missouri State Highway Department adopted pavement surface texturing with wire combs with 1/16" wide tines spaced at 1/4" centers in lieu of the burlap drag. However, on later projects, it was noted that texture depths and skid numbers decreased rapidly with higher annual average daily traffic (AADT) and higher percentages of studded tires. Thus, a new problem existed in deciding which tine spacing, and possibly which tine length, would provide the most desirable skid resistance and noise levels.

Objective

High initial friction of a surface is an important property but the surface should also maintain a reasonable level of improved skid resistance for a sufficient length of service time. The objective of this study was to determine friction wear factors, using the Missouri skid trailer, for a number of portland cement concrete pavements, constructed to have improved skid resistance.

Included in this report is a brief description of each project, summaries of the friction tests, sand patch texture depth tests, and sound level measurements. All of the skid testing has been performed with a skid trailer which substantially complies with ASTM E 274. Sound level measurements were made subjectively or with a General Radio Type 1565-D Sound Level Meter using the A-weighted scale. The units of this scale are commonly referred to as dbA.

It is realized that many factors can influence skid resistance properties of a pavement, such as temperature, studded tires, precipitation, and vehicle contaminants. The influence is evident when it is observed how the skid numbers raise and lower over a period of time.

CONCLUSIONS

The following conclusions are based on the results of this investigation:

1. With the available data, there is no statistically significant difference in the SN's between the 1/4" and 1/2" wire comb textures. However, if the present trends continue, there will be a statistical difference with the 1/2" wire comb textures providing higher skid resistance for a greater amount of accumulated traffic.
2. The linear regression analysis using a log-log relationship is much more effective for computing wear factors than the simple equation for computing the slope between two points.
3. It was noted that the pavement textures in areas of high average daily traffic with high percentages of studded tire traffic wear away much more quickly than in areas of lower average daily traffic with small percentages of studded tire traffic.
4. There were many problems associated with the use of the Gomaco Roll-A-Groove machine, such as non-uniform texture, slow operation, and ridges between passes, even though the skid resistance and texture depths of the texture were suitable.
5. The A-weighted scale on a sound level meter is inadequate for determining the irritability of noise caused by the various pavement surface textures.
6. There was no significant difference on the A-weighted scale in the noise level produced by the different wire comb textures.
7. With the limited amount of data on the 3/4" and 1" wire comb textures, no evaluation could be made of the durability of the skid resistance; however, it was noted that there was no significant difference in the initial test results when comparing the 3/4" and 1" wire comb textures to the other wire comb textures.
8. It appeared that nominal changes in the wire comb tine length, width and thickness did not significantly affect skid resistance.

IMPLEMENTATION

Based on data obtained in this investigation to date, use of the wire comb with nominal .0625" wide tines spaced at 1/2" centers will be continued for PCC pavement texturing.

Efforts will be made to determine other methods of pavement surface texturing which will provide improved skid resistance.

Monitoring of the skid resistance and texture depth of the 3/4" and 1" tine spaced wire comb textures will be continued.

DISCUSSION

Scope

This study began in December, 1973; however, three projects were constructed before this study began. They were: the original experimental texturing project on Route 63, Boone County, which was the first project using a 1/4" wire comb; the Route I-435 project in Jackson County, which also used a 1/4" wire comb and was completed about a year after the first experimental texturing project; and a third project on Route 163, Boone County, which also used a 1/4" wire comb and was completed about another year later.

The study involved fifty-one test sections and 56.862 miles of tested pavement. Following is the number of sections and the number of miles for each type texture:

Three sections of burlap drag	3.417 miles
Fourteen sections of 1/4" wire comb	14.501 miles
Two sections of 1/2" wire comb preceded by a burlap drag	2.046 miles
Fourteen sections of 1/2" wire comb not preceded by a burlap drag	17.607 miles
Three sections of 3/4" wire comb preceded by a burlap drag	3.202 miles
Four sections of 3/4" wire comb not preceded by a burlap drag	5.851 miles
Three sections of 1" wire comb preceded by a burlap drag	3.693 miles
Three sections of 1" wire comb not preceded by a burlap drag	3.296 miles
One section of AstroTurf drag	0.957 mile
One section of heavy nylon bristle broom	0.625 mile
One section of fine nylon bristle broom	0.511 mile
One section of natural bristle broom	0.498 mile
One section of Gomaco Roll-A-Groove	0.658 mile

Skid resistance measurements were made on all of these projects. Some of the earlier projects were not evaluated for noise levels but most projects were tested for texture depth. All available data was used to evaluate each of the various test sections.

Skid Trailer

Frictional properties of the pavements on these projects were determined using a locked wheel skid trailer which substantially complies with ASTM E 274. The skid testing system was calibrated at the Field Test and Evaluation Center, located at Texas Transportation Institute, College Station, Texas, in April, 1974, and again in February, 1977. Prior to April, 1974, the trailer was equipped with 7.75 x 14 standard test tires conforming to requirements of ASTM E 249. After April, 1974, G78 x 15 tires conforming to requirements of ASTM E 501 were used.

During the evaluation period in February, 1977, the water nozzles were changed to the Penn State type to obtain a wider water stream.

Testing Procedures

Generally, each test section was tested for skid resistance in five locations per direction at each test speed. There were cases where the test section was not of sufficient length to permit five tests. Some projects were tested in more than one lane. In order to simplify wheelpath indication, a method of numbering was devised. The test positions (wheelpaths) were numbered consecutively from right to left starting with the right wheelpath of the first through traffic lane. Most of the testing was performed in "position 2" (inner wheelpath)

On the two-lane undivided projects, there were five sand patch texture depth test spots per lane, each being in position 2. All ten tests were averaged for reporting.

On divided projects, there were five sand patch texture depth test spots in position 2 and five in position 3. The averages were of only the five tests in a lane.

Data Analysis

In this report, several references are made to skid numbers (SN). When referring to a particular test speed, SN's are subscripted to indicate the speed (SN₂₀).

For analyzing changes in SN's due to traffic, annual average daily traffic (AADT) and age at time of testing were used to calculate estimated accumulated traffic.

It has been found that, when trying to relate SN's and estimated accumulated traffic, a log-log relationship is most meaningful. The slope of the line through the points is defined as the friction wear factor. It quickly became evident that the equation for a line was not adequate for determining a wear factor if it involves more than two data points.

Generally, the same result can be obtained from a linear regression analysis using a log-log relationship.

Also, included in the analysis is the standard error of estimate ($S_{y,x}$). These values are given in logarithmic form. $S_{y,x}$ is a measure of variability similar to standard deviation. However, in a regression analysis, variability is about a line rather than about a mean.

The coefficient of variation (CV) is defined as the ratio of the standard error of estimate to the mean SN, expressed as a percentage.

The coefficient of determination (r^2) expresses to what degree SN's are affected by accumulated traffic (TR). It might be said that for an r^2 value of .668, it would be indicated that 66.8% of the influence on the SN's is caused by TR. The other 33.2% influence is from factors other than TR. It is possible that a trend could be established for some other variable considered.

A 95% level of confidence was used to determine significance of the effects of accumulated traffic. If significance was established, the regression line was drawn on the graph. It should be realized that this regression line is valid only within the limits of the existing data. If non-significance was established, it was indicated with the sentence, "A regression analysis indicates that the skid numbers are not significantly affected by accumulated traffic, therefore, a dependable wear factor cannot be calculated."

Project Results

Route 63, Boone County, (Section A of the appendix): The 3" x 1/4" wire comb texture has the least desirable wear factor of all of the experimental textures, however, it had skid numbers of at least 5 or 6 numbers higher than the other textures. The only texture that had higher skid numbers when last tested was the heavy nylon bristle broom texture which was considerably more noisy than the wire comb texture.

Route 163, Boone County, (Section B of the appendix): The 3" x 1/4" wire comb textured surface on this project is performing adequately but it does have a rather large wear factor.

Route 50, Morgan County, (Section C of the appendix): Both 4" x 1/4" and 4" x 1/2" wire combs were used for texturing on this project. Each texture is performing rather well but the 4" x 1/4" wire comb texture appears to be wearing faster than the 4" x 1/2" wire comb texture.

Route I-435, Jackson County, (Section D of the appendix): A burlap drag and a 1/4" wire comb were each used for texturing on this project. This pavement has a high AADT and such a high percentage of studded tire traffic that neither of the textures did well. The wear factors for the burlap drag texture are more desirable than those for the 1/4" wire comb textures.

Route 71, Barton County, (Section E of the appendix): Texturing operations utilized 3" x 1/4", 3" x 1/2", 5" x 1/4" and 5" x 1/2" wire combs and also an AstroTurf drag. All textures maintained reasonably good skid resistance. There was no difference in noise levels and very little difference in texture depth changes. The wear factors were reasonably good on all of the textures.

Route I-35, Harrison County, (Section F of the appendix): Texturing equipment consisted of a Gomaco Roll-A-Groove and a 3" x 1/2" wire comb. Both textures provided reasonably good skid resistance and maintained good texture depths. However, the wire comb held up slightly better than the Roll-A-Groove.

Route 63, Boone County, second project, (Section G of the appendix): This project provided a comparison of 4" x 3/4" and 3" x 1/2" wire comb textures. Subjective noise level measurements indicated that the 4" x 3/4" wire comb was producing a slightly objectionable frequency of noise. The 4" x 3/4" wire comb has provided slightly higher skid numbers than the 3" x 1/2" wire comb, but the wear factors are about the same.

Route 63, Boone County, third project, (Section H of the appendix): Four sections were textured with the 3" x 1/2" wire comb, all of which have produced reasonably good skid resistance.

Route I-57, Mississippi County, (Section I of the appendix): Texturing on this project utilized all twelve combinations of 3" x 1/2", 3" x 3/4", and 3" x 1" wire combs both with and without a burlap drag preceding and with nominal wire tine widths of 1/16" and 1/8". The wire tine thickness was a nominal 1/32" in all cases. Use of the 1/8" wide tines resulted in a texture with a better appearance than the 1/16" wide tines. In some cases, the textures with the 3/4" and 1" tine spacings produced some objectionable noises. All measurements were performed before the pavement was opened to traffic. All SN₄₀'s were above 50 on this project.

Route I-35, Daviess County, (Section J of the appendix): This project utilized textures with 3" x 3/4" and 3" x 1" wire combs, both with and without a burlap drag preceding and with a 3" x 1/2" tine spacing not preceded by a burlap drag. Nominal tine dimensions were 1/32" in thickness and 1/16" in width. The 1" wire comb texture produced some slightly objectionable noise. All measurements were performed before the pavement was opened to traffic. All SN₄₀'s on this project were above 59.

APPENDIXES

DISTINCTIVE CHARACTERISTICS

DISCUSSION OF RESULTS

DESCRIPTION OF PROJECTS

TABLES

FIGURES

**ROUTE 63
BOONE COUNTY
PROJECT CO10-63(19)**

Distinctive Characteristics

The following textures were constructed on this project: burlap drag, wire comb with 3" tine length and 1/4" tine spacing center to center (3" x 1/4" wire comb), heavy nylon bristle broom, fine nylon bristle broom, and natural bristle broom. All textures except the burlap drag were transversely formed.

Discussion of Results

This project was used as part of an earlier study involving skid resistance. That study concluded that the wire comb texture unquestionably performed as well or better than all of the other experimental textures. The conclusion was based upon the evaluation of skid resistance, the rate of deterioration of the surface texture, and the evaluation of noise level changes when crossing the boundaries from one texture to another. It was also concluded that the skid resistance and texture depths were not as desirable as they might have been. As a result, it was then recommended that further testing be done involving other spacings of wire comb tines. The wire comb tine spacing used on this project was 1/4" with a tine length of 3". Other projects have since been constructed utilizing 1/4", 1/2", 3/4" and 1" tine spacings. Testing on this project was completed in June, 1975, because the pavement was included as the southbound lanes of a divided pavement.

Description of Project

The pavements are all undivided two lane pavements. The lengths of pavement for each texture are as follows: burlap drag - 0.523 mile, wire comb - 0.519 mile, heavy nylon bristle broom - 0.625 mile, fine nylon bristle broom - 0.511 mile and a natural bristle broom - 0.498 mile.

The testing of each section consisted of a series of ten tests, five in each direction, the averages of the results of which are shown in Table I-A and plotted in Figure I. All tests were performed in position 2 and represent a five year period.

Texture depth tests were also performed on this project. The Missouri standard test method of determining texture depth was used. This involves the use of the sand patch test procedure. These test results are shown in Table I-B.

The project was opened to traffic in August, 1970.

TABLE I-A

SKID TESTS AND TRAFFIC DATAROUTE 63
BOONE COUNTY

<u>Date Tested</u>	<u>SN</u> <u>40</u>	<u>SN</u> <u>50</u>	<u>AADT</u> <u>/Lane</u>	<u>Age in</u> <u>Months</u>	<u>Est. Acc.</u> <u>Traffic</u>
<u>Section 1 - Burlap Drag</u>					
8/31/70	48.4	37.6	2305	0	1,000
10/14/70	39.7	35.7	2305	2	140,000
3/15/71	43.2	36.5	2550	8	600,000
8/23/71	36.1	33.3	2550	13	980,000
11/ 8/71	39.6	36.5	2550	16	1,210,000
4/10/72	39.3	34.1	2625	21	1,600,000
5/18/73	40.5	--	2960	34	2,760,000
6/17/74	38.5	34.5	2785	47	3,840,000
4/17/75	36.2	31.0	2785	57	4,680,000
<u>Section 2 - 3" x 1/4" Wire Comb</u>					
8/31/70	67.8	59.7	2305	0	1,000
10/14/70	56.9	53.4	2305	2	140,000
3/15/71	54.5	49.0	2550	8	600,000
8/23/71	46.9	45.2	2550	13	980,000
11/ 8/71	47.9	46.2	2550	16	1,210,000
4/10/72	47.9	42.6	2625	21	1,600,000
5/18/73	42.6	--	2960	34	2,760,000
6/17/74	41.4	37.7	2785	47	3,840,000
4/17/75	37.0	31.1	2785	57	4,680,000
<u>Section 3 - Heavy Nylon Bristle Broom</u>					
8/31/70	62.9	50.7	2305	0	1,000
10/14/70	52.3	48.9	2305	2	140,000
3/15/71	48.1	43.2	2550	8	600,000
8/23/71	42.7	38.6	2550	13	980,000
11/ 8/71	43.6	40.2	2550	16	1,210,000
4/10/72	43.2	37.6	2625	21	1,600,000
5/18/73	39.3	--	2960	34	2,760,000
6/17/74	38.4	34.1	2785	47	3,840,000
4/17/75	39.2	30.5	2785	57	4,680,000

TABLE I-A (Continued)

SKID TESTS AND TRAFFIC DATA

ROUTE 63
BOONE COUNTY

<u>Date Tested</u>	<u>SN</u> 40	<u>SN</u> 50	<u>AADT</u> <u>/Lane</u>	<u>Age in</u> <u>Months</u>	<u>Est. Acc.</u> <u>Traffic</u>
<u>Section 4 - Fine Nylon Bristle Broom</u>					
8/31/70	61.8	48.4	2305	0	1,000
10/14/70	50.6	47.0	2305	2	140,000
3/15/71	46.2	39.4	2550	8	600,000
8/23/71	37.5	34.6	2550	13	980,000
11/ 8/71	40.6	37.2	2550	16	1,210,000
4/10/72	39.6	34.8	2625	21	1,600,000
5/18/73	38.2	--	2960	34	2,760,000
6/17/74	36.8	33.2	2785	47	3,840,000
4/17/75	35.4	30.7	2785	57	4,680,000
<u>Section 5 - Natural Bristle Broom</u>					
8/31/70	62.7	47.5	2305	0	1,000
10/14/70	49.0	45.1	2305	2	140,000
3/15/71	46.7	40.3	2550	8	600,000
8/23/71	39.1	36.8	2550	13	980,000
11/ 8/71	41.2	38.7	2550	16	1,210,000
4/10/72	41.6	36.2	2625	21	1,600,000
5/18/73	40.2	--	2960	34	2,760,000
6/17/74	38.6	35.0	2785	47	3,840,000
4/17/75	36.6	31.4	2785	57	4,680,000

TABLE I-B
TEXTURE DEPTH OF EACH TEXTURE
 ROUTE 63
 BOONE COUNTY

<u>Date</u>	<u>Avg. Texture Depth, TX</u>	<u>Standard Deviation</u>	<u>Est. Acc. Traffic</u>
<u>Section 1 - Burlap Drag</u>			
8/70	.020	.004	1,000
6/71	.014	.002	830,000
6/72	.011	.001	1,780,000
6/75	.011	.001	4,850,000
<u>Section 2 - 3" x 1/4" Wire Comb</u>			
8/70	.027	.007	1,000
6/71	.017	.005	830,000
6/72	.016	.003	1,780,000
6/75	.011	.001	4,850,000
<u>Section 3 - Heavy Nylon Bristle Broom</u>			
8/70	.029	.004	1,000
6/71	.016	.001	830,000
6/72	.013	.001	1,780,000
6/75	.013	.001	4,850,000
<u>Section 4 - Fine Nylon Bristle Broom</u>			
8/70	.027	.003	1,000
6/71	.012	.001	830,000
6/72	.011	.001	1,780,000
6/75	.012	.001	4,850,000
<u>Section 5 - Natural Bristle Broom</u>			
8/70	.021	.006	1,000
6/71	.011	.001	830,000
6/72	.011	.001	1,780,000
6/75	.012	.001	4,850,000

Figure 1

EFFECTS OF TRAFFIC ON SKID NUMBERS

ROUTE 63

BOONE COUNTY

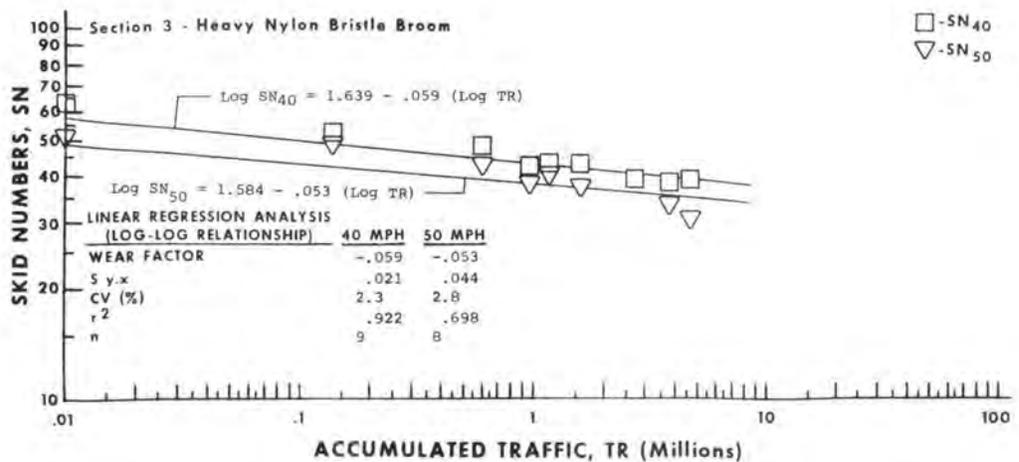
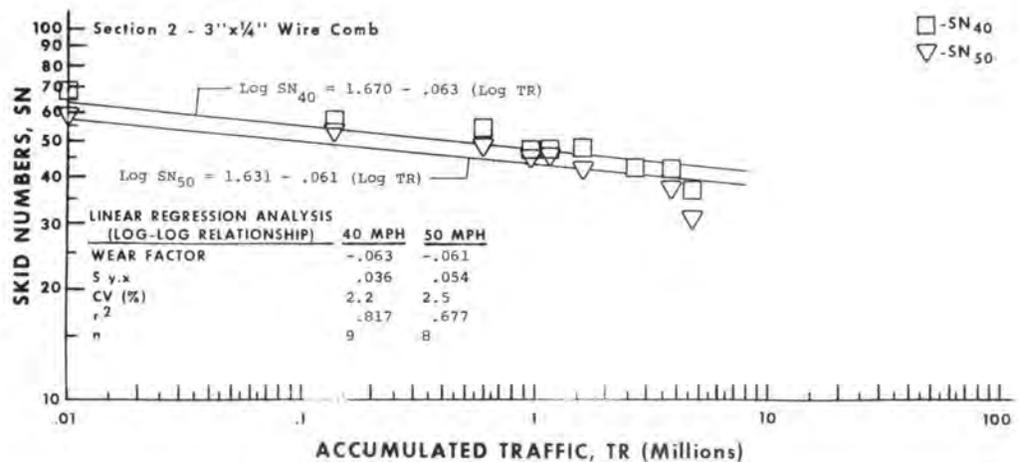
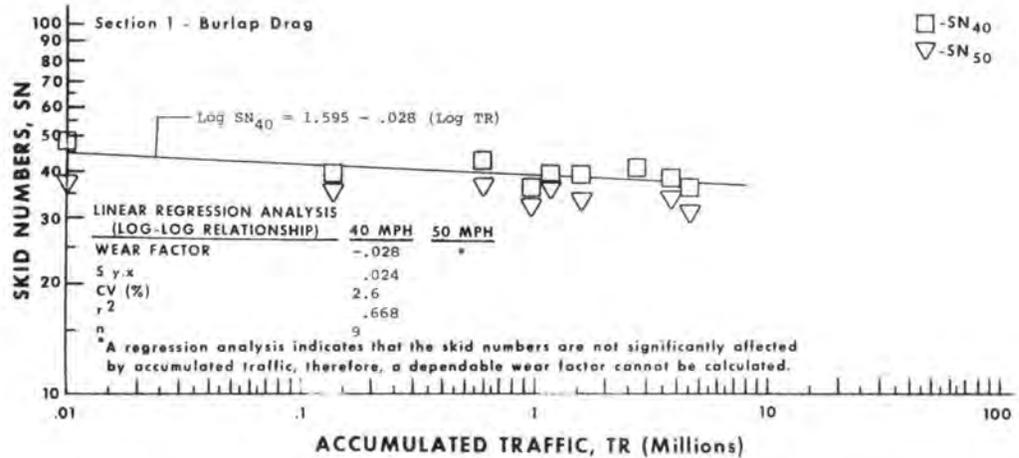
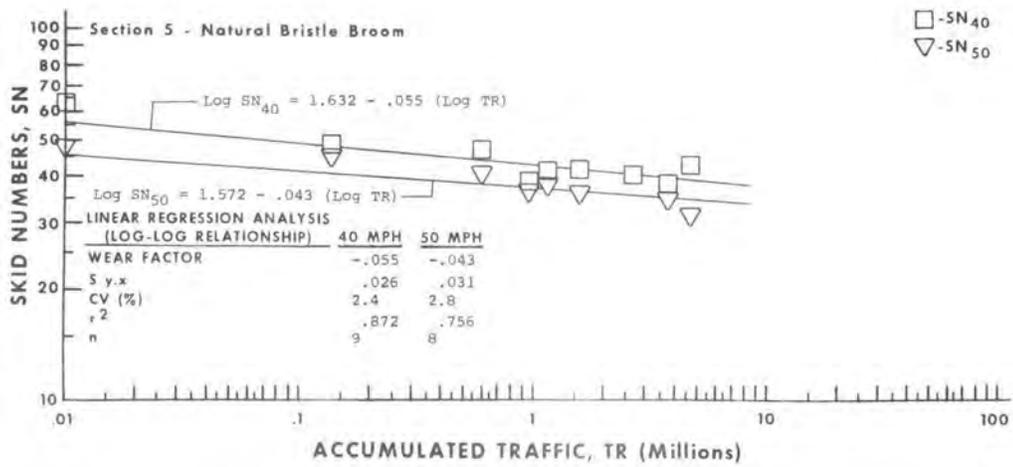
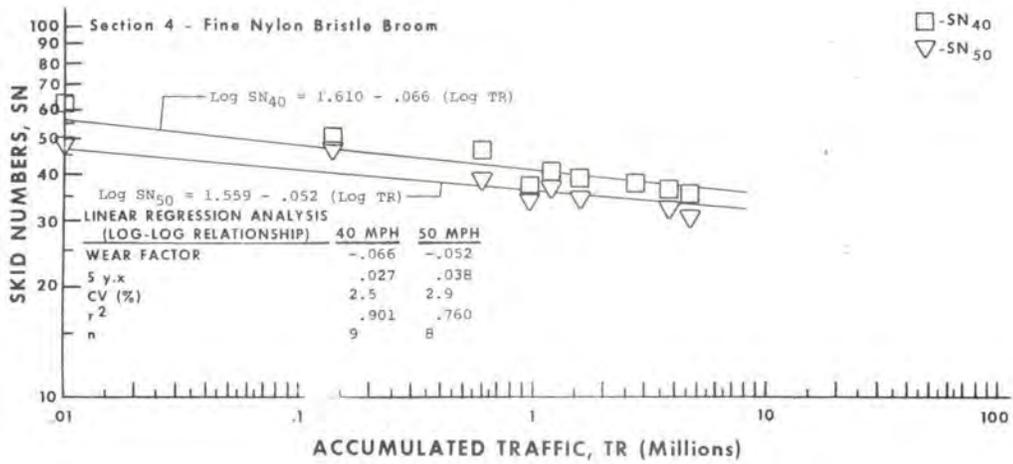


Figure I (Continued)

EFFECTS OF TRAFFIC ON SKID NUMBERS
 ROUTE 63
 BOONE COUNTY



**ROUTE 163
BOONE COUNTY
PROJECT S-SU-51(8)**

Distinctive Characteristics

This project was textured transversely with a wire comb with 3" tine length and 1/4" spacing center to center (3" x 1/4" wire comb).

Discussion of Results

Section 3 had the lowest skid numbers for the project. The lowest SN₄₀ was 36.0. The most desirable wear factor was obtained on Section 4 at -.0101 for the 40 mph test. Nearly five years of testing is represented by the data.

Description of Project

The lengths of the test sections are as follows: Section 1 (divided-northbound) - 0.797 mile, Section 2 (divided-southbound) - 0.404 mile, Section 3 (undivided) - 1.239 miles, Section 4 (undivided) - 0.593 mile and Section 5 (undivided) - 0.580 mile. Five tests were performed at each of the various test speeds in each direction in the undivided test sections and five tests were performed at each test speed in the divided sections. All tests were performed in position 2.

The project was opened to traffic in October, 1972. The skid test results and traffic data are shown in Table II and plotted in Figure II.

TABLE II
SKID TESTS AND TRAFFIC DATA

ROUTE 163
 BOONE COUNTY

<u>Date Tested</u>	<u>SN</u> <u>20</u>	<u>SN</u> <u>30</u>	<u>SN</u> <u>40</u>	<u>SN</u> <u>50</u>	<u>AADT</u> <u>/Lane</u>	<u>Age in</u> <u>Months</u>	<u>Est. Acc.</u> <u>Traffic</u>
<u>Section 1 - 3" x 1/4" Wire Comb</u>							
3/30/73	--	57.4	49.0	--	2208	5	383,000
6/18/74	55.3	52.9	45.3	41.0	3147	20	1,545,000
12/ 5/74	55.4	44.2	--	--	3147	25	2,017,000
4/17/75	51.5	46.7	--	--	3143	30	2,489,000
10/10/75	48.6	46.6	--	--	3143	35	2,960,000
4/ 8/76	53.4	45.7	--	--	3143	41	3,492,000
5/22/77	48.5	41.2	--	--	3143	53	4,490,000
8/ 5/77	46.6	43.0	--	--	3143	57	4,822,000
<u>Section 2 - 3" x 1/4" Wire Comb</u>							
3/30/73	--	57.8	56.5	--	1517	5	263,000
6/18/74	60.3	54.2	--	--	2162	20	1,002,000
12/ 5/74	58.3	51.2	--	--	2162	25	1,386,000
4/17/75	53.6	48.6	--	--	2160	30	1,710,000
10/10/75	49.2	46.8	--	--	2160	35	2,034,000
4/ 8/76	45.4	44.6	--	--	1903	41	2,400,000
3/22/77	46.5	41.2	--	--	1903	53	3,085,000
8/ 5/77	50.2	41.8	--	--	1903	57	3,313,000
<u>Section 3 - 3" x 1/4" Wire Comb</u>							
3/30/73	--	57.9	52.3	42.3	2970	5	520,000
6/18/74	--	55.0	46.5	43.4	4232	20	2,084,000
12/ 5/74	--	48.1	43.1	39.0	4232	25	2,718,000
4/17/75	--	50.0	45.3	38.5	3790	30	3,300,000
10/10/75	--	46.0	41.2	35.5	3790	35	3,869,000
4/ 8/76	--	44.4	40.0	34.8	3340	41	4,510,000
3/22/77	--	41.4	36.0	--	3340	53	5,713,000
8/ 5/77	--	43.2	39.5	--	3340	57	6,114,000

TABLE II (Continued)
SKID TESTS AND TRAFFIC DATA

ROUTE 163
BOONE COUNTY

<u>Date Tested</u>	<u>SN</u> <u>20</u>	<u>SN</u> <u>30</u>	<u>SN</u> <u>40</u>	<u>SN</u> <u>50</u>	<u>AADT</u> <u>/Lane</u>	<u>Age in</u> <u>Months</u>	<u>Est. Acc.</u> <u>Traffic</u>
<u>Section 4 - 3" x 1/4" Wire Comb</u>							
3/30/73	--	63.0	57.9	55.3	1773	5	257,000
6/18/74	--	58.2	53.0	48.7	2527	20	1,191,000
12/ 5/74	--	53.7	49.8	46.6	2527	25	1,570,000
4/17/75	--	53.4	49.0	46.2	2628	30	1,961,000
10/10/75	--	50.9	46.7	41.6	2628	35	2,355,000
4/ 8/76	--	53.4	48.0	42.8	2316	41	2,800,000
3/22/77	--	48.2	41.2	--	2316	53	3,634,000
8/ 5/77	--	50.4	47.0	--	2316	57	3,912,000
<u>Section 5 - 3" x 1/4" Wire Comb</u>							
3/30/73	--	67.7	63.1	57.0	1773	5	257,000
6/18/74	--	63.0	54.1	48.7	2527	20	1,191,000
12/ 5/74	--	52.5	50.0	48.5	2527	25	1,570,000
4/17/75	--	56.0	51.0	47.2	2192	30	1,909,000
10/10/75	--	51.6	47.1	42.0	2192	35	2,237,000
4/ 8/76	--	53.4	47.4	44.5	1930	41	2,608,000
3/22/77	--	47.4	43.6	--	1930	53	3,303,000
8/ 5/77	--	49.0	46.2	--	1930	57	3,535,000

Figure II

EFFECTS OF TRAFFIC ON SKID NUMBERS

ROUTE 163 BOONE COUNTY

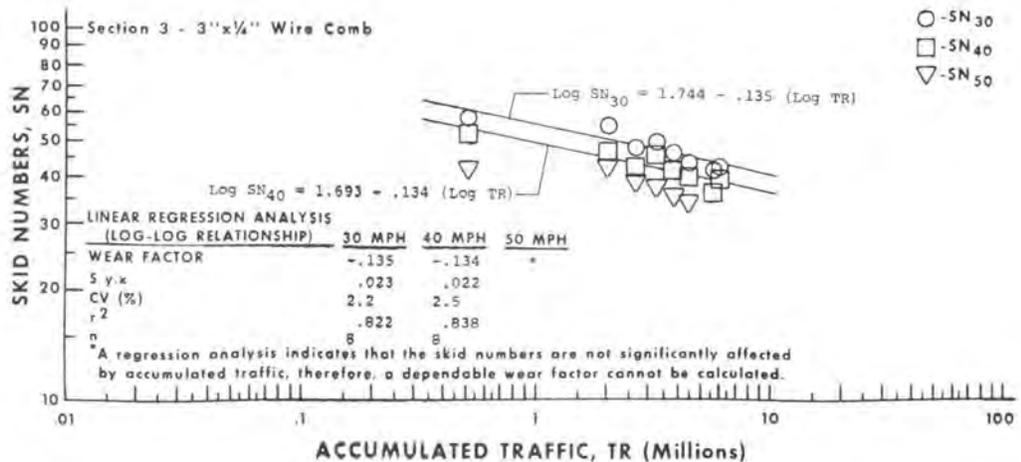
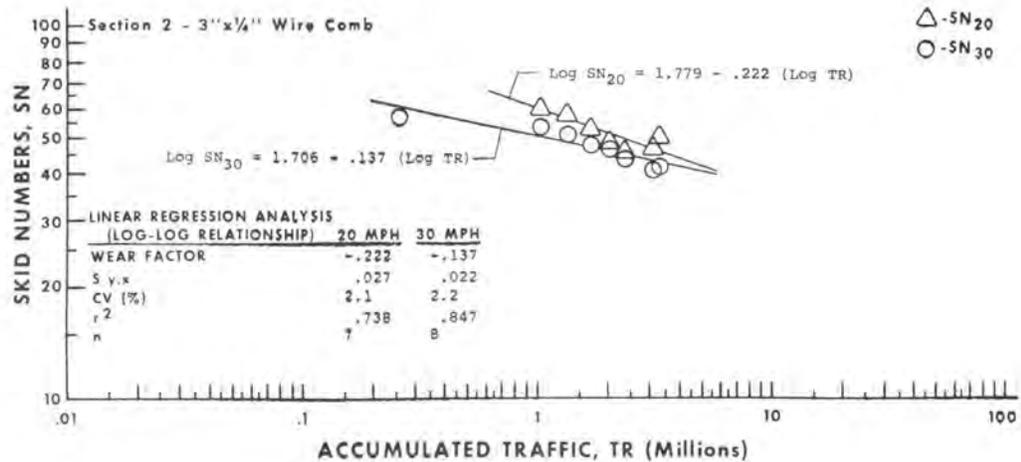
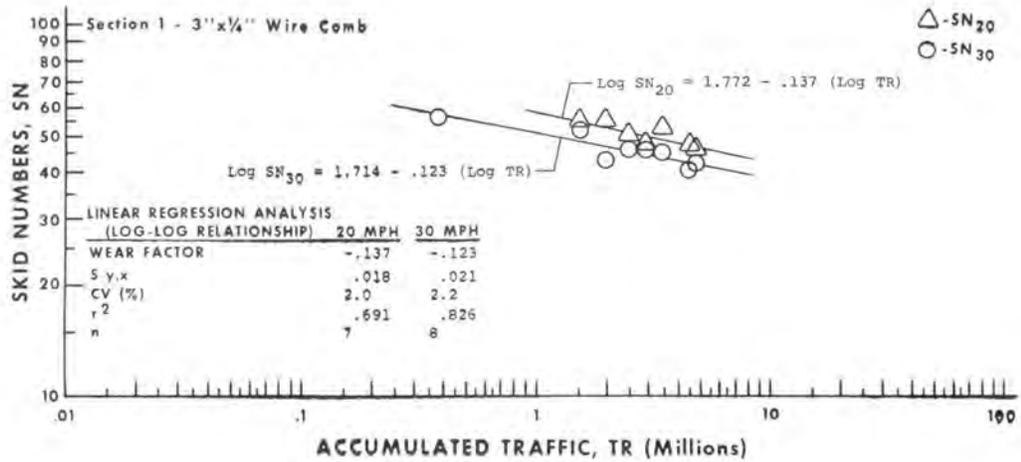
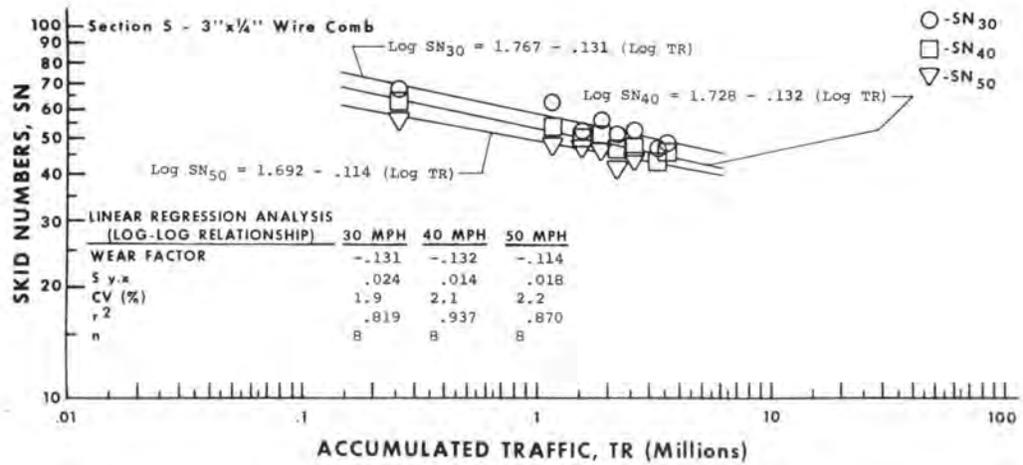
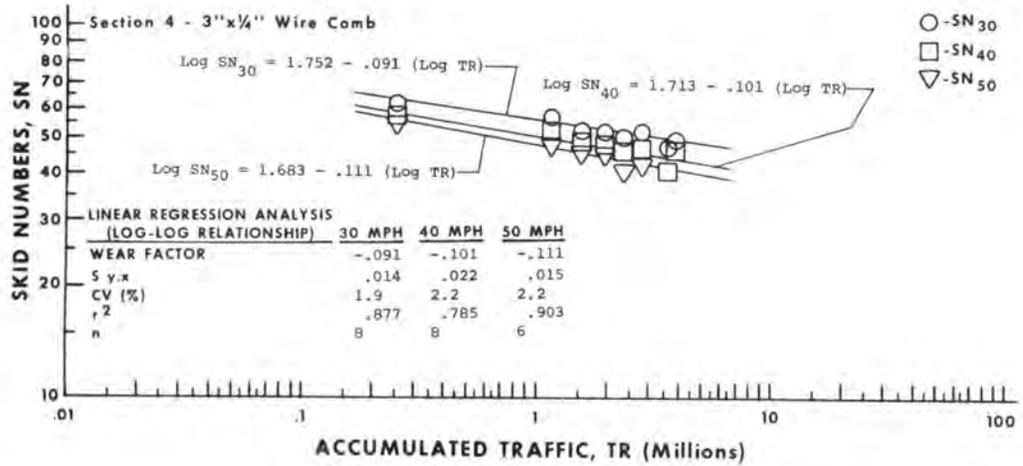


Figure II (Continued)

EFFECTS OF TRAFFIC ON SKID NUMBERS ROUTE 163 BOONE COUNTY



ROUTE 50
MORGAN COUNTY
PROJECT DP-F-FG-50-3(18)

Distinctive Characteristics

The following transverse textures were constructed on this project: wire combs with 4" tine length and 1/4" and 1/2" tine spacings (4" x 1/4" and 4" x 1/2" wire combs).

Discussion of Results

The skid numbers at 40 mph on this project have maintained a level of about 50. It can be seen by examining the data that the skid numbers from the 1/2" wire comb section are dropping at a lower rate than are those from the 1/4" wire comb section. The surface texture is wearing at about the same rate on both sections as indicated in Table III-B.

Description of Project

This two lane undivided pavement was opened to traffic in October, 1974. The section with the 1/2" tine spacing is 0.780 mile in length and the other section is 1.390 miles in length. Five test locations in each direction were selected for each section. All skid tests and sand patch tests were performed in position 2. The results of these tests are shown in Tables III-A and III-B and plotted in Figure III.

TABLE III-A
SKID TESTS AND TRAFFIC DATA

ROUTE 50
 MORGAN COUNTY

<u>Date Tested</u>	<u>SN</u> <u>30</u>	<u>SN</u> <u>40</u>	<u>SN</u> <u>50</u>	<u>AADT</u> <u>/Lane</u>	<u>Age in</u> <u>Months</u>	<u>Est. Acc.</u> <u>Traffic</u>
<u>Section 1 - 4" x 1/2" Wire Comb</u>						
11/ 7/74	56.6	54.5	50.2	1128	1	34,000
3/31/75	55.5	48.2	46.0	1310	6	219,000
10/ 9/75	51.6	50.8	48.4	1310	12	455,000
3/26/76	52.2	52.0	53.1	1388	18	698,000
10/14/76	56.1	52.8	49.8	1388	24	948,000
3/25/77	47.0	44.2	41.8	1388	30	1,198,000
8/26/77	51.5	48.0	44.0	1388	35	1,406,000
<u>Section 2 - 4" x 1/4" Wire Comb</u>						
11/ 7/74	61.7	62.0	57.4	1128	1	34,000
3/31/75	59.2	55.1	51.1	1310	6	219,000
10/ 9/75	57.3	54.6	51.6	1310	12	455,000
3/26/76	56.2	52.3	51.0	1388	18	698,000
10/14/76	60.4	55.4	51.9	1388	24	948,000
3/25/77	53.0	51.8	46.1	1388	30	1,198,000
8/26/77	54.6	51.8	47.4	1388	35	1,406,000

TABLE III-B
TEXTURE DEPTH OF EACH TEXTURE

ROUTE 50
 MORGAN COUNTY

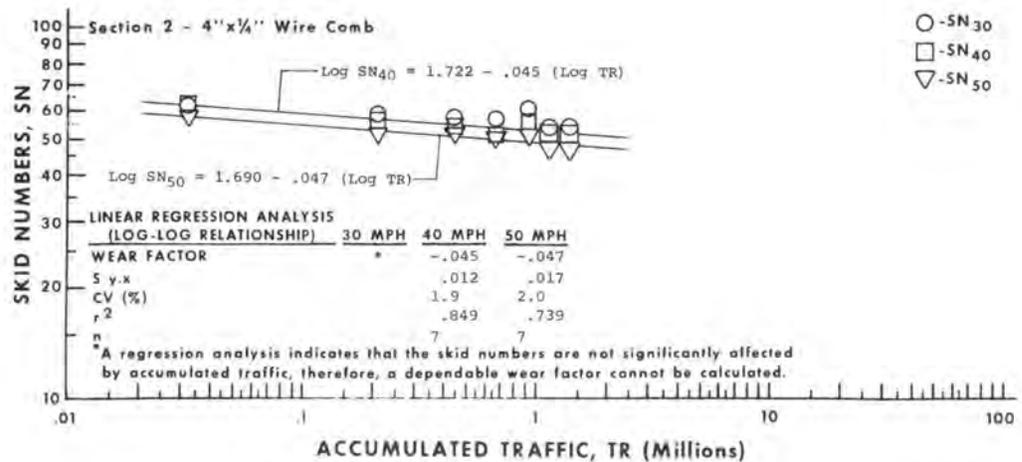
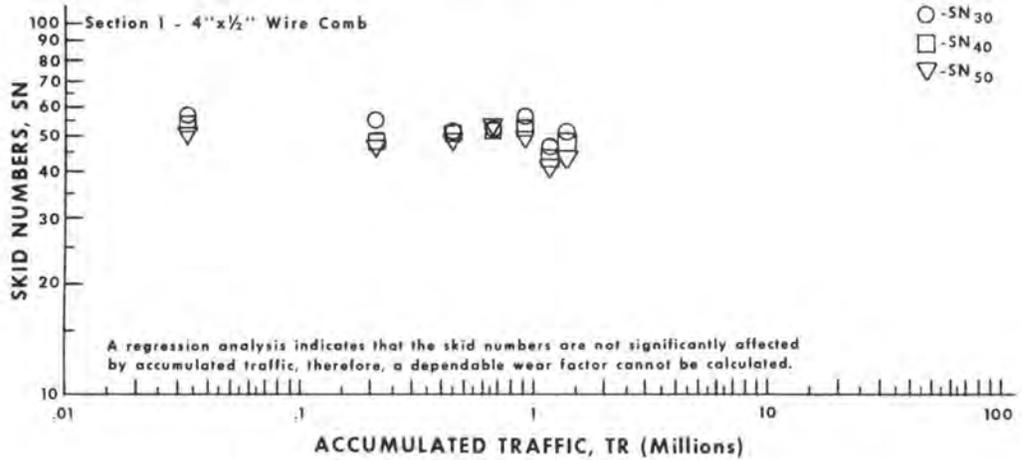
<u>Date</u>	<u>Avg. Texture Depth, TX</u>	<u>Standard Deviation</u>	<u>Est. Acc. Traffic</u>
<u>Section 1 - 4" x 1/2" Wire Comb</u>			
6/ 5/74	.064	.018	0
12/11/75	.037	.013	474,000
7/ 7/76	.030	.011	865,000
6/10/77	.031	.010	1,239,000
<u>Section 2 - 4" x 1/4" Wire Comb</u>			
6/ 5/74	.071	.015	0
12/11/75	.038	.009	474,000
7/ 7/76	.031	.006	865,000
6/10/77	.032	.006	1,239,000

Figure III

EFFECTS OF TRAFFIC ON SKID NUMBERS

ROUTE 50

MORGAN COUNTY



ROUTE I-435
JACKSON COUNTY
PROJECT I-IG-435-1(9)
PROJECT I-435-1(61)16UA

Distinctive Characteristics

This project was constructed with one section of longitudinal burlap drag and two sections of transverse wire comb with 1/4" tine spacing.

Discussion of Results

None of the three sections have suitable wear factors. The initial skid numbers on the wire comb sections were higher than were those on the burlap drag sections, however, the wear factors are generally much less desirable. The AADT and percentage of studded tire traffic are higher than on the other test projects.

Description of Project

The burlap drag section was in Project I-435-1(61)16UA and the wire comb sections were in Project I-IG-435-1(9).

Each texturing device was applied to both northbound and southbound lanes. This six lane divided pavement was opened to traffic in September, 1971. Five test locations per direction were selected for the 2.894 miles of burlap drag section and ten locations per direction were selected for the 5.696 miles of the wire comb sections. The skid test results and traffic data are shown in Table IV and plotted in Figure IV.

TABLE IV
SKID TESTS AND TRAFFIC DATA

ROUTE I-435
 JACKSON COUNTY

<u>Date Tested</u>	<u>SN</u> <u>40</u>	<u>SN</u> <u>50</u>	<u>AADT</u> <u>/Lane</u>	<u>Age in</u> <u>Months</u>	<u>Est. Acc.</u> <u>Traffic</u>
<u>Section 1 - Burlap Drag - Southbound Lanes</u>					
6/ 8/72	37.8	29.5	7037	9	1,900,000
11/ 2/72	34.9	25.8	7037	14	2,956,000
5/ 2/73	32.3	29.4	7037	20	4,222,000
10/23/74	31.8	26.8	7037	38	8,022,000
4/10/75	32.7	28.9	7037	43	9,078,000
9/24/75	25.4	22.2	7037	49	10,344,000
<u>Section 2 - 1/4" Wire Comb - Southbound Lanes</u>					
11/ 2/72	53.9	52.5	5552	14	2,332,000
5/ 2/73	41.6	41.0	5552	20	3,331,000
10/23/74	40.2	33.1	5552	38	6,329,000
4/10/75	36.7	32.7	5552	43	7,162,000
9/24/75	37.3	30.0	5552	49	8,161,000
<u>Section 3 - 1/4" Wire Comb - Southbound Lanes</u>					
6/ 8/72	53.8	47.5	5908	9	1,595,000
11/ 2/72	47.4	41.0	5908	14	2,481,000
5/ 2/72	33.7	31.6	5908	20	3,545,000
10/23/74	31.4	28.1	5908	38	6,735,000
4/10/75	30.4	28.2	5908	43	7,621,000
9/24/75	26.4	23.4	5908	49	8,685,000
<u>Section 1 - Burlap Drag - Northbound Lanes</u>					
6/ 8/72	39.9	31.2	7037	9	1,900,000
11/ 2/72	41.6	31.8	7037	14	2,956,000
5/ 2/73	32.9	31.6	7037	20	4,222,000
10/23/74	33.7	25.6	7037	38	8,022,000
4/10/75	29.8	28.2	7037	43	9,078,000
9/24/75	24.6	22.4	7037	49	10,344,000

TABLE IV (Continued)
SKID TESTS AND TRAFFIC DATA

ROUTE I-435
 JACKSON COUNTY

<u>Date Tested</u>	<u>SN</u> <u>40</u>	<u>SN</u> <u>50</u>	<u>AADT</u> <u>/Lane</u>	<u>Age in</u> <u>Months</u>	<u>Est. Acc.</u> <u>Traffic</u>
<u>Section 2 - 1/4" Wire Comb - Northbound Lanes</u>					
11/ 2/72	57.4	49.0	5552	14	2,332,000
5/ 2/73	40.1	41.6	5552	20	3,331,000
10/23/74	39.4	32.1	5552	38	6,329,000
4/10/75	36.8	32.1	5552	43	7,162,000
9/24/75	31.2	27.6	5552	49	9,161,000
<u>Section 3 - 1/4" Wire Comb - Northbound Lanes</u>					
6/ 8/72	57.3	51.0	5908	9	1,595,000
11/ 2/72	52.3	47.1	5908	14	2,481,000
5/ 2/73	35.8	34.0	5908	20	3,545,000
10/23/74	33.9	27.7	5908	38	6,735,000
4/10/75	30.1	29.2	5908	43	7,621,000
9/24/75	25.0	21.6	5908	49	8,685,000

Figure IV EFFECTS OF TRAFFIC ON SKID NUMBERS ROUTE I-435 JACKSON COUNTY

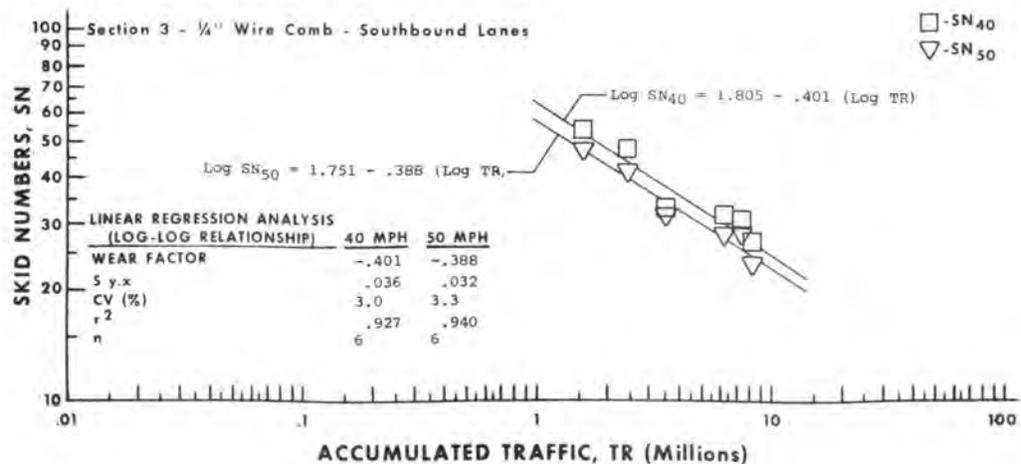
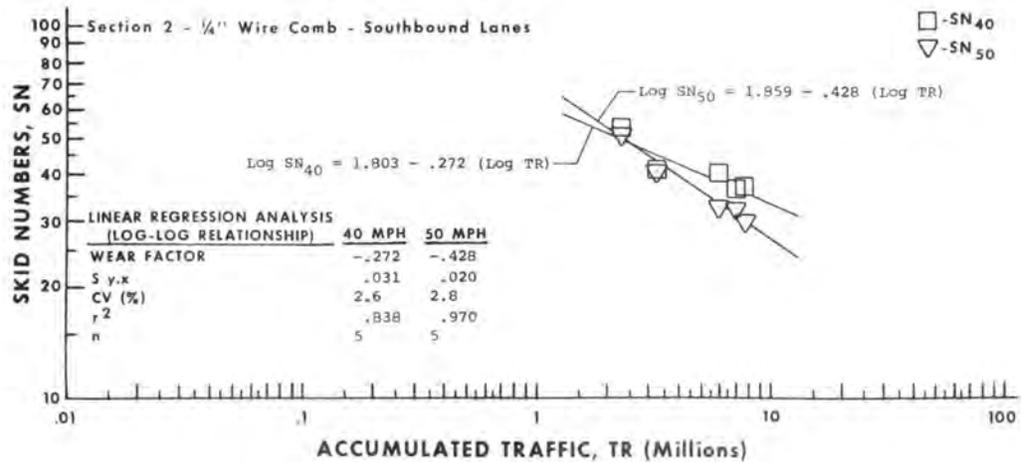
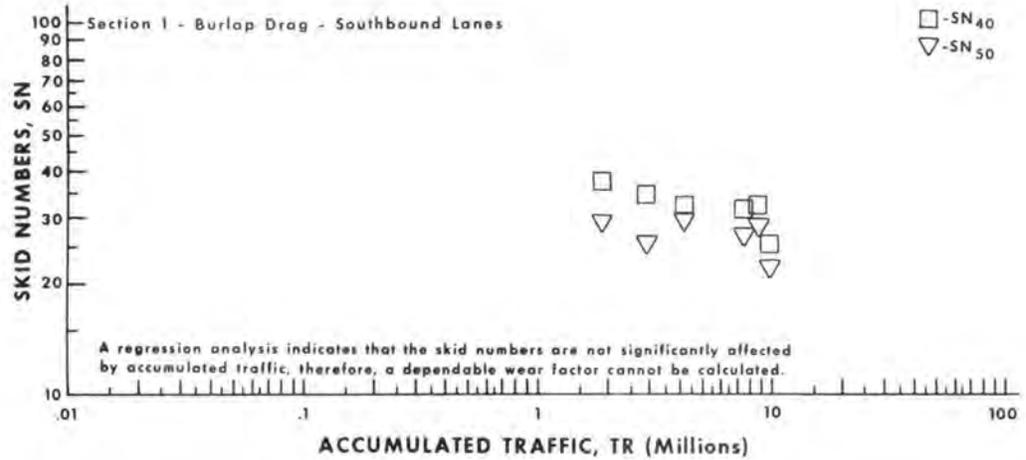
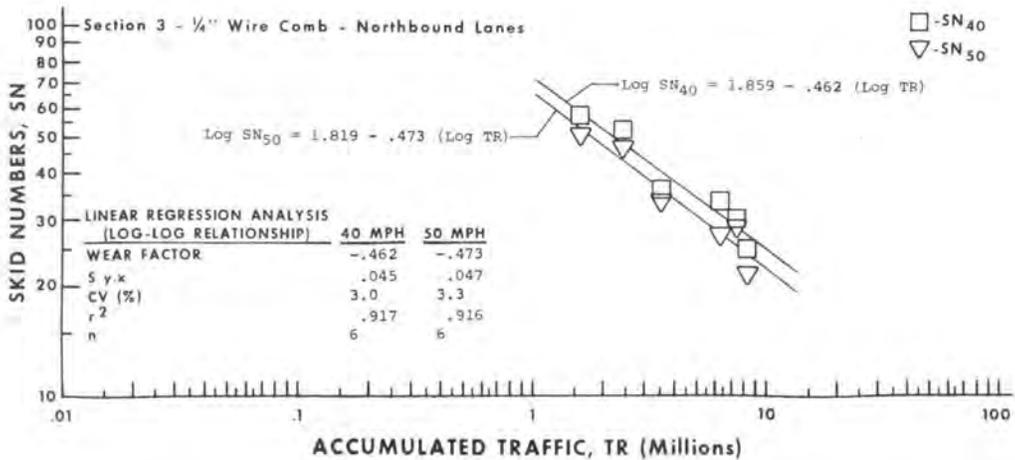
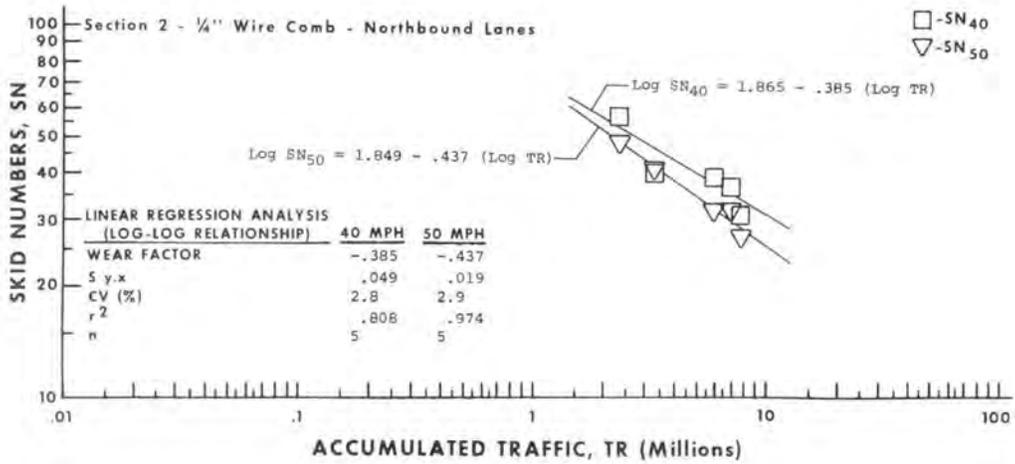
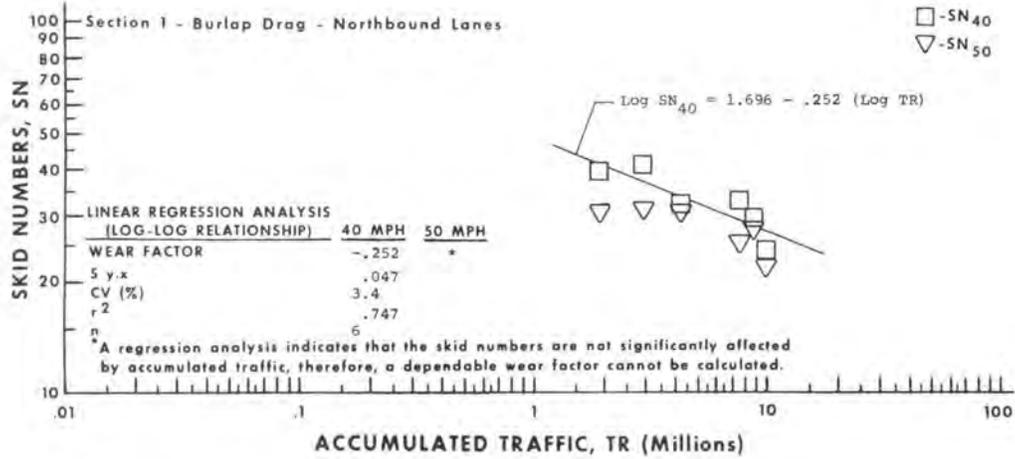


Figure IV (Continued)

EFFECTS OF TRAFFIC ON SKID NUMBERS

ROUTE I-435

JACKSON COUNTY



ROUTE 71
BARTON COUNTY
PROJECT 7-P-71-13

Distinctive Characteristics

The following textures were constructed on this project: transverse wire combs with 3" and 5" tine lengths and 1/4" and 1/2" tine spacings and a section of longitudinal AstroTurf drag.

Discussion of Results

It will be noted that the AstroTurf drag section in general has the lowest skid resistance of all of the test sections. When considering 40 mph tests, Sections 2, 5 and 6 appear to be slightly better than the others.

Sound measurements were performed on Sections 4, 5 and 6 both subjectively and with a sound level meter. The averages of the meter readings on each of the sections were 79.2 dbA, 79.6 dbA and 80.2 dbA, respectively. It will also be noted that the largest difference is 1.0 dbA. A minimum difference of 2.5 to 3 dbA is necessary to be noticeable to the human ear. Subjective ratings also indicate no differences in noise between textures.

Description of Project

This four lane divided pavement was opened to traffic in 1974. Sections 4, 5 and 6 were opened to traffic several months before the other sections. Five tests were taken on each section in position 2. The test lengths are as follows: Section 1 - 1.757 miles, Section 2 - 1.245 miles, Section 3 - 0.957 mile, Section 4 - 1.005 miles, Section 5 - 0.966 mile, Section 6 - 1.042 miles, Section 7 - 1.033 miles and Section 8 - 1.757 miles. Sand patch texture depth tests were not performed on Sections 1, 2 and 8. The skid test results and traffic data are shown in Table V-A and plotted in Figure V. The sand patch texture depth tests are shown in Table V-B.

TABLE V-A
SKID TESTS AND TRAFFIC DATA

ROUTE 71
 BARTON COUNTY

<u>Date Tested</u>	<u>SN</u> 30	<u>SN</u> 40	<u>SN</u> 50	<u>AADT</u> <u>/Lane</u>	<u>Age in</u> <u>Months</u>	<u>Est. Acc.</u> <u>Traffic</u>
<u>Section 1 - 3" x 1/2" Wire Comb</u>						
11/25/74	57.3	50.6	47.7	1952	2	117,000
4/ 8/75	55.8	50.2	46.6	2030	6	358,000
10/ 8/75	52.7	48.8	44.1	2030	12	724,000
4/14/76	53.5	48.6	44.4	2311	18	1,114,000
8/31/76	46.2	45.5	41.8	2311	23	1,461,000
4/ 6/77	46.7	42.3	38.9	2311	30	1,946,000
8/24/77	45.5	43.0	40.0	2311	35	2,293,000
<u>Section 2 - 3" x 1/4" Wire Comb</u>						
11/25/74	58.8	54.2	51.7	2262	2	136,000
4/ 8/75	57.9	53.7	49.8	1752	6	361,000
10/ 8/75	57.5	50.2	46.0	1752	12	677,000
4/14/76	53.9	51.0	44.0	2079	18	1,021,000
8/31/76	53.7	49.7	45.1	2079	23	1,333,000
4/ 6/77	51.4	46.2	41.5	2079	30	1,770,000
8/24/77	53.0	48.2	42.8	2079	35	2,082,000
<u>Section 3 - AstroTurf Drag</u>						
11/25/74	54.0	50.6	46.5	2262	2	136,000
4/ 8/75	59.3	50.9	45.7	1752	6	361,000
10/ 8/75	56.8	46.9	45.3	1752	12	677,000
4/14/76	50.5	46.5	39.8	2079	18	1,021,000
8/31/76	47.3	43.8	42.2	2079	23	1,333,000
4/ 6/77	46.2	39.3	34.7	2079	30	1,770,000
8/24/77	47.3	40.1	37.6	2079	35	2,082,000

TABLE V-A (Continued)

SKID TESTS AND TRAFFIC DATAROUTE 71
BARTON COUNTY

<u>Date Tested</u>	<u>SN</u> 30	<u>SN</u> 40	<u>SN</u> 50	<u>AADT</u> <u>/Lane</u>	<u>Age in</u> <u>Months</u>	<u>Est.Acc.</u> <u>Traffic</u>
<u>Section 4 - 3" x 1/4" Wire Comb</u>						
7/ 9/74	64.0	60.2	51.3	2491	1	75,000
11/25/74	55.6	51.7	50.3	2319	6	438,000
4/ 8/75	57.9	52.7	47.8	1899	10	679,000
10/ 8/75	55.2	50.0	45.6	1899	16	1,020,000
4/14/76	55.5	52.3	46.4	2179	22	1,387,000
8/31/76	52.5	48.3	44.7	2179	27	1,714,000
4/ 6/77	50.9	45.4	40.0	2179	34	2,172,000
8/24/77	49.5	44.9	42.0	2179	39	2,499,000
<u>Section 5 - 3" x 1/2" Wire Comb</u>						
7/ 9/74	61.1	55.8	48.9	2491	1	75,000
11/25/74	52.7	48.3	43.9	2319	6	438,000
4/ 8/75	56.8	52.2	47.5	1899	10	679,000
10/ 8/75	55.9	49.6	46.1	1899	16	1,020,000
4/14/76	53.9	50.7	44.2	2179	22	1,387,000
8/31/76	54.2	47.6	43.4	2179	27	1,714,000
4/ 6/77	52.0	45.2	40.3	2179	34	2,172,000
8/24/77	55.2	46.2	44.0	2179	39	2,499,000
<u>Section 6 - 5" x 1/2" Wire Comb</u>						
7/ 9/74	54.5	51.7	46.3	2491	1	75,000
11/25/74	53.4	51.0	48.2	2319	6	438,000
4/ 8/75	57.7	51.1	44.8	1899	10	679,000
10/ 8/75	57.2	51.4	45.1	1899	16	1,020,000
4/14/76	55.4	49.7	46.1	2179	22	1,387,000
8/31/76	54.1	48.4	42.2	2179	27	1,714,000
4/ 6/77	52.0	43.1	39.3	2179	34	2,172,000
8/24/77	53.7	46.6	41.1	2179	39	2,499,000

TABLE V-A (Continued)
SKID TESTS AND TRAFFIC DATA

ROUTE 71
 BARTON COUNTY

<u>Date Tested</u>	<u>SN</u> <u>30</u>	<u>SN</u> <u>40</u>	<u>SN</u> <u>50</u>	<u>AADT</u> <u>/Lane</u>	<u>Age in</u> <u>Months</u>	<u>Est. Acc.</u> <u>Traffic</u>
<u>Section 7 - 5" x 1/4" Wire Comb</u>						
11/25/74	59.0	54.4	49.6	2319	2	139,000
4/ 8/75	58.0	52.5	47.5	2319	6	380,000
10/ 8/75	55.8	49.4	45.2	1899	12	722,000
4/14/76	55.4	50.4	44.6	1899	18	1,089,000
8/31/76	53.8	49.8	44.0	2179	23	1,415,000
4/ 6/77	50.6	46.2	39.9	2179	30	1,873,000
8/24/77	51.3	46.8	43.0	2179	35	2,200,000
<u>Section 8 - 3" x 1/2" Wire Comb</u>						
11/25/74	57.1	50.9	47.6	2003	2	120,000
4/ 8/75	58.1	51.2	47.6	2083	6	368,000
10/ 8/75	56.0	51.8	44.7	2083	12	743,000
4/14/76	54.6	50.5	45.7	2247	18	1,132,000
8/31/76	53.7	47.0	43.2	2247	23	1,469,000
4/ 6/77	48.7	44.5	39.8	2247	30	1,941,000
8/24/77	50.5	45.0	43.8	2247	35	2,278,000

TABLE V-B

TEXTURE DEPTH OF EACH TEXTUREROUTE 71
BARTON COUNTY

Date	Position 3			Position 2		
	Avg. Texture Depth, TX	Std. Dev.	Est. Traffic	Avg. Texture Depth, TX	Std. Dev.	Est. Traffic
<u>Section 3 - AstroTurf Drag</u>						
5/ /74	.050	.010	0	.053	.018	0
6/25/75	.022	.004	53,000	.020	.005	519,000
7/22/76	.021	.003	129,000	.017	.004	1,271,000
6/15/77	.022	.004	192,000	.017	.003	1,895,000
<u>Section 4 - 3" x 1/4" Wire Comb</u>						
5/ /74	.049	.011	0	.052	.009	0
6/25/75	.022	.004	340,000	.020	.002	850,000
7/22/76	.021	.004	399,000	.018	.003	1,649,000
6/15/77	.020	.004	447,000	.017	.003	2,302,000
<u>Section 5 - 3" x 1/2" Wire Comb</u>						
5/ /74	.074	.019	0	.061	.017	0
6/25/75	.034	.013	340,000	.025	.011	850,000
7/22/76	.033	.013	399,000	.022	.008	1,649,000
6/15/77	.030	.012	447,000	.023	.009	2,302,000
<u>Section 6 - 5" x 1/2" Wire Comb</u>						
5/ /74	.047	.006	0	.049	.011	0
6/25/75	.024	.005	340,000	.022	.004	850,000
7/22/76	.022	.004	399,000	.020	.003	1,649,000
6/15/77	.021	.006	447,000	.020	.005	2,302,000
<u>Section 7 - 5" x 1/4" Wire Comb</u>						
5/ /74	.044	.009	0	.048	.015	0
6/25/75	.025	.007	41,000	.024	.007	551,000
7/22/76	.022	.004	100,000	.019	.005	1,350,000
6/15/77	.024	.005	149,000	.018	.006	2,004,000

Figure V

EFFECTS OF TRAFFIC ON SKID NUMBERS
ROUTE 71
BARTON COUNTY

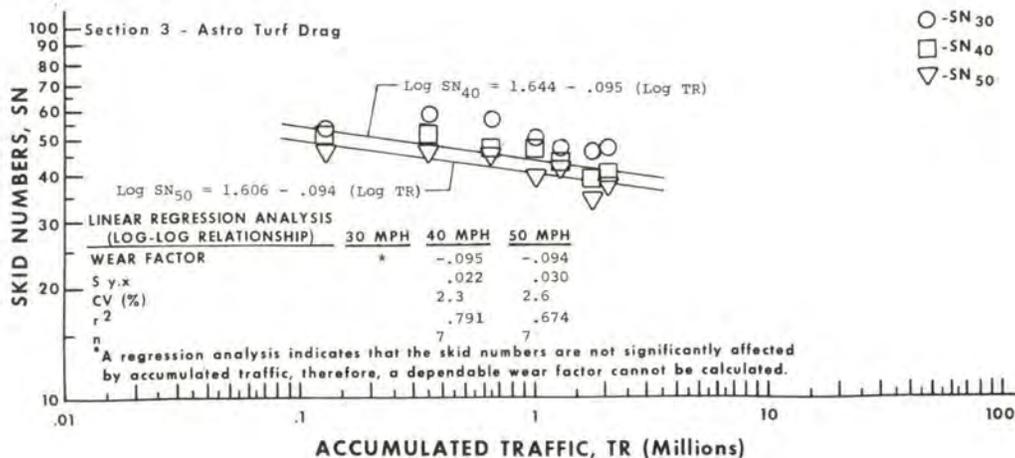
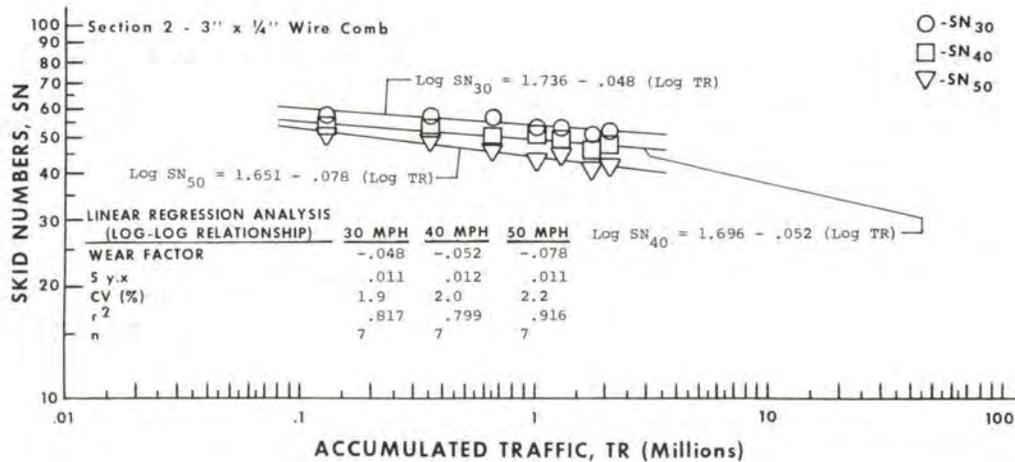
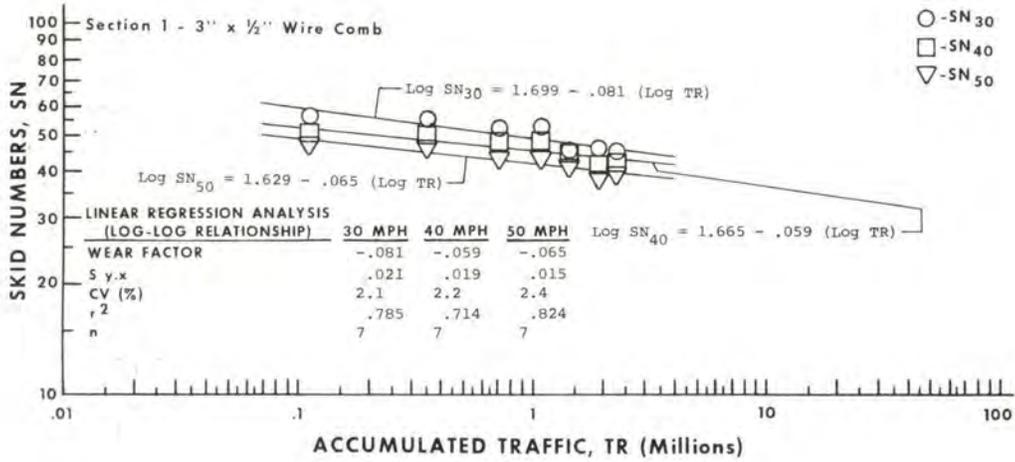


Figure V (Continued)

EFFECTS OF TRAFFIC ON SKID NUMBERS

ROUTE 71

BARTON COUNTY

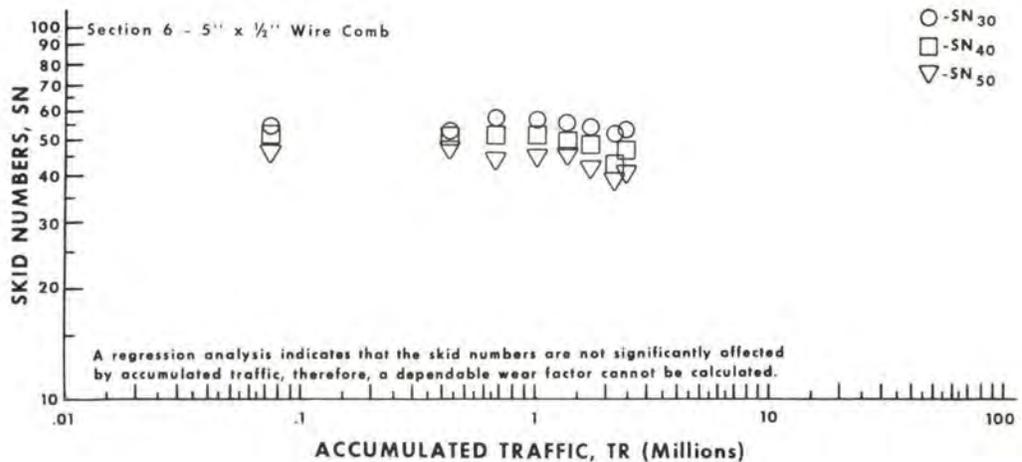
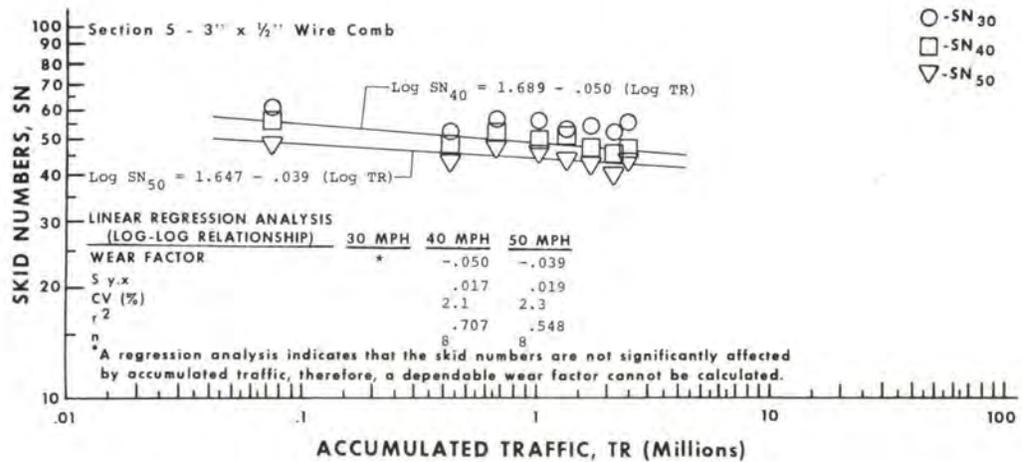
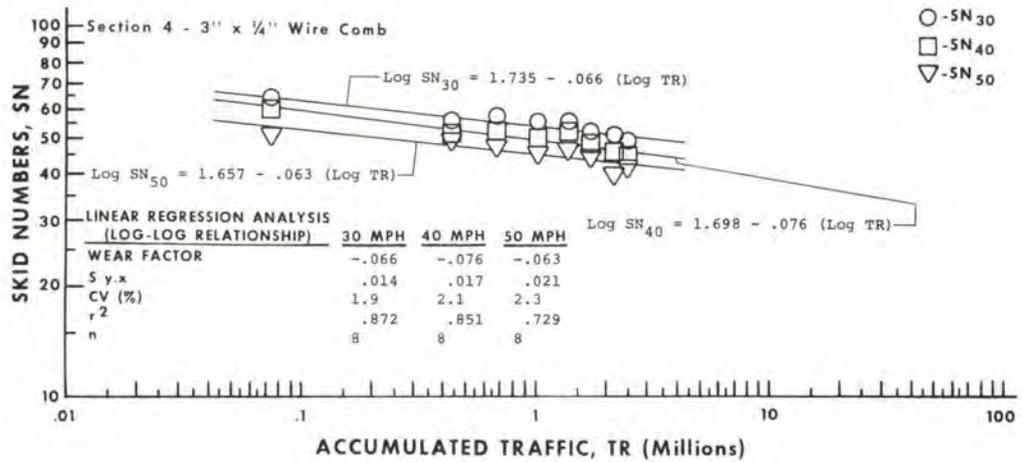
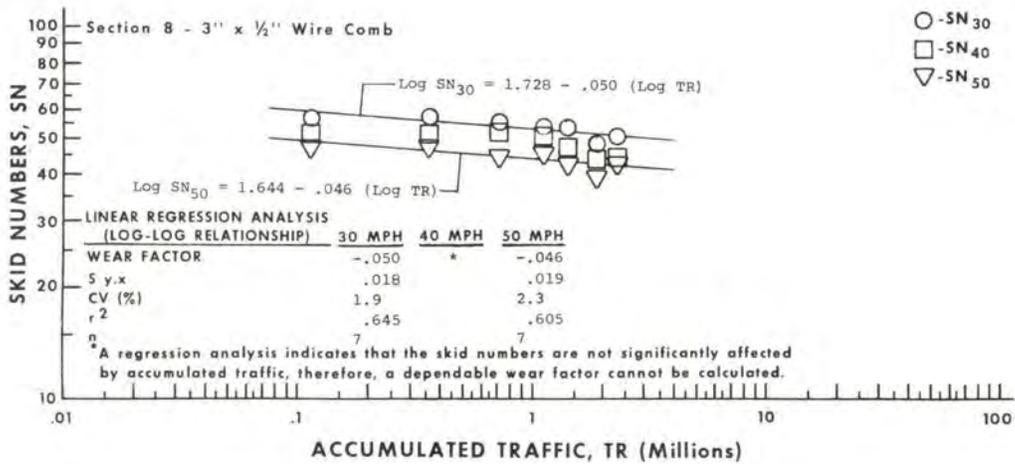
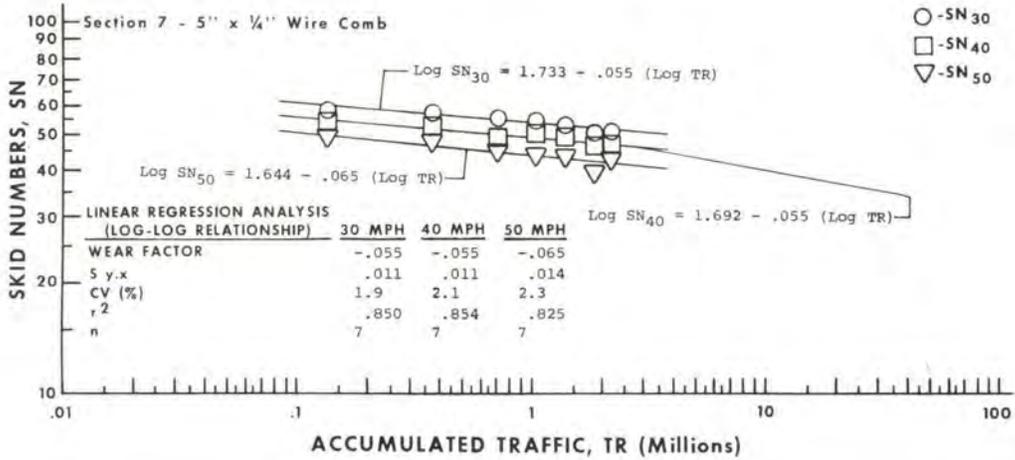


Figure V (Continued)

EFFECTS OF TRAFFIC ON SKID NUMBERS
ROUTE 71
BARTON COUNTY



**ROUTE I-35
HARRISON COUNTY
PROJECT I-35-2(6)96**

Distinctive Characteristics

The following textures were constructed on this project: Gomaco Roll-A-Groove (3/16" groove width, 3/8" groove depth, and 3/4" groove spacing) and a wire comb with 3" tine length and 1/2" tine spacing center to center (3" x 1/2" wire comb).

Discussion of Results

The level of skid resistance on this project is remaining relatively steady at values near those obtained initially. The sand patch texture depth values have remained nearly unchanged over the past two years. By plotting the SN's for only one position on a graph, the regression analyses all indicate that the SN's are not significantly affected by accumulated traffic, however, by plotting positions 2 and 3 together as shown in Figure VI, a definite trend is established.

Several problems such as non-uniform appearance, very slow operation, and ridges between passes were associated with the use of the Gomaco Roll-A-Groove.

Description of Project

This divided pavement project (northbound only) involves the use of two different types of surface texturing devices: A Gomaco Roll-A-Groove machine on 0.658 mile of pavement and a wire comb on 1.808 miles of pavement.

There are five test locations in each section. Tests were performed in positions 2 and 3. The results of the skid tests are shown in Table VI-A and plotted in Figure VI. The sand patch texture depth tests are shown in Table VI-B.

The project was opened to traffic in December, 1974.

TABLE VI-A

SKID TESTS AND TRAFFIC DATA

ROUTE I-35
HARRISON COUNTY

<u>Date Tested</u>	<u>SN</u> 40	<u>SN</u> 50	<u>AADT</u> <u>/Lane</u>	<u>Age in</u> <u>Months</u>	<u>Est. Acc.</u> <u>Traffic</u>
<u>Section 1 - Position 2 - Roll-A-Groove</u>					
4/ 9/75	52.1	47.5	2034	4	244,000
9/ 9/75	52.9	48.9	2034	9	549,000
3/30/76	50.7	47.6	2045	16	977,000
9/16/76	50.1	45.6	2045	22	1,345,000
5/ 4/77	51.8	47.9	2045	29	1,774,000
8/ 2/77	51.7	46.0	2045	32	1,958,000
<u>Section 1 - Position 3 - Roll-A-Groove</u>					
9/ 9/75	57.4	54.8	180	9	49,000
3/30/76	58.9	53.6	181	16	87,000
9/16/76	57.9	54.5	181	22	119,000
8/ 2/77	58.8	55.1	181	32	174,000
<u>Section 2 - Position 2 - 3" x 1/2" Wire Comb</u>					
4/ 9/75	54.7	51.7	2034	4	244,000
9/ 9/75	56.1	52.6	2034	9	549,000
3/30/76	56.7	52.9	2045	16	977,000
9/16/76	53.6	49.8	2045	22	1,345,000
5/ 4/77	55.0	52.5	2045	29	1,774,000
8/ 2/77	55.3	50.6	2045	32	1,958,000
<u>Section 2 - Position 3 - 3" x 1/2" Wire Comb</u>					
9/ 9/75	61.8	57.5	180	9	49,000
3/30/76	63.8	61.8	181	16	87,000
9/16/76	61.5	59.7	181	22	119,000
8/ 2/77	63.1	59.3	181	32	174,000

TABLE VI-B
TEXTURE DEPTH OF EACH TEXTURE

ROUTE I-35
 HARRISON COUNTY

<u>Date</u>	<u>Position 3</u>				<u>Position 2</u>			
	<u>Avg.</u> <u>Texture</u> <u>Depth, TX</u>	<u>Std.</u> <u>Dev.</u>	<u>Est.</u> <u>Traffic</u>	<u>Acc.</u>	<u>Avg.</u> <u>Texture</u> <u>Depth, TX</u>	<u>Std.</u> <u>Dev.</u>	<u>Est.</u> <u>Traffic</u>	<u>Acc.</u>
<u>Section 1 - Roll-A-Groove</u>								
1/75	.052	.009		0	.053	.012		0
7/31/75	.034	.005		38,000	.026	.004		427,000
7/20/76	.031	.004		108,000	.024	.005		1,222,000
6/ 1/77	.031	.005		162,000	.023	.003		1,835,000
<u>Section 2 - 3" x 1/2" Wire Comb</u>								
7/31/75	.034	.011		38,000	.028	.004		427,000
7/20/76	.034	.009		108,000	.024	.002		1,222,000
6/ 1/77	.035	.010		162,000	.025	.003		1,835,000

Figure VI

EFFECTS OF TRAFFIC ON SKID NUMBERS

ROUTE I-35

HARRISON COUNTY

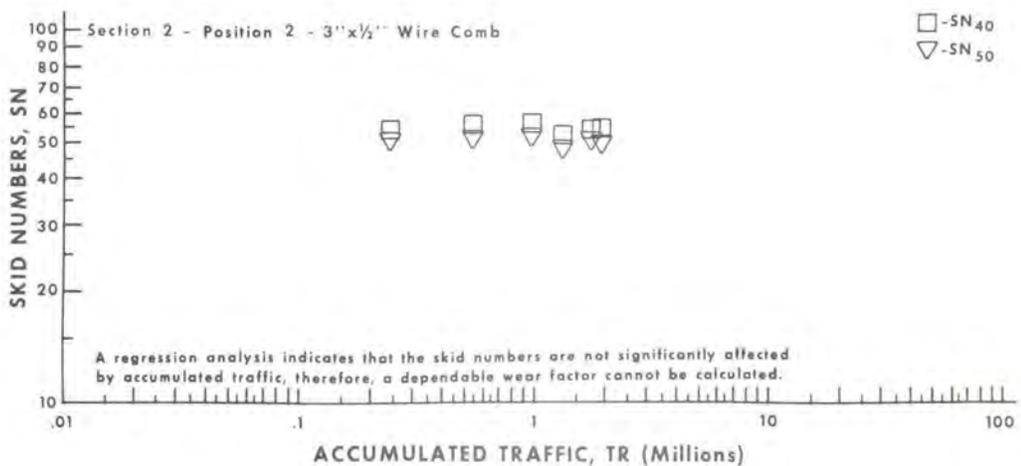
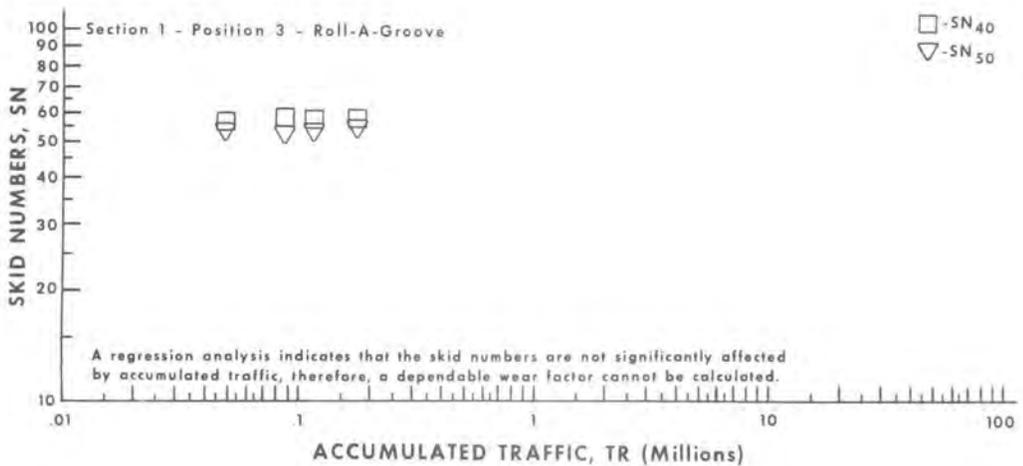
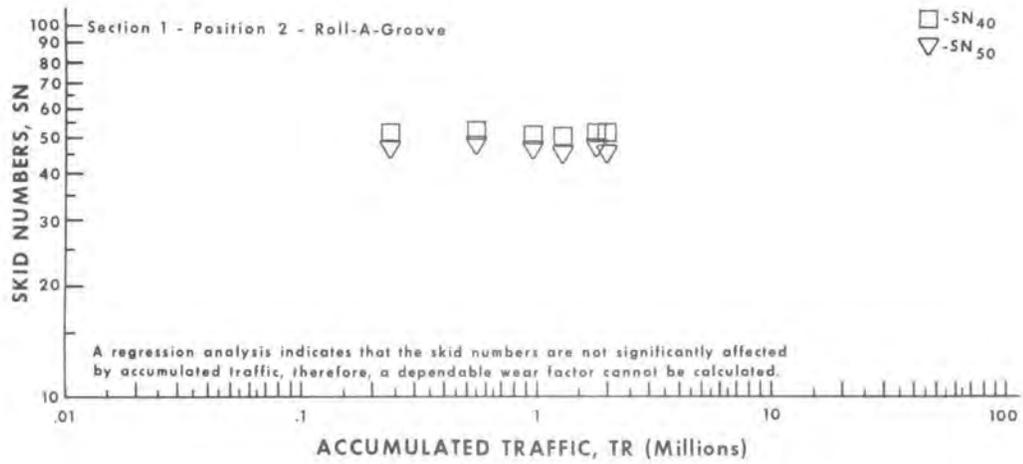
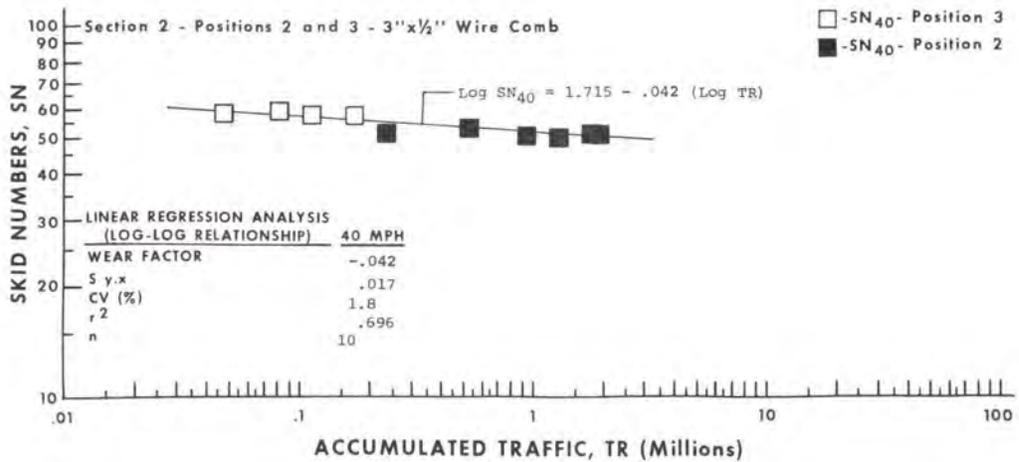
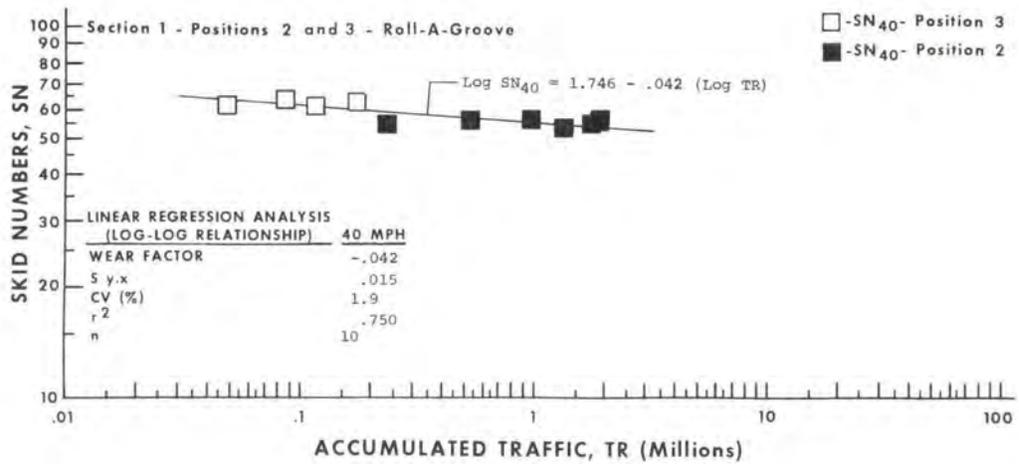
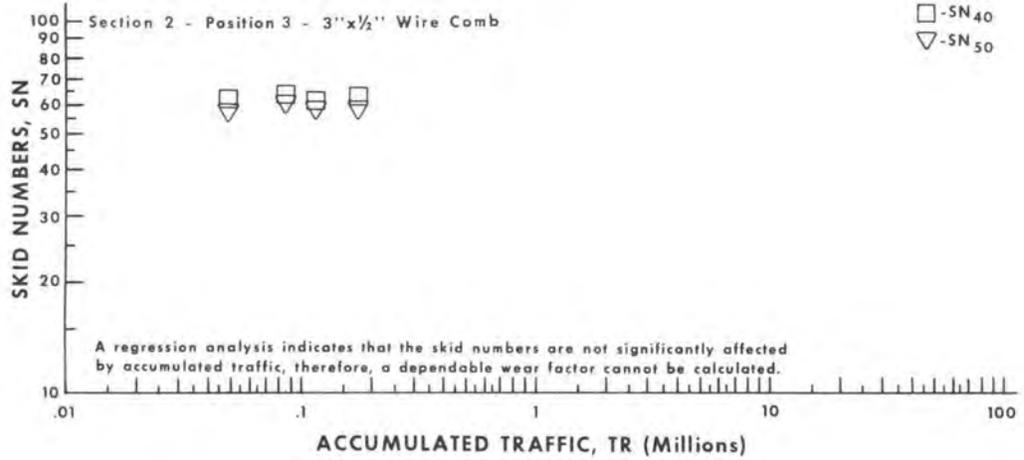


Figure VI (Continued)

EFFECTS OF TRAFFIC ON SKID NUMBERS

ROUTE I-35

HARRISON COUNTY



ROUTE 63
BOONE COUNTY
PROJECT RF-63-3(17)

Distinctive Characteristics

This project was constructed with textures produced by wire combs of a 3" tine length and a 1/2" tine spacing (3" x 1/2" wire comb) and a 4" tine length and a 3/4" tine spacing (4" x 3/4" wire comb).

Discussion of Results

A regression analysis on the skid numbers for each speed indicates that the skid numbers are not significantly affected by traffic. It can mean either that the skid numbers vary too greatly to fit the regression line well or that the slope of the regression line is not significantly different from zero.

The wire comb texture with 1/2" spacing had slightly higher skid numbers but both textures were wearing at nearly identical rates.

A sound level meter indicates that the 3/4" comb texture produces readings an average of 1.4 dbA higher than the 1/2" wire comb texture. This difference is considered to be less than the human ear can detect. In a subjective rating, the 3/4" wire comb texture produced certain frequencies of noise which were slightly objectionable.

Description of Project

The 1/2" spacing section has a test length of 1.598 miles and the 3/4" spacing section has a test length of 2.420 miles. Five test locations were established in each section. Both sections are in the northbound lanes of a divided pavement. The skid tests and sand patch texture depth tests were performed in positions 2 and 3. The results of the skid tests are shown in Table VII-A and plotted in Figure VII. The sand patch texture depth tests are shown in Table VII-B.

The project was opened to traffic in November, 1975.

TABLE VII-A
SKID TESTS AND TRAFFIC DATA

ROUTE 63
 BOONE COUNTY

<u>Date Tested</u>	<u>SN</u> <u>30</u>	<u>SN</u> <u>40</u>	<u>SN</u> <u>50</u>	<u>AADT</u> <u>/Lane</u>	<u>Age in</u> <u>Months</u>	<u>Est. Acc.</u> <u>Traffic</u>
<u>Section 1 - Position 2 - 3" x 1/2" Wire Comb</u>						
12/19/75	57.4	50.9	48.5	2542	2	153,000
3/12/76	52.7	50.2	47.7	2481	4	301,000
8/24/76	45.4	40.1	38.5	2481	10	748,000
10/13/76	54.3	48.6	43.0	2481	11	822,000
3/22/77	51.5	50.1	43.4	2481	17	1,269,000
8/ 5/77	48.8	44.6	39.8	2481	21	1,567,000
<u>Section 1 - Position 3 - 3" x 1/2" Wire Comb</u>						
12/19/75	62.4	54.9	52.7	354	2	21,000
3/12/76	63.5	60.0	57.0	345	4	42,000
8/24/76	61.0	58.3	55.5	345	10	104,000
10/13/76	60.8	55.6	51.3	345	11	115,000
8/ 5/77	61.3	56.2	57.9	345	21	218,000
<u>Section 2 - Position 2 - 4" x 3/4" Wire Comb</u>						
12/19/75	53.0	49.1	44.5	2542	2	153,000
3/12/76	52.4	50.1	47.6	2481	4	301,000
8/24/76	42.5	39.0	35.0	2481	10	748,000
10/13/76	51.7	48.1	44.5	2481	11	822,000
3/22/77	50.6	46.7	42.4	2481	17	1,269,000
8/ 5/77	48.4	43.9	39.6	2481	21	1,567,000
<u>Section 2 - Position 3 - 4" x 3/4" Wire Comb</u>						
12/19/75	52.3	51.6	46.4	354	2	21,000
3/12/76	61.5	56.8	52.2	345	4	42,000
8/24/76	56.8	52.8	50.9	345	10	104,000
10/13/76	58.5	53.4	50.5	345	11	115,000
8/ 5/77	59.2	54.9	51.8	345	21	218,000

TABLE VII-B
TEXTURE DEPTH OF EACH TEXTURE

ROUTE 63
 BOONE COUNTY

<u>Date</u>	<u>Position 3</u>			<u>Position 2</u>		
	<u>Avg. Texture Depth, TX</u>	<u>Std. Dev.</u>	<u>Est. Traffic</u>	<u>Avg. Texture Depth, TX</u>	<u>Std. Dev.</u>	<u>Est. Traffic</u>
<u>Section 1 - 3" x 1/2" Wire Comb</u>						
9/25/75	.043	.011	0	.054	.012	0
12/ 5/75	.035	.012	21,000	.037	.014	153,000
7/ 6/76	.028	.011	94,000	.029	.013	674,000
12/ 3/76	-	-	136,000	.030	.015	971,000
5/26/77	.031	.011	197,000	.034	.012	1,418,000
<u>Section 2 - 4" x 3/4" Wire Comb</u>						
10/14/75	.052	.009	0	.057	.019	0
12/ 5/75	.041	.006	21,000	.041	.007	153,000
7/ 6/76	.034	.006	94,000	.033	.010	674,000
12/ 1/76	-	-	136,000	.038	.013	971,000
5/26/77	.039	.009	197,000	.036	.014	1,418,000

Figure VII

EFFECTS OF TRAFFIC ON SKID NUMBERS

ROUTE 63

BOONE COUNTY

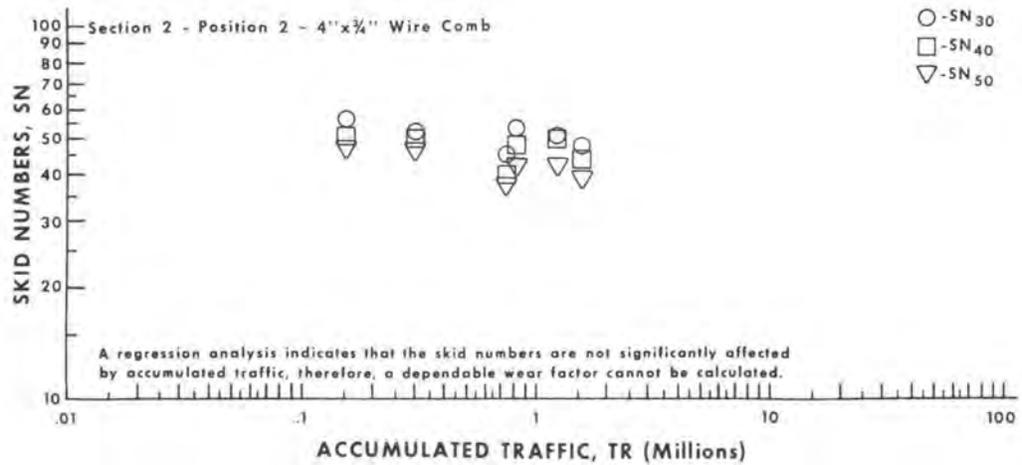
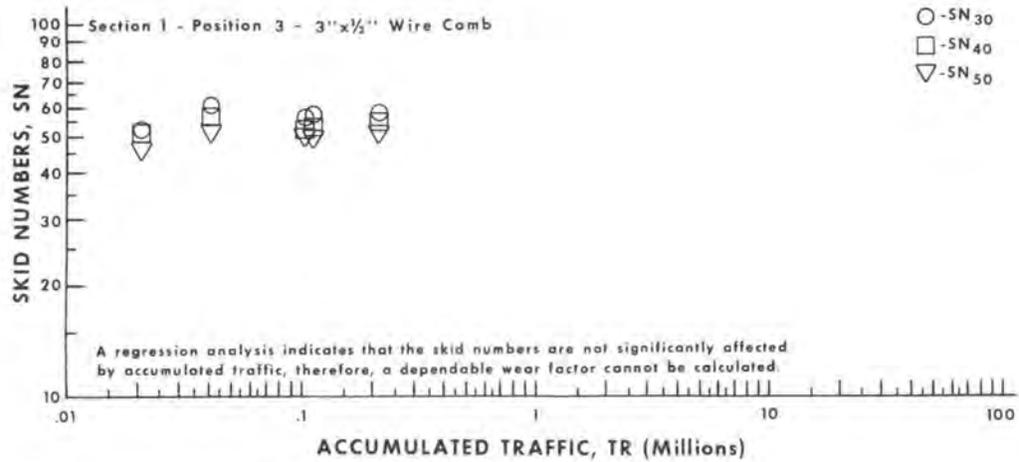
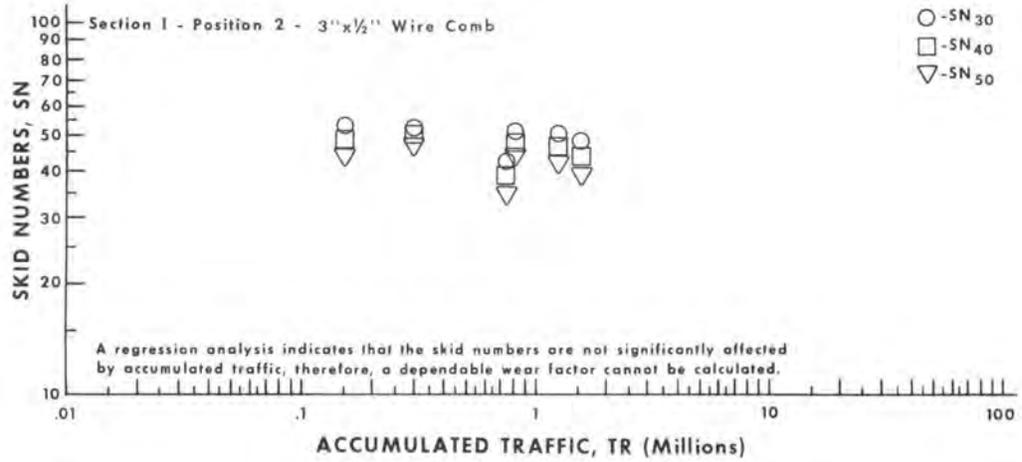
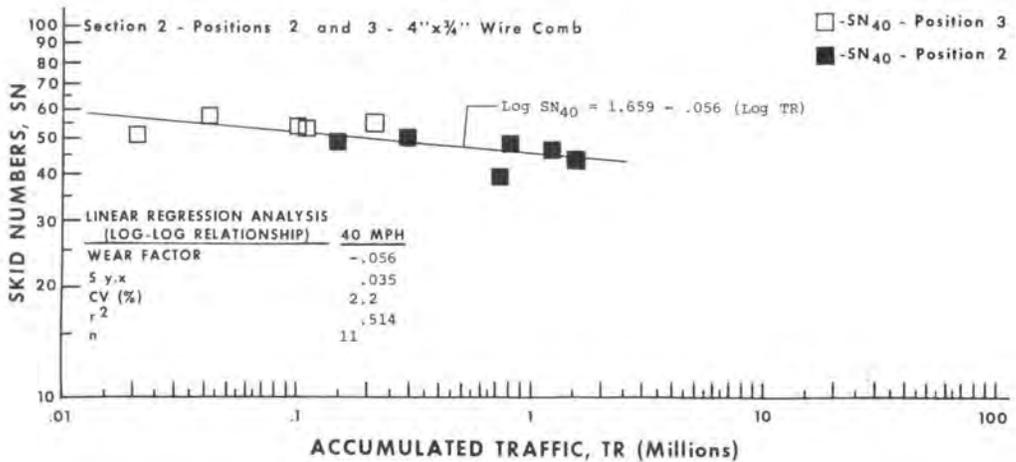
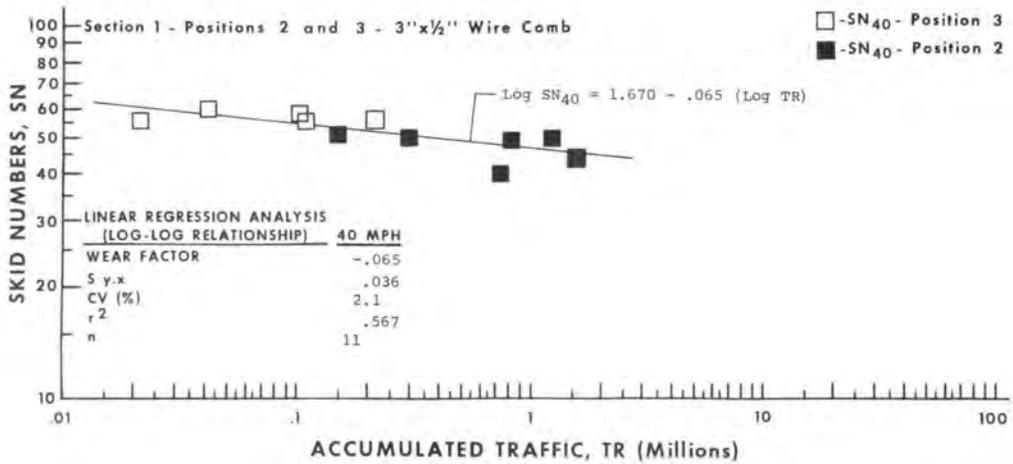
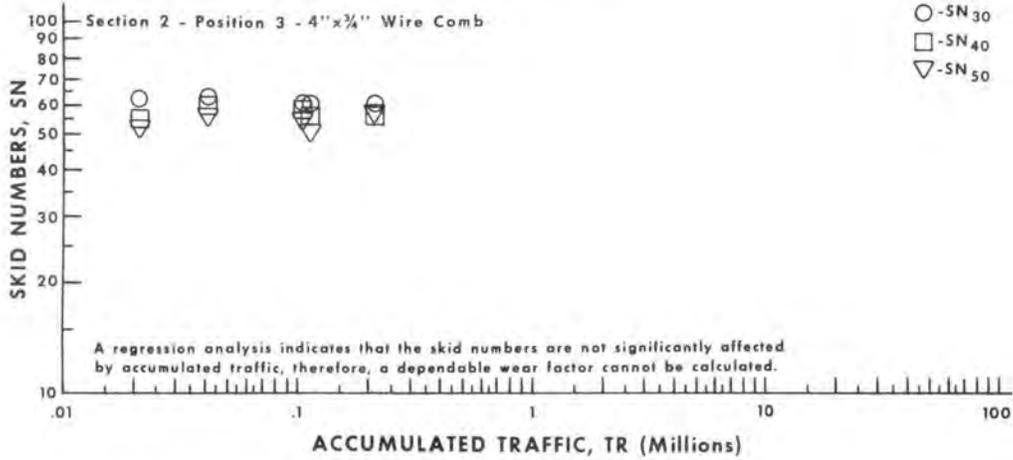


Figure VII (Continued)

EFFECTS OF TRAFFIC ON SKID NUMBERS
ROUTE 63
BOONE COUNTY



ROUTE 63
BOONE COUNTY
PROJECT 5-P-63-32

Distinctive Characteristics

This project involved transverse texturing with a wire comb with a 3" tine length and a 1/2" tine spacing (3" x 1/2" wire comb)

Discussion of Results

The wear factors on this project are reasonably good. Skid numbers at 40 mph are being maintained in the lower forties. All SN₄₀'s have stayed within a 10 SN range during the three year testing period

The sand patch texture depth tests are showing very slight changes over the two years.

Description of Project

This project, constructed in four sections, was opened to traffic in October, 1974. It is a four lane divided pavement having 15 test locations over a test length of 3.660 miles in the northbound lanes and having 5 test locations over a 0.900 mile length in the southbound lanes. The results of the skid tests are shown in Table VIII-A and plotted in Figure VIII. The sand patch texture depth tests are shown in Table VIII-B.

TABLE VIII-A
SKID TESTS AND TRAFFIC DATA

ROUTE 63
 BOONE COUNTY

<u>Date Tested</u>	<u>SN</u> <u>30</u>	<u>SN</u> <u>40</u>	<u>SN</u> <u>50</u>	<u>AADT</u> <u>/Lane</u>	<u>Age in</u> <u>Months</u>	<u>Est. Acc.</u> <u>Traffic</u>
<u>Section 1 - 3" x 1/2" Wire Comb</u>						
12/ 5/74	--	50.3	47.5	2756	1	83,000
4/16/75	50.2	45.8	41.8	3126	6	541,000
10/10/75	49.8	46.4	42.5	3126	11	1,009,000
3/25/76	47.9	44.9	40.3	3217	17	1,580,000
10/13/76	53.1	49.4	46.8	3217	23	2,159,000
3/22/77	49.2	44.2	40.0	3217	29	2,738,000
8/ 5/77	49.7	43.0	41.9	3217	33	3,124,000
<u>Section 2 - 3" x 1/2" Wire Comb</u>						
12/ 5/74	--	49.0	45.4	2975	1	89,000
4/16/75	49.4	44.3	40.2	3353	6	581,000
10/10/75	50.4	45.0	39.7	3353	11	1,084,000
3/25/76	45.8	40.6	36.5	3467	17	1,698,000
10/13/76	51.3	45.6	40.6	3467	23	2,322,000
3/22/77	44.6	40.5	35.9	3467	29	2,946,000
8/ 5/77	43.5	41.2	36.1	3467	33	3,362,000
<u>Section 3 - 3" x 1/2" Wire Comb</u>						
12/ 5/74	--	47.1	47.0	2975	1	89,000
4/16/75	48.6	45.1	42.4	3353	6	581,000
10/10/75	54.4	47.8	42.8	3353	11	1,084,000
3/25/76	45.8	42.0	37.0	3467	17	1,698,000
10/13/76	53.6	48.1	42.8	3467	23	2,322,000
3/22/77	43.7	38.4	35.9	3467	29	2,946,000
8/ 5/77	48.4	41.5	38.7	3467	33	3,362,000
<u>Section 4 - 3" x 1/2" Wire Comb</u>						
12/ 5/74	--	50.3	45.8	3010	1	90,000
4/16/75	50.2	45.6	41.4	3419	6	591,000
10/10/75	57.8	47.4	43.1	3419	11	1,104,000
3/25/76	47.0	42.4	41.2	3677	17	1,742,000
10/13/76	54.2	47.4	41.8	3677	23	2,404,000
3/22/77	45.0	40.6	37.5	3677	29	3,066,000
8/ 5/77	45.3	42.4	37.1	3677	33	3,507,000

TABLE VIII-B
TEXTURE DEPTH OF EACH TEXTURE

ROUTE 63
 BOONE COUNTY

Date	Position 3			Position 2		
	Avg. Texture Depth, TX	Std. Dev.	Est. Traffic	Avg. Texture Depth, TX	Std. Dev.	Est. Traffic
<u>Section 1 - 3" x 1/2" Wire Comb</u>						
7/ 1/75	.031	.008	101,000	.032	.004	729,000
7/ 6/76	.029	.010	260,000	.028	.004	1,870,000
5/26/77	.032	.012	408,000	.027	.004	2,931,000
<u>Section 2 - 3" x 1/2" Wire Comb</u>						
7/ 1/75	.025	.003	109,000	.020	.003	782,000
7/ 8/76	.023	.003	280,000	.017	.002	2,010,000
5/26/77	.027	.004	439,000	.021	.005	3,154,000
<u>Section 3 - 3" x 1/2" Wire Comb</u>						
7/ 1/75	.033	.008	109,000	.021	.007	782,000
7/ 8/76	.028	.007	280,000	.018	.008	2,010,000
5/27/77	.032	.009	439,000	.023	.008	3,154,000
<u>Section 4 - 3" x 1/2" Wire Comb</u>						
7/ 1/75	.028	.012	100,000	.025	.013	796,000
7/ 8/76	.026	.011	261,000	.019	.012	2,073,000
5/27/77	.029	.013	414,000	.028	.012	3,287,000

Figure VIII

EFFECTS OF TRAFFIC ON SKID NUMBERS

ROUTE 63

BOONE COUNTY

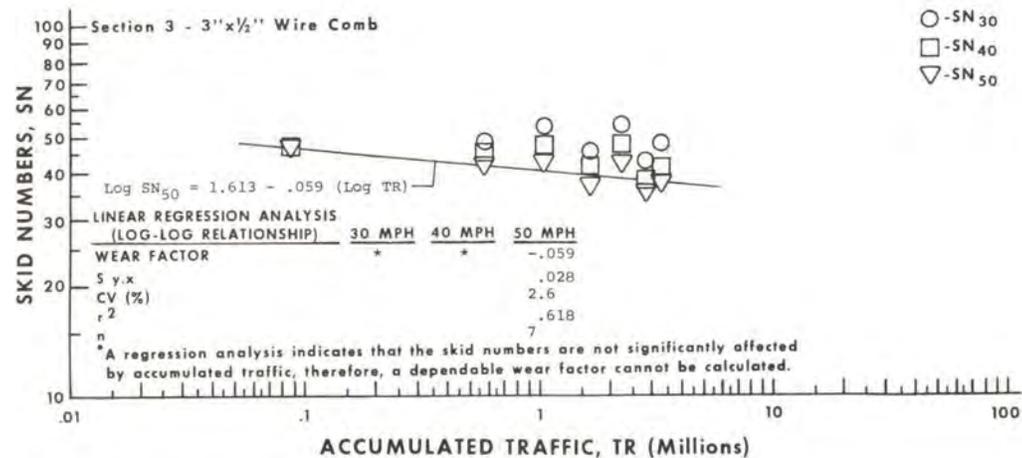
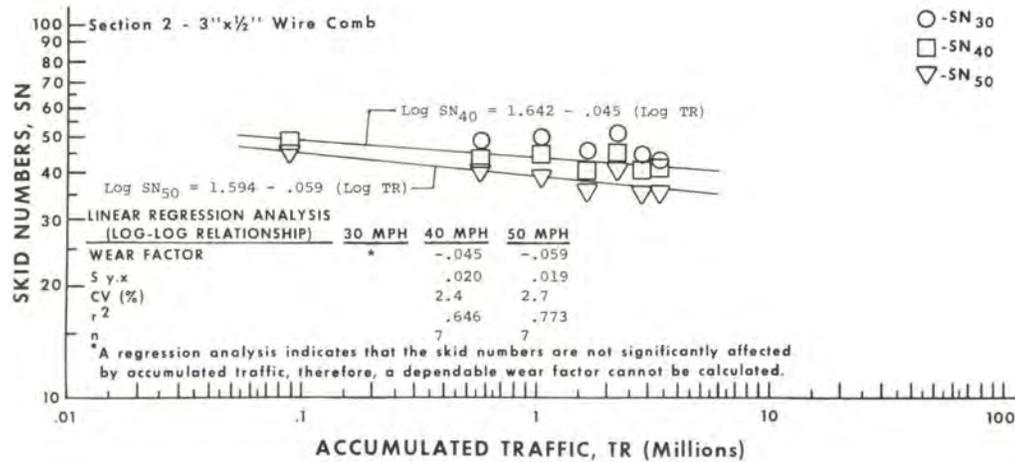
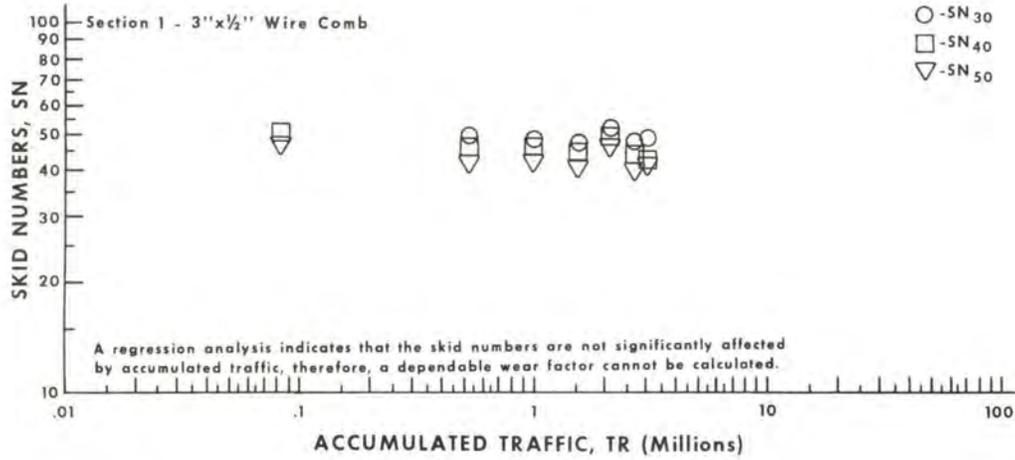
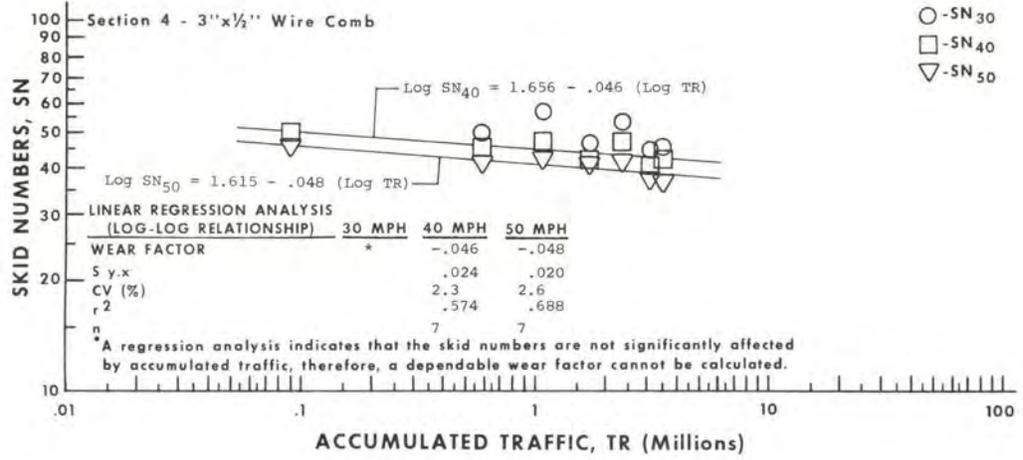


Figure VIII (Continued)
EFFECTS OF TRAFFIC ON SKID NUMBERS
ROUTE 63
BOONE COUNTY



**ROUTE I-57
MISSISSIPPI COUNTY
PROJECT I-57-1(9)**

Distinctive Characteristics

This project is a four lane divided pavement with 12 test sections. Pavements in each direction have sections of pavement textured with wire combs with 1/2", 3/4" and 1" spacings, each type having a section both preceded and not preceded by a burlap drag. The pavement in the northbound direction was textured with different tine dimensions than was the pavement in the southbound direction. All of the tine lengths were 3"

Discussion of Results

Only one full set of skid data has been accumulated on this project. The skid resistance values at 40 mph are all beginning at a level of 50 or above.

Description of Project

The project is in both the northbound and southbound lanes of a four lane divided highway.

At this time, this project has not been opened to traffic. The following is a description of the sections: Sections 1 and 12 - 3" x 1/2" wire comb - 1.110 miles each, Sections 2 and 11 - 3" x 1" wire comb - 1.061 miles each, Sections 3 and 10 - 3" x 1" wire comb preceded by a burlap drag - 1.061 miles each, Sections 4 and 9 - 3" x 3/4" wire comb - 1.023 miles each, Sections 5 and 8 - 3" x 3/4" wire comb preceded by a burlap drag - 1.061 miles each, and Sections 6 and 7 - 3" x 1/2" wire comb preceded by a burlap drag - 1.023 miles each. Sections 1 through 6 are in the northbound lanes and Sections 7 through 12 are in the corresponding southbound lanes. The wire comb used in the northbound lanes had tine dimensions of 0.025" in thickness and 0.123" in width while the wire comb used in the southbound lanes had tine dimensions of 0.022" in thickness and 0.064" in width. Standard specifications require nominal dimensions of 0.028" in thickness and 0.0625" in width.

Skid tests were performed at five locations each in positions 2 and 3 of each section. Results of the skid testing, texture data, and sound measurements are shown in Table IX.

TABLE IX

SKID NUMBERS, TEXTURE DEPTHS, AND SOUND LEVEL MEASUREMENTS

ROUTE I-57
MISSISSIPPI COUNTY

	3" x 1/2"		3" x 3/4"		3" x 1"	
	Wire Comb		Wire Comb		Wire Comb	
	Positions	Positions	Positions	Positions	Positions	Positions
	2	3	2	3	2	3
<u>Tine Dimensions-0.123"W x 0.025"T</u>						
<u>Preceded by Burlap Drag</u>						
Sound Level-dBA 30 mph	61.0	--	62.0 ²	--	62.5 ¹	--
Sound Level-dBA 40 mph	63.0	--	64.0 ²	--	64.5 ¹	--
Sound Level-dBA 50 mph	67.0	--	66.5	--	68.0 ¹	--
SN ₄₀	61.0	66.1	54.4	58.9	58.8	59.5
SN ₅₀	60.5	62.8	51.2	53.8	55.6	56.6
TX	.069	.077	.070	.066	.054	.054
<u>Not preceded by Burlap Drag</u>						
Sound Level-dBA 30 mph	62.0	--	62.5 ²	--	62.0 ¹	--
Sound Level-dBA 40 mph	64.0	--	65.0	--	65.0 ¹	--
Sound Level-dBA 50 mph	66.5	--	68.0	--	68.5 ¹	--
SN ₄₀	62.7	63.4	52.3	60.3	62.2	64.4
SN ₅₀	59.8	61.2	48.6	55.8	58.9	60.4
TX	.045	.050	.061	.058	.073	.070
<u>Tine Dimensions-0.064"W x 0.022"T</u>						
<u>Preceded by Burlap Drag</u>						
Sound Level-dBA 30 mph	62.0	--	62.0 ⁴	--	62.0	--
Sound Level-dBA 40 mph	64.0	--	64.0	--	64.0	--
Sound Level-dBA 50 mph	66.5	--	67.0	--	67.0 ¹	--
SN ₄₀	60.2	61.5	56.4	50.2	63.1	62.3
SN ₅₀	53.7	53.7	48.8	46.2	54.6	56.2
TX	.047	.055	.046	.046	.043	.050

TABLE IX (Continued)

SKID NUMBERS, TEXTURE DEPTHS, AND SOUND LEVEL MEASUREMENTSROUTE I-57
MISSISSIPPI COUNTY

	3" x 1/2"		3" x 3/4"		3" x 1"	
	Wire Comb		Wire Comb		Wire Comb	
	Positions	Positions	Positions	Positions	Positions	Positions
	2	3	2	3	2	3
<u>Not Preceded by Burlap Drag</u>						
Sound Level-dBA 30 mph	62.5	--	62.0	--	63.5	--
Sound Level-dBA 40 mph	64.5	--	64.5	--	65.0 ¹	--
Sound Level-dBA 50 mph	67.5	--	67.5	--	68.0 ^{1,3}	--
SN ₄₀	70.0	66.8	57.9	56.1	66.6	63.5
SN ₅₀	65.0	61.1	51.4	51.6	59.5	56.0
TX	.060	.055	.043	.047	.043	.047

- 1 Some objectionable frequency noise noticed.
- 2 Very slight objectionable frequency noise noticed.
- 3 Slight rumble noticed.
- 4 Contamination may have interfered with measurement.

NOTE: All sound level measurements were recorded on 8/11/77. Although it is indicated that sound level measurements were taken in position 2, they were actually in the driving lane. All texture tests were recorded between 6/21/77 and 8/10/77. All skid tests were performed on 9/15/77. Some sections had earlier skid tests but the results were very close to those of 9/15/77. All testing was done when the project was subjected to construction traffic only.

ROUTE I-35
DAVIESS COUNTY
PROJECT I-35-2(35)68
PROJECT I-IG-35-2(2)76

Distinctive Characteristics

This project was transversely textured with a wire comb having 3" tine length and 1/2", 3/4" and 1" tine spacings (3" x 1/2", 3" x 3/4" and 3" x 1" wire combs). The 3/4" and 1" textures were made both with and without a preceding burlap drag.

Discussion of Results

Only one partial set of skid data has been accumulated on this project. Most of the skid numbers are in the low 60's.

Description of Project

The project is in the southbound two lanes of a four lane divided highway.

At this time, this project has not been opened to traffic. The following is a description of the sections: Section 1 - 3" x 1" wire comb preceded by a burlap drag - 1.571 miles, Section 2 - 3" x 3/4" wire comb preceded by a burlap drag - 1.385 miles, Section 3 - 3" x 1/2" wire comb - 1.119 miles, Section 4 - 3" x 3/4" wire comb preceded by a burlap drag - 1.080 miles, and Section 5 - 3" x 1" wire comb - 1.174 miles. The tine dimensions were 0.032" in thickness and 0.064" in width. Standard specifications require nominal dimensions of 0.028" in thickness and 0.0625" in width.

Skid testing consisted of 5 test locations in each section. Results of the skid tests, texture depth measurements and sound level measurements are shown in Table X.

TABLE X

SKID NUMBERS, TEXTURE DEPTHS, AND SOUND LEVEL MEASUREMENTS

ROUTE I-35
DAVISS COUNTY

3" x 1/2"		3" x 3/4"		3" x 1"	
Wire Comb					
Positions	Positions	Positions	Positions	Positions	Positions
2	3	2	3	2	3

Tine Dimensions-0.064"W x 0.032"T

Preceded by Burlap Drag

Sound Level-dBA 30 mph	*	*	--	--	65.0	--
Sound Level-dBA 40 mph			--	--	66.0	--
Sound Level-dBA 50 mph			68.0	--	69.0	--
SN40			60.9	61.1	60.3	61.2
SN50			54.2	59.8	59.1	61.8
TX			.046	.045	.048	.057

Not preceded by Burlap Drag

Sound Level-dBA 30 mph	--	--	64.0	--	--	--
Sound Level-dBA 40 mph	--	--	65.0	--	--	--
Sound Level-dBA 50 mph	67.0	--	68.0	--	67.0	--
SN40	66.3	70.8	**	**	59.2	60.9
SN50	62.8	67.8	**	**	53.3	54.6
TX	.061	.060	.046	.048	.047	.051

*No test section of this type.

**The skid test vehicle could not get to this section.

NOTE: The sound level measurements were recorded on 8/22/77 and 8/30/77. All texture depth tests were recorded between 8/2/77 and 8/30/77. All skid tests were performed on 9/20/77. All testing was done when the project was subjected to construction traffic only. There were some slightly objectionable noises noted on the 3" x 1" section not preceded by a burlap drag.

**ROUTE 65
CHRISTIAN COUNTY
PROJECT F-HHS-65-1(14)**

Distinctive Characteristics

This project will consist of transverse wire comb texturing with a wire comb with tine spacings of 1/2", 3/4" and 1". The 1" spacing will be on two sections, one preceded by a fabric drag and the other not.

Discussion of Results

No testing has been performed.

Description of Project

At this time, this project has not been paved.

The test sections will be as follows: Section 1 - 1" tine spacing preceded by a fabric drag - 0.855 mile, Section 2 - 1/2" tine spacing - 1.610 miles, Section 3 - 3/4" tine spacing - 1.042 miles, and Section 4 - 1" tine spacing - 1.851 miles.

Each test section will have 5 test locations. Tests will be performed at speeds of 30 mph, 40 mph and 50 mph in positions 2 and 3. All tests will be in the southbound lanes of a four lane divided highway.

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