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MISSOURI COOPERATIVE HIGHWAY RESEARCH PROGRAM

FINAL REPORT

78-3

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AN INVESTIGATION OF FRICTIONAL PROPERTIES ON WIRE COMBED PCC PAVEMENT SURFACES

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AN INVESTIGATION OF FRICTIONAL PROPERTIES ON WIRE COMBED PCC PAVEMENT SURFACES

STUDY 78-3

Prepared By

MISSOURI HIGHWAY AND TRANSPORTATION DEPARTMENT

DIVISION OF MATERIALS AND RESEARCH

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In Cooperation With

Federal Highway Administration

The opinions, findings, and conclusions expressed in this publication are not necessarily those of the Federal Highway Administration.

ABSTRACT

This report involves PCC Pavements constructed with surface textures produced by a wide variety of wire combs. A small amount of testing was also performed on PCCP with other textures as a follow-up of previous research on frictional properties.

A limited amount of noise evaluation by rating panels and sound level (dbA) meters was conducted to assist in selection of an optimum tine spacing for wire combs on future PCC Pavement projects. Based on frictional characteristics and noise ratings, the currently specified wire comb with 0.100" to 0.125" wide tines having a clear spacing of 1/2" appears to be near optimum for texturing plastic PCC pavement.

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

Monitoring of pavement frictional characteristics will be continued on some of the projects with 1/2" to 1" tine spacing. Additional evaluation of fine aggregate with respect to friction number of PCC Pavement appears warranted, based on differences in FN on pavements with rounded and angular sands when texture depths were small.

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LIST OF ABBREVIATIONS

A	Intercept of Regression Line
AADTL	Annual Average Daily Lane Traffic
AASHTO	American Association of State Highway and Transportation Officials
ANOVA	Analysis of Variance
ASTM	American Society for Testing and Materials
B1	Coefficient of First Independent Variable
B2	Coefficient of Second Independent Variable
CV (%)	Coefficient of Variation, in percent
D	Depth of Groove, in inches
FN_{20}	Friction Number at 20 mph
FN_{30}	Friction Number at 30 mph
FN_{40} or FN	Friction Number at 40 mph
FN_{50}	Friction Number at 50 mph
n	Number of Observations
PCC	Portland Cement Concrete
PCCP	Portland Cement Concrete Pavement
r	Multiple Correlation Coefficient
r^2	Coefficient of Determination
$S_{(y.x)}$	Standard Error of Estimated FN from Simple Linear Regression
Std. Error	Standard Error of Estimated FN from Multiple Linear Regression
TR	Total Traffic Accumulated Vehicle Passes
TX	Texture Depth by Sandpatch Method, in inches
W	Width of Groove, in inches

INTRODUCTION

Pavement frictional characteristics have been the subject of many studies by various agencies in recent years. Long term testing of experimental sections has shown accumulated traffic, which was once believed to be an independent variable useful for predicting frictional characteristics is in fact a secondary or dependent variable. Daily traffic volume and texture depth have been found to be independent variables which can be used to predict friction numbers for given paving materials.

Friction tests were performed with two friction testers which substantially comply with AASHTO T 242. Texture depth measurements were performed according to the sand-patch method with limited verification by a modified tire-tread-depth gauge. Noise measurements were performed by a four-man team in each of two different passenger cars (standard and compact) in addition to limited data from a sound level meter using the dbA weighted scale.

Many other items such as temperature, precipitation, contamination, aggregate properties, and daily traffic volume were recognized as factors which may influence pavement frictional characteristics either in an orderly or random manner.

Included in the appendices of this report is a brief description of each project meeting the primary objective along with summaries of friction tests, texture measurements (sand-patch method), and noise ratings.

The Missouri Highway and Transportation Department has performed four earlier studies of pavement frictional properties in addition to maintaining a current inventory of friction numbers for over 7900 roadway miles of interstate and primary highways within the State.

Problem

A PCC Pavement project with several experimental textures was constructed in 1970 for the purpose of studying frictional properties. A wire comb with 0.0625" tines at 1/4" centers was found to produce a surface texture which provided initial friction numbers higher than burlap drags or various brooms. History proved the texture produced by this wire comb was not durable in areas with high annual average daily traffic per lane or where studded snow tires were used extensively.

Additional research has been focused on selection of a wire comb which will provide high initial friction numbers, good resistance to wear, and acceptable noise levels.

Objective

The primary objective of this study was to determine wear factors, using the Missouri friction tester, for a number of PCC Pavement sections textured with wire combs having tine spacings between 1/2" and 1" on centers. Secondary objectives were to perform noise ratings and texture measurements on these sections with limited monitoring of friction characteristics on wire combed sections of PCC Pavement from earlier studies.

CONCLUSIONS

All conclusions below are based on frictional characteristics and noise ratings from this study or prior studies of frictional characteristics on Missouri pavements and may not be applicable to pavements under other environments or utilizing different aggregates.

Frictional characteristics of PCC Pavement are primarily dependent upon texture depth, average daily traffic per lane, and type of fine aggregate when constructed with limestone coarse aggregate.

Based on frictional characteristics and noise ratings, the currently specified wire comb with 0.100" to 0.125" wide tines having 1/2" clear spacing appears to be near optimum for texturing plastic PCC Pavement.

Objectionable noise ratings occurred more frequently as the wire comb tine spacing increased on PCC Pavement surfaces.

Objectionable noise ratings also occurred more frequently when a burlap drag was used ahead of the wire comb than when a burlap drag was used as the sole texturing device.

Sound level measurements (dbA) from inside a passenger car or from a site near the pavement did not accurately reflect personal opinion concerning textures which produced objectionable noise.

There were no significant differences between long-term frictional characteristics of sections textured with

combs having tine spacings of 1/2" to 1" either as the sole texturing device or when used after dragging the surface with burlap.

Texture depths should be increased to provide high frictional characteristics for a longer period of time on PCC pavements. A method of providing a PCCP mixture with an internal structure which will renew the frictional properties as the surface wears appears to be the most desirable method for improving pavement friction numbers in urban areas with very high traffic volumes. Such factors as aggregate angularity, differential hardness, or other items should be addressed in future studies of PCCP frictional characteristics.

Accumulated vehicle passes is a secondary variable and should not be used as an independent variable for prediction of PCC Pavement frictional characteristics. Long-term monitoring of frictional characteristics has shown friction number decreases while texture depth is decreasing, but then becomes relatively constant for a particular level of traffic. Some seasonal variation will naturally occur after this equilibrium level has been achieved.

Wear factors have been rejected as a tool for determining frictional characteristics of PCC Pavement because of the lack of validity of assuming accumulated traffic to be an independent variable.

Fine aggregate (sand) characteristics are more significant than coarse aggregate characteristics for the

PCC Pavement sections in Missouri. All coarse aggregate in this study, and essentially all coarse aggregate in PCC Pavement is currently crushed limestone. Availability of non-polishing coarse aggregates in other areas could very well alter this strong influence of fine aggregate.

IMPLEMENTATION

The Missouri Standard Specification on PCCP texturing was changed in January, 1980, based on data obtained in this and other investigations. A wire comb with 0.100" to 0.125" wide tines having a clear spacing of 1/2" and producing an average texture depth of approximately 0.125" was specified.

Consideration will be given to increasing the specified average texture depth.

Monitoring of frictional properties of PCC Pavement textured with wire combs will be continued on a reduced schedule to verify preliminary findings from this study.

SCOPE

This study began in August, 1978 with all experimental sections except five already being evaluated under a previous study. Primary emphasis was placed on transverse textures produced with wire combs having tine spacings of 1/2" to 1", although several other textures were tested on a reduced schedule.

The study involved 34 test sections and 39.799 miles of tested pavement. Following is a brief summary of textures tested:

Sections	Texture Description	Length (miles)
Four	1/4" Comb	4.669
Nine	1/2" Comb	11.856
Three	1/2" Comb w/Burlap Drag	3.165
Five	3/4" Comb	6.829
Three	3/4" Comb w/Burlap Drag	3.202
Five	1" Comb	4.717
Four	1" Comb w/Burlap Drag	4.404
One	AstroTurf Drag	0.957

Friction number tests and sand-patch texture measurements were performed on all sections and noise level evaluations were conducted on most projects. All available data was used to evaluate each texture classification.

EQUIPMENT AND PROCEDURES

Friction Tester

Frictional properties of pavement test sections in this study were determined with two locked-wheel trailers which substantially comply with AASHTO T 242. Tests prior to August, 1980 were conducted with trailer MO-1 and after that date were conducted with trailer MO-2. Trailer MO-1 was calibrated in April, 1974, and February, 1977, at the Central/Western Friction Test Center at Texas A & M University in College Station, Texas. Upon receipt of MO-2, a correlation of the two trailers was performed. Trailer MO-2 was calibrated at Central/Western Friction Test Center in October, 1980. An in-house calibration center was constructed in the spring of 1981 and has been used for monitoring trailer MO-2 at intervals of one to two months during the friction testing season.

Trailer MO-1 was initially equipped with ASTM E 249 (7.75-14) tires and non-divergent water nozzles designed by K. J. Law Engineers for 7.75-14 tires. ASTM E 501 (G78-15) tires were installed at the calibration center in 1974 with no change in water nozzles. Divergent water nozzles designed by Pennsylvania State University for G78-15 tires were installed at the calibration center in 1977.

Trailer MO-2 is equipped with AASHTO M 261 (G78-15) tires and non-divergent water nozzles as specified by AASHTO T 242.

Testing Procedure (And Small Equipment)

A set of five tests was conducted at each speed in each wheelpath tested. Wheelpath positions are numbered from right to left starting with the right wheelpath in the first through traffic lane. Most tests were conducted in positions two (left wheelpath of traffic lane) and three (right wheelpath of passing lane) in order to include maximum variation in annual average daily traffic per lane and minimize contamination from shoulders or right-of-way. On two-lane pavements, position two was tested in each direction.

Sand-patch texture measurements were performed according to Missouri Highway and Transportation Department Standard Test Method T 19-1-71 at five locations in each position being evaluated for texture depth and frictional characteristics. Groove depths were measured with a modified tire-tread-depth gauge on 10 or more consecutive grooves in most sand-patch areas. Preliminary tests with up to 30 groove measurements indicated 10 measurements provided approximately the same order of precision as eight diameters for a sand-patch texture.

Noise evaluations were performed on some sections using a General Radio Type 1565-D sound level meter, set to the A-weighted scale (dbA), near the pavement and also inside a passenger vehicle. Preliminary readings on one project were performed with the meter near the pavement, and all other tests were performed inside the vehicle to minimize interference from other traffic such as large trucks. A four-man panel of engineers performed a subjective rating of noise on the test sections textured with wire combs having tine spacings of

1/2" to 1" in each of two different passenger cars. A standard-sized Plymouth Fury and compact-sized Plymouth Volare were used by the rating team.

DISCUSSION AND DATA ANALYSIS

Data Analysis: General

Data included in this study was evaluated with ANOVA and various regression techniques. Regressions were performed on raw data and then on data which had been transformed by logarithmic or exponential formulae in order to determine the proper relationship between variables. Step-wise multiple regressions were performed to study primary correlations as well as interactions between various variables.

A wire comb with 0.100" to 0.125" wide tines having a clear spacing of 1/2" and producing grooves 0.125" deep has been selected for current PCCP construction. All data analyses presented below, except aggregate characteristics, were considered before selecting a standard wire comb. This comb has been in general use for a limited amount of time.

Photographs of typical textures produced by wire combs with 1/2", 3/4", and 1" tine spacings are included in Appendix I. Average TX and groove depth measurements are shown for each area.

Data Analysis: Wear Factor

Wear factors for test sections were all computed as the slope of log (FN) vs log (TR) on a "best fit" basis by regression techniques. Analysis of data from single wheelpaths generally did not result in significant correlations, which would be interpreted as wear factors of zero for most test sections. Data from all wheelpaths in a test section

was then combined and an overall wear factor was computed as shown in the appendices. Even after combining data from a lane with low AADTL and a lane with high AADTL, some sections did not have a significant wear factor. Other sections with the same texture type on different projects had wide differences in wear factors. These findings led to searching for other independent variables with which to predict FN for PCCP sections.

Data Analysis: Traffic Volume, Texture, and Aggregate

Correlations of FN vs various functions of AADTL yielded slightly better correlations than previous correlations using TR as the independent variable. Utilizing a function of TX as the independent variable also yielded significant correlations. Several other factors were substituted as the independent variable with general lack of significant relationships.

Multiple correlations of FN vs various functions of TR, AADTL, and TX as simultaneous independent variables were then performed. An equation of the general form FN = A + B1 (AADTL) + B2 (TX) evolved as the best combination of independent variables for predicting FN. Even though this multiple correlation was much superior to simple correlations, there were certain projects for which the predicted FN was consistently high or low for all texture types on the project.

Design and construction variables were studied for each project and a difference in sand types was found for those projects on which predicted FN values were less than measured values. While most PCCP projects were constructed with a well-rounded river sand, some projects were constructed

with an angular or sub-angular field or river sand. Data from projects constructed with well-rounded sand was then compiled separately and data from all other projects was compiled as a combined angular and sub-angular group for additional analysis. Multiple correlations on these two sets of data revealed FN was very sensitive to AADTL for PCCP constructed with rounded sand while it was only moderately sensitive when angular or sub-angular sand was incorporated. Both groups indicated FN was very sensitive to TX although the coefficient for rounded sand was over one and a half times the coefficient for angular sands.

Data from previous studies of frictional characteristics on PCCP and a limited amount of data from pavement friction inventory testing was then combined with the data from this study while maintaining the distinction of sand type. This additional data greatly extended the range of AADTL available for correlation and stabilized the exponent required for each of the independent variables without significantly changing predicted FN values for sections in this study.

While additional study of the relationship between frictional characteristics and sand in PCCP mixtures will need to be conducted before coefficients and exponents for the variables can be precisely established, this study has definitely shown the existence of significant influence of sand. The interim equations for the two categories identified to date when used in conjunction with limestone coarse aggregates are:

$$FN = 49.8 - 5.858\ (AADTL/1000)^{0.6} + 314\ TX$$
(Rounded Sand: n=340, r=0.91, std. error=4.1), and

$$FN = 51.2 - 3.020\ (AADTL/1000)^{0.6} + 194\ TX$$
(Angular Sand: n=256, r=0.77, std. error=4.3)

These equations were developed without regard to type of texturing device or age of pavement. Neither of these two items contributed significantly to the relationship after AADTL and TX were introduced, in a step-wise fashion, into the multiple regression. Coarse aggregate could only be included by formation or source since all PCCP in this study was constructed with limestone coarse aggregate. Based on the high multiple correlation coefficient obtained for the sections utilizing rounded sand, searching for small variations between the frictional characteristics of available limestones did not appear to be a worth-while endeavor.

As stated earlier, the mechanism (angularity alone, hardness, differential hardness, parent material, a combination of factors, etc.) which causes FN to be influenced more by AADTL for the group of rounded sands than for the angular group of sands has not yet been identified.

Another study of frictional characteristics is needed to identify the mechanism and a laboratory method for determining how to classify any particular sand.

Spacing of tines in the range of 1/2" to 1" had very little influence on the FN measured on PCCP except in an indirect manner. Combs having tines with close spacings are difficult to control, and depth of grooves in the fresh PCCP are quite variable. Since depth of grooves has a large influence on the frictional properties of PCCP, this indirect

influence can often overshadow any influence of tine spacing. Combs with 1/4" spacing, which were used for a few years, were particularly susceptible to timing of combing operations and therefore difficult to control.

Tine widths in the range of 0.100" to 0.125" are generally more effective in producing high frictional characteristics than the 0.0625" tines previously specified. Grooves produced by the wider tines are less susceptible to elimination by mortar flow than those produced by narrow tines. The larger tines may also withstand increased downward loads without twisting and decrease the sensitivity of timing for combing operations. There may be some tendency for the larger tines to produce grooves without disturbing the PCCP surface between grooves to the extent it was disturbed by narrow tines.

Earlier reports had indicated the combs with closer tine spacings gave higher initial FN values. This is true in many cases, but any difference tends to quickly disappear under moderate to heavy traffic conditions. The surfaces with closely spaced wire tines tend to give a false indication of texture depth because of loosely bound mortar and sand grains on the surface of the pavement. These particles are generally cemented sufficiently not to be removed by surface preparations prior to sand-patch measurements on newly completed PCCP, but they are quickly removed by vehicular traffic.

Sand-patch texture depth measurements are subject to many inaccuracies, but no simple method of texture depth determination has been found which will provide more accuracy

for textures in general. A tire-tread-depth gauge was modified by grinding two sides of the probe to provide a thin blade-like apparatus for insertion into the pavement grooves. A gauge modified in this manner can be used to determine groove depth of newly constructed PCCP, textured with wire combs, at a much earlier age than sand-patch apparatus.

Early attempts to correlate TX with groove depth on a small sample of surfaces combed with 0.063" tines were not successful. After gathering additional data, correlations for some groups were very poor. A multiple linear regression of TX vs groove depth, tine spacing, and tine width yielded the following equation:

$$TX = 0.010 + 0.2791\ D - 0.0298\ S + 0.1654\ W$$
$$(n = 711,\ r=0.85,\ \text{std. error}=0.0083)$$

Where:

D = Depth of Groove, in inches

S = Spacing of Tines, center to center, in inches

W = Width of Tines, in inches

All tests included in the above equation averaged 0.13" groove depth and 0.037 TX. Although the standard error of estimate remained high, it was only about half the standard deviation of TX. The multiple linear regression for all wire combed textures produced approximately the same goodness of fit as simple linear regressions of TX vs groove depth for 0.123" wide tines when stratified by tine spacing and was much better than for some regressions with 0.060" to 0.080" wide tines.

Figure I-A is an example of expected TX based on groove depth, tine width, and tine spacings as computed by the multiple linear regression.

Dragging the surface of fresh PCCP with burlap prior to transverse texturing with a wire comb had no significant influence on long-term frictional properties of the pavement.

Data Analysis: Sound Level (dbA) and Noise Ratings

Sound level (dbA) measurements included in this report were conducted under Study 74-5 (AN INVESTIGATION OF THE DURABILITY OF SKID RESISTANCE OF WIRE COMBED PCC PAVEMENT SURFACES) and reported briefly in 1978. These readings did not show any differences between texturing methods, although the operator noticed objectionable noise on some sections. The only significant difference in the sound level readings was between vehicle speeds.

Noise ratings by the rating team were conducted in the summer of 1979 on test sections in projects with wire comb tine spacings of 1/2" to 3/4" or 1". A technician marked test sections with small flags prior to the ratings, and raters were told to evaluate sections sequentially (between flags) without prior knowledge of which texture type was being evaluated. Raters were instructed to give an overall rating of non-objectionable, slightly objectionable, moderately objectionable, or highly objectionable for the entire section delineated by the flags. They also rated the boundary conditions (at each flag) according to whether the noise level increased, decreased, or stayed the same when the vehicle left one texture type and entered another. These boundary ratings are not included in the appendices

because they were only for verification of average ratings within each test section. For purposes of analysis, the subjective ratings were given weights where each rating carried twice the weight of the next quieter rating. The values of 1, 2, 4, and 8 were thus established and entered into ANOVA programs according to several stratifications.

Neither car was consistently more noisy than the other although certain sections were rated much worse with one car or the other. Since "non-objectionable" and "highly objectionable" ratings were matters of personal opinion (no definitions were included in instructions to raters), some raters consistently rated higher than others to a certain degree. Averaging the rating from all panel members compensated for any individual rater bias and the difference between raters became the "yardstick" by which differences between vehicles and texture types were judged.

Noise ratings on individual test sections appeared to have a casual correlation with texture depth as well as tine spacing. The range in texture depths at the time of the noise ratings was not sufficient to provide a basis for performing a correlation.

Sections on which a burlap drag was followed by a wire comb were rated significantly more noisy than companion sections on which a wire comb was used as the sole texturing device.

Wire comb tine spacings of 3/4" and 1" were rated significantly more objectionable than spacings of 1/2"

with only a slight difference between 3/4" and 1" spacings. There was a consistent increase in noise level with increased tine spacing within the range of 1/2" to 1" tine spacings. Prior experience with several sections textured with a wire comb having tines at 1/4" center to center and a very short section of PCCP textured with a grooving tool at 1 1/4" spacing verifies the trend established by the rating panel.

APPENDICES

Texture Correlation

Typical Surface Texture Photographs

Sound Level (dbA), and Noise Ratings

Description of Project

Project Data Tables

Project Data Figures

FIGURE I-A

Sand-patch Texture as a Function of Depth, Width, and Center to Center Spacing of Grooves (in inches)

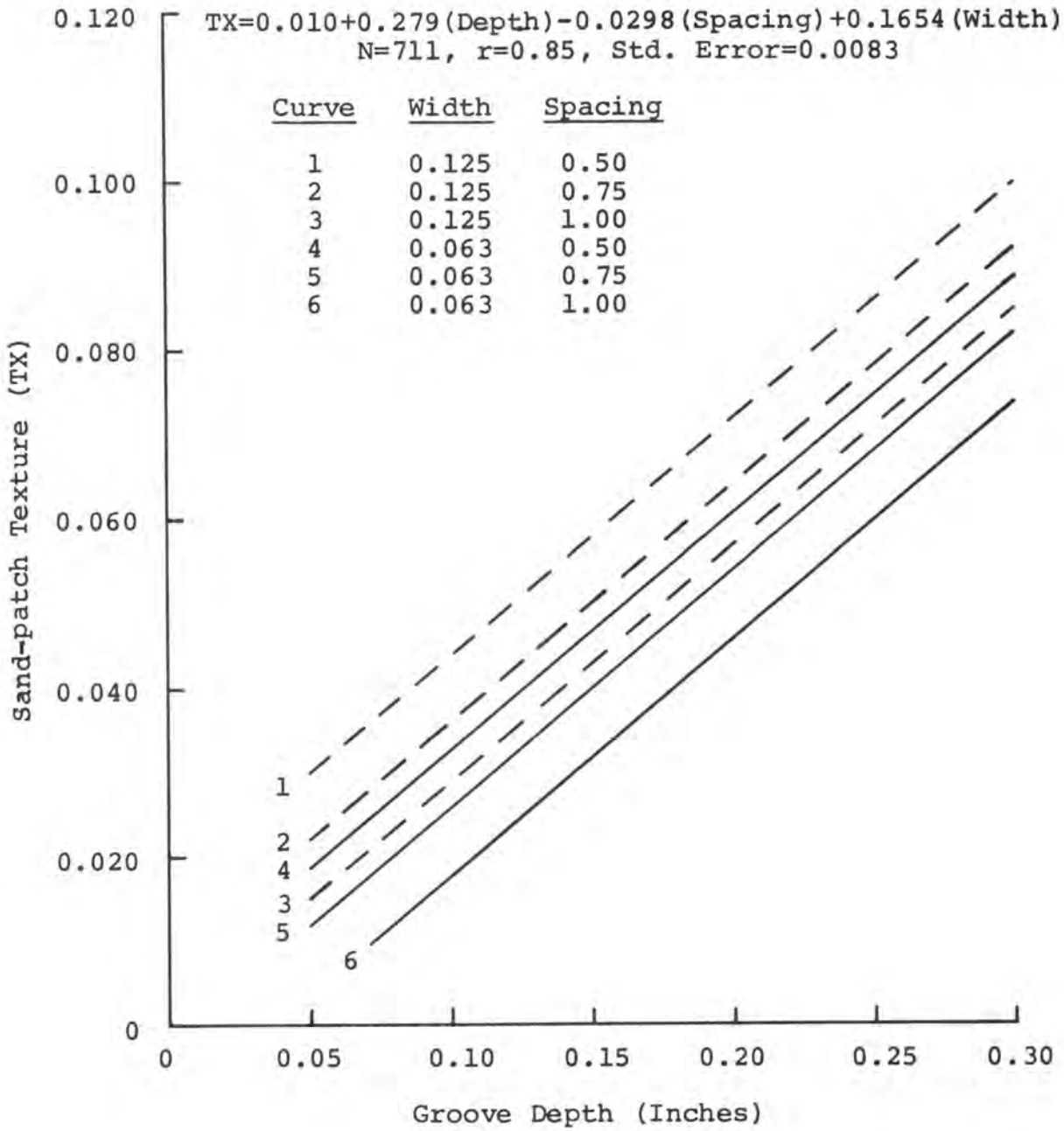
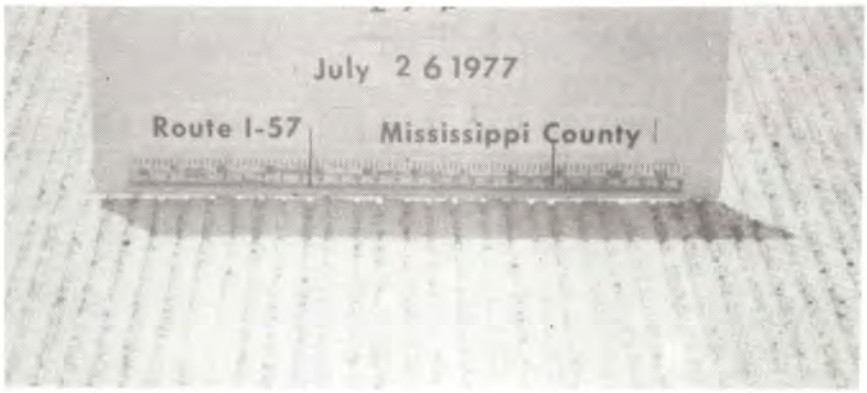


FIGURE I-B

TYPICAL WIRE-COMBED PCCP SURFACE TEXTURES



0.123" Wide Tines

1/2" Center to Center Spacing

0.09" Groove Depth

0.042" Sand-patch Texture

0.083" Wide Tines

3/4" Center to Center Spacing

0.18" Groove Depth

0.039" Sand-patch Texture

0.123" Wide Tines

1" Center to Center Spacing

0.12" Groove Depth

0.035" Sand-patch Texture

TABLE I-A

SOUND LEVEL (dbA) MEASUREMENTS

Speed (MPH)	Texturing Method	Wire Comb Tine Spacing		
		1/2"	3/4"	1"
30	Comb Alone	62.0 62.5	62.0 62.0 64.0	62.0 63.5
	Comb With Burlap Drag	61.0 62.0	62.0 62.0	62.5 62.0 65.0
40	Comb Alone	64.0 64.5	64.0 64.5 65.0	65.0 65.0
	Comb With Burlap Drag	63.0 64.0	64.0 64.0	64.5 64.0 66.0
50	Comb Alone	66.5 67.5	67.0 67.5 68.0	68.5 68.0 67.0
	Comb With Burlap Drag	67.0 66.5	66.5 67.0 68.0	68.0 67.0 69.0

Table I-B

Subjective Noise Rating (Percentage Basis)

Texturing Method	Rating	Wire Comb Tine Spacing		
		1/2"	3/4"	1"
Comb Alone	Highly Objectionable	0	0	0
	Moderately Objectionable	3	19	19
	Slightly Objectionable	31	53	62
	Non Objectionable	66	28	19
Comb w/Burlap Drag	Highly Objectionable	0	3	6
	Moderately Objectionable	0	19	28
	Slightly Objectionable	38	66	53
	Non Objectionable	62	12	13

II.

ROUTE I-35
DAVIESS COUNTY
PROJECT I-35-2(35)68
PROJECT I-IG-35-3(2)72

Description of Project

This test project included five sections in the southbound lanes of a four-lane-divided highway which was opened to traffic in December, 1977 and June, 1978. Transverse texturing was accomplished by wire comb alone, or by a burlap drag followed by a wire comb. The wire comb tines were 0.032" thick by 0.064" wide spaced at 1/2", 3/4", or 1" center to center.

Friction tests and sand-patch texture tests were performed in positions 2 and 3. Sound level (dbA) determinations were performed in the driving lane during August, 1977. Noise level ratings by a four-man panel were performed in the driving lane during July, 1979.

Fine aggregate in the PCCP mixture was a slightly angular river sand.

TABLE II-A

FRICTION TESTS AND TRAFFIC DATA

ROUTE I-35
DAVIESS COUNTY

Date Tested	FN_{40}	FN_{50}	AADT /Lane	Age in Months	Est. Acc. Traffic
Section 1 - Position 2 - 1" Wire Comb preceded by a Burlap Drag					
9/20/77	60.3	59.1	0	0	0
4/19/78	59.1	56.6	2404	4	288,000
9/12/78	49.5	45.7	2404	8	577,000
5/22/79	53.1	49.4	2346	17	1,217,000
8/21/79	54.0	48.6	2346	20	1,428,000
6/25/80	53.5	49.1	2192	30	2,104,000
8/21/80	49.5	43.6	2192	32	2,236,000
3/31/81	51.8	47.8	2192	39	2,696,000
9/21/81	49.1	44.8	2192	45	3,091,000
Section 1 - Position 3 - 1" Wire Comb preceded by a Burlap Drag					
9/20/77	61.2	61.8	0	0	0
4/19/78	63.5	60.8	209	4	25,000
9/12/78	59.1	54.7	209	8	50,000
5/22/79	58.4	53.9	204	17	106,000
8/21/79	57.4	55.1	204	20	124,000
8/21/80	57.3	51.6	191	32	196,000
3/31/81	59.8	58.6	191	39	238,000
9/21/81	56.0	52.3	191	45	269,000
Section 2 - Position 2 - 3/4" Wire Comb					
9/12/78	50.9	48.3	2404	2	144,000
5/22/79	52.9	48.1	2346	11	785,000
8/21/79	53.5	49.8	2346	14	996,000
6/25/80	54.6	49.7	2192	24	1,672,000
8/21/80	51.0	45.7	2192	26	1,803,000
3/31/81	50.5	46.6	2192	33	2,264,000
9/21/81	54.4	48.4	2192	39	2,658,000
Section 2 - Position 3 - 3/4" Wire Comb					
9/12/78	58.7	55.3	209	2	12,000
5/22/79	59.3	56.1	204	11	68,000
8/21/79	57.5	55.3	204	14	87,000
8/21/80	57.2	52.9	191	26	157,000
3/31/81	59.8	57.9	191	33	197,000
9/21/81	56.1	54.2	191	39	231,000

TABLE II-A (Continued)

FRICTION TESTS AND TRAFFIC DATA

ROUTE I-35
DAVIESS COUNTY

Date Tested	FN_{40}	FN_{50}	AADT /Lane	Age in Months	Est. Acc. Traffic
Section 3 - Position 2 - 1/2" Wire Comb preceded by a Burlap Drag					
9/20/77	66.3	62.8	0	0	0
4/19/78	59.1	55.3	2404	4	288,000
9/12/78	51.7	46.7	2404	8	577,000
5/22/79	53.7	47.7	2346	17	1,217,000
8/21/79	51.6	47.1	2346	20	1,428,000
6/25/80	52.1	47.3	2192	30	2,104,000
8/21/80	50.3	44.7	2192	32	2,236,000
3/31/81	48.8	45.0	2192	39	2,696,000
9/21/81	52.0	46.2	2192	45	3,091,000
Section 3 - Position 3 - 1/2" Wire Comb preceded by a Burlap Drag					
9/20/77	70.8	67.8	0	0	0
4/19/78	61.7	58.8	209	4	25,000
9/12/78	59.7	54.7	209	8	50,000
5/22/79	59.6	56.6	204	17	106,000
8/21/79	59.5	56.0	204	20	124,000
8/21/80	59.2	54.1	191	32	196,000
3/31/81	58.3	58.1	191	39	238,000
9/21/81	54.6	54.2	191	45	269,000
Section 4 - Position 2 - 3/4" Wire Comb preceded by a Burlap Drag					
9/20/77	60.9	54.2	0	0	0
4/19/78	57.0	53.0	2507	4	301,000
9/12/78	48.8	45.5	2507	8	602,000
5/22/79	48.5	45.0	2447	17	1,270,000
8/21/79	46.9	44.5	2447	20	1,490,000
6/25/80	49.0	42.9	2287	30	2,195,000
8/21/80	48.0	43.1	2287	32	2,332,000
3/31/81	43.6	40.7	2287	39	2,813,000
9/21/81	46.3	42.3	2287	45	3,224,000

TABLE II-A (Continued)

FRICTION TESTS AND TRAFFIC DATA

ROUTE I-35
DAVIESS COUNTY

Date Tested	FN_{40}	FN_{50}	AADT /Lane	Age in Months	Est. Acc. Traffic
Section 4 - Position 3 - 3/4" Wire Comb preceded by a Burlap Drag					
9/20/77	61.1	59.8	0	0	0
4/19/78	62.6	58.6	218	4	26,000
9/12/78	58.0	53.2	218	8	52,000
5/22/79	56.5	53.6	212	17	110,000
8/21/79	55.4	54.1	212	20	129,000
8/21/80	54.9	51.6	199	32	202,000
3/31/81	56.7	55.3	199	39	244,000
9/21/81	53.8	51.3	199	45	280,000
Section 5 - Position 2 - 1" Wire Comb					
9/20/77	59.2	53.3	0	0	0
4/19/78	54.4	48.3	2507	4	301,000
9/12/78	51.0	42.2	2507	8	602,000
5/22/79	53.7	46.2	2447	17	1,270,000
8/21/79	45.5	41.6	2447	20	1,490,000
6/25/80	48.8	42.7	2287	30	2,195,000
8/21/80	45.3	39.0	2287	32	2,332,000
3/31/81	44.2	37.6	2287	39	2,813,000
9/21/81	44.1	39.1	2287	45	3,224,000
Section 5 - Position 3 - 1" Wire Comb					
9/20/77	60.9	54.6	0	0	0
4/19/78	60.4	54.8	218	4	26,000
9/12/78	58.4	50.9	218	8	52,000
5/22/79	57.6	51.7	212	17	110,000
8/21/79	54.6	50.6	212	20	129,000
8/21/80	54.3	49.3	199	32	202,000
3/31/81	58.6	54.7	199	39	244,000
9/21/81	53.5	49.8	199	45	280,000

TABLE II-B

TEXTURE DEPTH OF EACH TEXTURE

ROUTE I-35
DAVIESS COUNTY

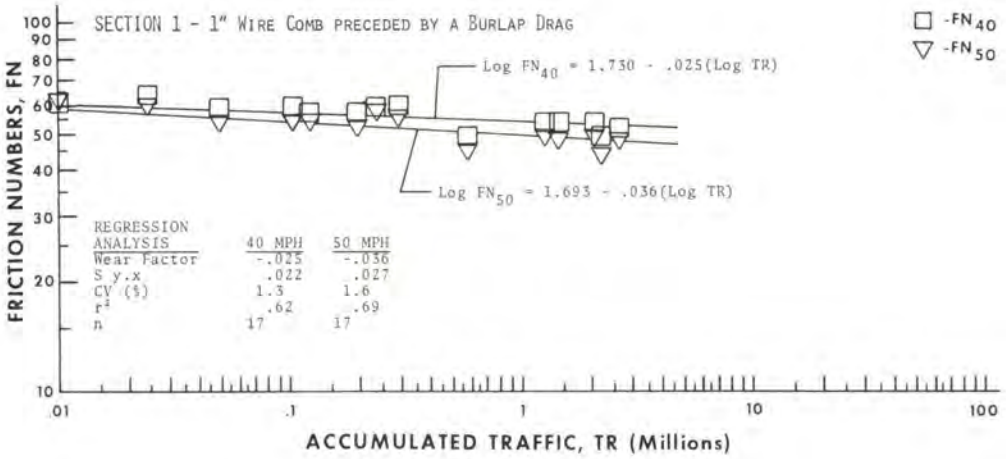
Date Tested	Position 3 Avg. Texture Depth, TX	Position 3 Std. Dev.	Position 3 Est. Acc. Traffic	Position 2 Avg. Texture Depth, TX	Position 2 Std. Dev.	Position 2 Est. Acc. Traffic
Section 1 - 1" Wire Comb preceded by a Burlap Drag						
8/23/77	.057	.008	0	.048	.011	0
7/25/78	.032	.010	44,000	.025	.008	505,000
8/12/80	.022	.008	189,000	.017	.005	2,170,000
Section 2 - 3/4" Wire Comb						
8/30/77	.048	.009	0	.046	.013	0
7/25/78	.034	.009	6,000	.030	.009	72,000
8/12/80	.023	.006	151,000	.024	.009	1,738,000
Section 3 - 1/2" Wire Comb preceded by a Burlap Drag						
8/ 2/77	.060	.021	0	.061	.020	0
7/25/78	.040	.017	44,000	.041	.016	505,000
8/12/80	.028	.013	189,000	.029	.013	2,170,000
Section 4 - 3/4" Wire Comb preceded by a Burlap Drag						
8/ 2/77	.045	.020	0	.046	.015	0
7/26/78	.035	.016	46,000	.034	.012	526,000
8/11/80	.027	.015	197,000	.025	.011	2,264,000
Section 5 - 1" Wire Comb						
8/ 2/77	.051	.016	0	.047	.007	0
7/26/78	.040	.012	46,000	.036	.011	526,000
8/11/80	.032	.011	197,000	.028	.011	2,264,000

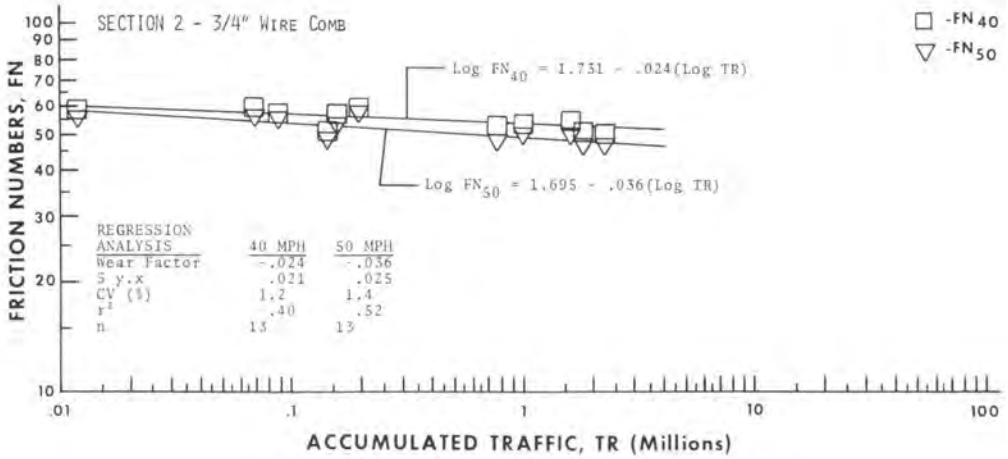
Figure 11

EFFECTS OF TRAFFIC ON FRICTION NUMBERS

ROUTE I-35

DAVIESS COUNTY





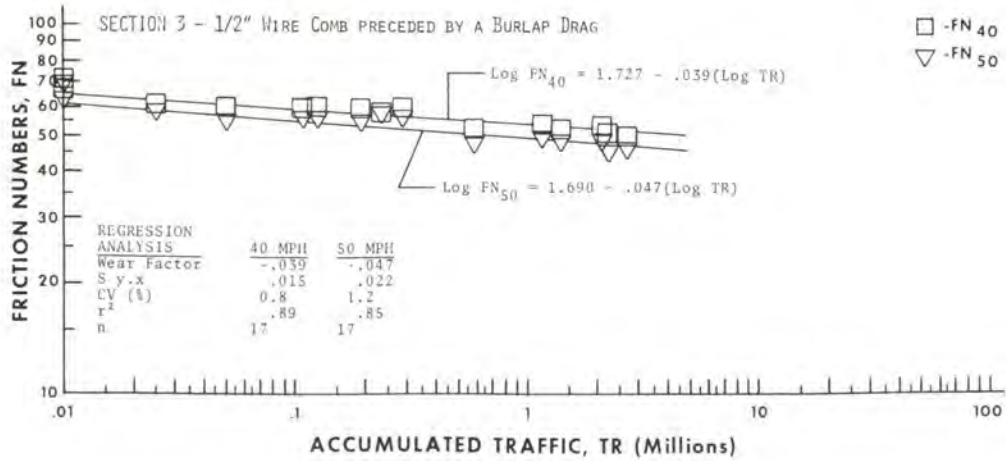
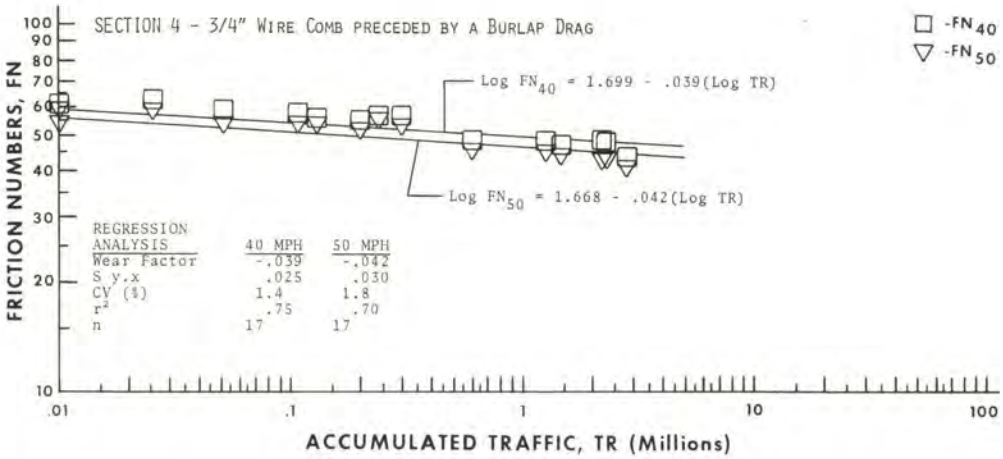


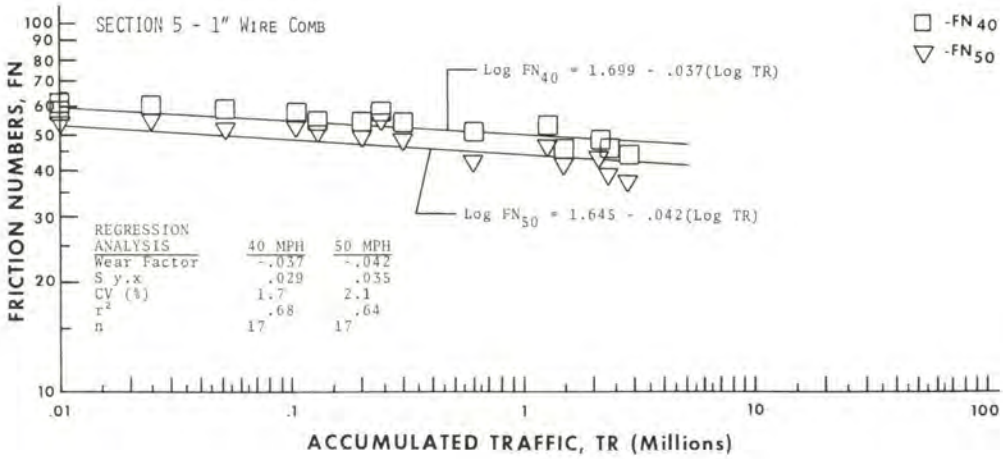
Figure II (Continued)

EFFECTS OF TRAFFIC ON FRICTION NUMBERS

ROUTE I-35

DAVIESS COUNTY





III.

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

Description of Project

This test project included two sections in an undivided pavement which was opened to traffic in October, 1974. Transverse texturing was accomplished by wire comb alone. The wire comb tines were specified to be 0.028" thick by 0.0625" wide spaced at 1/4" or 1/2" center to center.

Friction tests and sand-patch texture tests were performed in position 2.

Fine aggregate in the PCCP mixture was a well-rounded river sand.

TABLE III-A

FRICTION TESTS AND TRAFFIC DATA

ROUTE 50
MORGAN COUNTY

Date Tested	FN_{30}	FN_{40}	FN_{50}	AADT /Lane	Age in Months	Est. Acc. Traffic
Section 1 - 4" x 1/2" Wire Comb						
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	1416	30	1,200,000
8/26/77	51.5	48.0	44.0	1416	35	1,413,000
4/ 6/78		45.7	43.3	1936	42	1,757,000
5/11/79		43.9	40.6	1911	55	2,509,000
3/20/80	46.5	41.7	38.9	1825	65	3,077,000
3/26/81	47.2	42.7	38.8	1825	78	3,789,000
Section 2 - 4" x 1/4" Wire Comb						
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	1416	30	1,200,000
8/26/77	54.6	51.8	47.4	1416	35	1,413,000
4/ 6/78		48.8	48.0	1936	42	1,757,000
5/11/79		47.6	43.9	1911	55	2,509,000
3/20/80	48.7	44.0	41.6	1825	65	3,077,000
3/26/81	48.5	44.5	41.6	1825	78	3,789,000

TABLE III-B

TEXTURE DEPTH OF EACH TEXTURE

ROUTE 50
MORGAN COUNTY

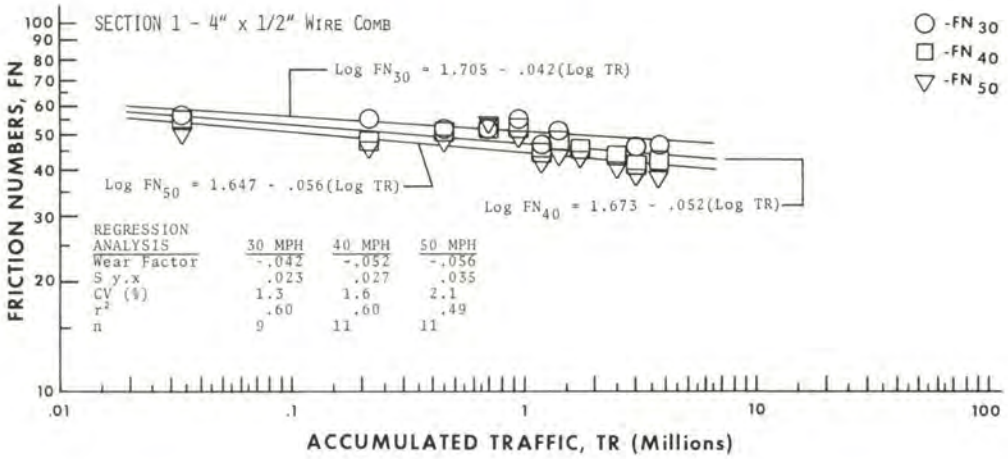
Date	Avg. Texture Depth, TX	Standard Deviation	Est. Acc. Traffic
Section 1 - 4" x 1/2" Wire Comb			
6/ 5/74	.064	.018	0
12/11/75	.037	.013	474,000
7/ 7/76	.030	.011	865,000
6/10/77	.031	.010	1,239,000
Section 2 - 4" x 1/4" Wire Comb			
6/ 5/74	.071	.015	0
12/11/75	.038	.009	474,000
7/ 7/76	.031	.006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

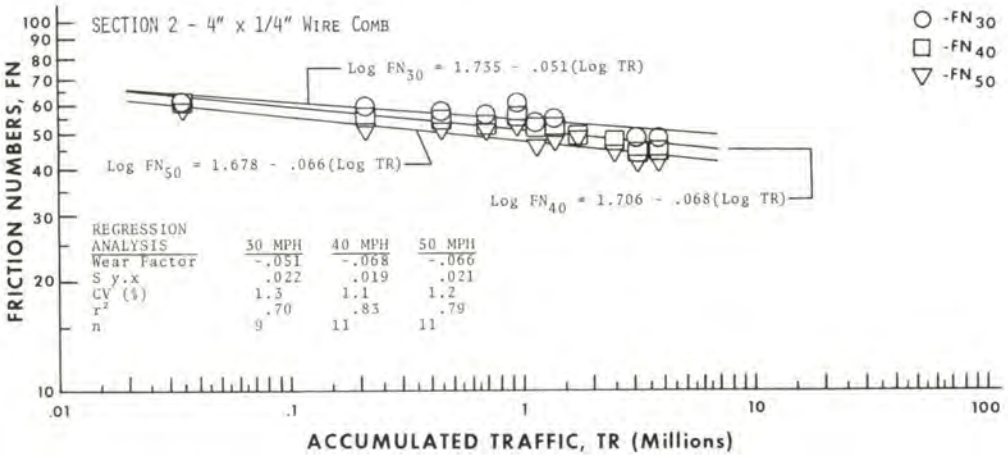
Figure III

EFFECTS OF TRAFFIC ON FRICTION NUMBERS

ROUTE 50

MORGAN COUNTY





IV.

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

Description of Project

This test project included six sections northbound and six sections southbound in a four-lane divided highway which was opened to traffic in June, 1978. Transverse texturing was accomplished by wire comb alone, or by a burlap drag followed by a wire comb. The wire comb tines were 0.025" thick by 0.123" wide in the northbound lane (test sections 1 - 6) and 0.022" thick by 0.064" wide in the southbound lane (test sections 7 - 12) and were spaced at 1/2", 3/4", or 1" center to center in each lane.

Friction tests and sand-patch texture tests were performed in positions 2 and 3. Sound level (dbA) determinations were performed in the driving lane during August, 1977. Noise level ratings by a four-man panel were performed in the driving lane during July, 1979.

Fine aggregate in the PCCP mixture was a slightly angular river sand or an angular field sand.

TABLE IV-A

FRICTION TESTS AND TRAFFIC DATA

ROUTE I-57
MISSISSIPPI COUNTY

Tine Dimensions - 0.025" T x 0.123" W

Date Tested	FN_{40}	FN_{50}	AADT /Lane	Age in Months	Est. Acc. Traffic
Section 1 - Position 2 - 1/2" Wire Comb					
8/11/77	63.1	60.7	0	0	0
9/15/77	62.7	59.8	0	0	0
4/27/78	64.0	56.9	0	0	0
10/ 3/78	54.0	51.3	3424	3	308,000
5/31/79	53.0	49.3	3325	11	1,115,000
9/ 5/79	52.3	46.4	3325	14	1,414,000
4/15/80	57.3	51.7	3312	21	2,111,000
9/25/80	55.5	50.6	3312	27	2,707,000
3/10/81	53.5	48.0	3312	32	3,204,000
9/15/81	51.5	49.3	3312	39	3,900,000
Section 1 - Position 3 - 1/2" Wire Comb					
9/15/77	63.4	61.2	0	0	0
4/27/78	62.4	57.8	0	0	0
10/ 3/78	56.0	52.9	380	3	34,000
5/31/79	57.6	52.5	369	11	124,000
9/ 5/79	52.3	48.8	369	14	157,000
4/15/80	57.6	53.1	368	21	234,000
9/25/80	57.0	51.4	368	27	301,000
3/10/81	49.4	44.9	368	32	356,000
9/15/81	56.8	52.6	368	39	433,000
Section 2 - Position 2 - 1" Wire Comb					
8/11/77	63.0	60.0	0	0	0
9/15/77	62.2	58.9	0	0	0
4/27/78	64.3	55.7	0	0	0
10/ 3/78	53.6	49.4	3424	3	308,000
5/31/79	51.8	47.8	3325	11	1,115,000
9/ 5/79	51.4	46.5	3325	14	1,414,000
4/15/80	56.0	51.1	3312	21	2,111,000
9/25/80	55.2	49.5	3312	27	2,707,000
3/10/81	51.9	47.3	3312	32	3,204,000
9/15/81	52.9	47.9	3312	39	3,900,000

TABLE IV-A (Continued)

FRICTION TESTS AND TRAFFIC DATA

ROUTE I-57
MISSISSIPPI COUNTY

Tine Dimensions - 0.025" T x 0.123" W

Date Tested	FN_{40}	FN_{50}	AADT /Lane	Age in Months	Est. Acc. Traffic
Section 2 - Position 3 - 1" Wire Comb					
9/15/77	65.8	60.4	0	0	0
4/27/78	62.9	59.0	0	0	0
10/ 3/78	55.6	51.8	380	3	34,000
5/31/79	53.5	49.5	369	11	124,000
9/ 5/79	52.0	49.2	369	14	157,000
4/15/80	56.7	51.7	368	21	234,000
9/25/80	54.9	49.7	368	27	301,000
3/10/81	44.6	40.9	368	32	356,000
9/15/81	55.8	51.3	368	39	433,000
Section 3 - Position 2 - 1" Wire Comb preceded by a Burlap Drag					
8/11/77	59.7	58.5	0	0	0
9/15/77	58.8	55.6	0	0	0
4/27/78	59.7	53.7	0	0	0
10/ 3/78	53.2	49.4	3424	3	308,000
5/31/79	53.2	50.8	3325	11	1,115,000
9/ 5/79	53.5	49.6	3325	14	1,414,000
4/15/80	58.7	52.8	3312	21	2,111,000
9/25/80	55.3	51.9	3312	27	2,707,000
3/10/81	53.8	48.7	3312	32	3,204,000
9/15/81	54.6	50.1	3312	39	3,900,000
Section 3 - Position 3 - 1" Wire Comb preceded by a Burlap Drag					
9/15/77	59.5	56.6	0	0	0
4/27/78	60.8	55.7	0	0	0
10/ 3/78	53.3	49.4	380	3	34,000
5/31/79	53.7	50.3	369	11	124,000
9/ 5/79	52.1	49.3	369	14	157,000
4/15/80	57.9	52.4	368	21	234,000
9/25/80	54.8	49.6	368	27	301,000
3/10/81	50.2	44.8	368	32	356,000
9/15/81	54.9	51.8	368	39	433,000

TABLE IV-A (Continued)

FRICTION TESTS AND TRAFFIC DATA

ROUTE I-57
MISSISSIPPI COUNTY

Tine Dimensions - 0.025" T x 0.123" W

Date Tested	FN_{40}	FN_{50}	AADT /Lane	Age in Months	Est. Acc. Traffic
Section 4 - Position 2 - 3/4" Wire Comb					
8/11/77	52.9	51.2	0	0	0
9/15/77	52.3	48.6	0	0	0
4/27/78	59.1	54.1	0	0	0
10/ 3/78	52.8	49.6	3424	3	308,000
5/31/79	51.9	49.3	3325	11	1,115,000
9/ 5/79	53.7	49.1	3325	14	1,414,000
4/15/80	57.3	51.3	3312	21	2,111,000
9/25/80	55.0	51.6	3312	27	2,707,000
3/10/81	54.4	48.3	3312	32	3,204,000
9/15/81	55.0	49.7	3312	39	3,900,000
Section 4 - Position 3 - 3/4" Wire Comb					
9/15/77	60.3	55.8	0	0	0
4/27/78	61.4	54.8	0	0	0
10/ 3/78	54.2	51.3	380	3	34,000
5/31/79	54.8	51.8	369	11	124,000
9/ 5/79	51.7	49.4	369	14	157,000
4/15/80	56.9	52.2	368	21	234,000
9/25/80	54.9	50.4	368	27	301,000
3/10/81	49.8	45.0	368	32	356,000
9/15/81	55.8	53.2	368	39	433,000
Section 5 - Position 2 - 3/4" Wire Comb preceded by a Burlap Drag					
9/15/77	54.4	51.2	0	0	0
4/27/78	59.2	53.9	0	0	0
10/ 3/78	51.9	49.4	3424	3	308,000
5/31/79	53.0	50.0	3325	11	1,115,000
9/ 5/79	55.3	50.1	3325	14	1,414,000
4/15/80	57.4	53.0	3312	21	2,111,000
9/25/80	54.3	51.3	3312	27	2,707,000
3/10/81	53.8	50.5	3312	32	3,204,000
9/15/81	55.0	49.7	3312	39	3,900,000

TABLE IV-A (Continued)

FRICTION TESTS AND TRAFFIC DATA

ROUTE I-57
MISSISSIPPI COUNTY

Tine Dimensions - 0.025" T x 0.123" W

Date Tested	FN_{40}	FN_{50}	AADT /Lane	Age in Months	Est. Acc. Traffic
Section 5 - Position 3 - 3/4" Wire Comb preceded by a Burlap Drag					
9/15/77	58.9	53.8	0	0	0
4/27/78	60.3	55.6	0	0	0
10/ 3/78	52.0	50.3	380	3	34,000
5/31/79	54.3	50.3	369	11	124,000
9/ 5/79	51.7	48.5	369	14	157,000
4/15/80	57.2	52.4	368	21	234,000
9/25/80	54.0	50.4	368	27	301,000
3/10/81	51.2	47.0	368	32	356,000
9/15/81	54.9	54.2	368	39	433,000
Section 6 - Position 2 - 1/2" Wire Comb preceded by a Burlap Drag					
9/15/77	61.0	60.5	0	0	0
4/27/78	70.3	62.5	0	0	0
10/ 3/78	54.4	50.6	3424	3	308,000
5/31/79	53.9	50.7	3325	11	1,115,000
9/ 5/79	54.5	50.4	3325	14	1,414,000
4/15/80	57.3	52.7	3312	21	2,111,000
9/25/80	54.2	51.5	3312	27	2,707,000
3/10/81	52.3	49.5	3312	32	3,204,000
9/15/81	55.0	50.9	3312	39	3,900,000
Section 6 - Position 3 - 1/2" Wire Comb preceded by a Burlap Drag					
9/15/77	66.1	62.8	0	0	0
4/27/78	69.0	64.6	0	0	0
10/ 3/78	59.7	54.9	380	3	34,000
5/31/79	60.1	57.4	369	11	124,000
9/ 5/79	55.9	54.3	369	14	157,000
4/15/80	60.9	55.1	368	21	234,000
9/25/80	58.0	55.5	368	27	301,000
3/10/81	52.4	48.5	368	32	356,000
9/15/81	59.0	57.2	368	39	433,000

TABLE IV-A (Continued)

FRICTION TESTS AND TRAFFIC DATA

ROUTE I-57
MISSISSIPPI COUNTY

Tine Dimensions - 0.022" T x 0.064" W

Date Tested	FN_{40}	FN_{50}	AADT /Lane	Age in Months	Est. Acc. Traffic
Section 7 - Position 2 - 1/2" Wire Comb preceded by a Burlap Drag					
9/15/77	60.2	53.7	0	0	0
4/27/78	63.7	56.7	0	0	0
10/ 3/78	53.2	49.1	2877	3	259,000
5/31/79	53.3	49.4	3416	11	1,030,000
9/ 5/79	53.3	48.4	3416	14	1,338,000
4/15/80	56.3	50.2	3312	21	2,046,000
9/25/80	53.4	52.2	3312	27	2,642,000
3/10/81	50.5	45.9	3312	32	3,139,000
9/15/81	52.3	47.2	3312	39	3,834,000
Section 7 - Position 3 - 1/2" Wire Comb preceded by a Burlap Drag					
9/15/77	61.5	53.7	0	0	0
4/27/78	61.7	55.9	0	0	0
10/ 3/78	54.9	51.6	320	3	29,000
5/31/79	55.2	51.8	380	11	115,000
9/ 5/79	53.1	50.1	380	14	149,000
4/15/80	58.2	54.6	368	21	227,000
9/25/80	54.0	49.4	368	27	294,000
3/10/81	48.6	46.2	368	32	349,000
9/15/81	54.6	52.7	368	39	426,000
Section 8 - Position 2 - 3/4" Wire Comb preceded by a Burlap Drag					
9/15/77	56.4	48.8	0	0	0
4/27/78	60.3	55.5	0	0	0
10/ 3/78	50.8	45.0	2877	3	259,000
5/31/79	52.2	48.2	3416	11	1,030,000
9/ 5/79	50.8	46.6	3416	14	1,338,000
4/15/80	55.9	50.6	3312	21	2,046,000
9/25/80	54.7	50.0	3312	27	2,642,000
3/10/81	49.8	46.9	3312	32	3,139,000
9/15/81	51.1	46.4	3312	39	3,834,000

TABLE IV-A (Continued)

FRICTION TESTS AND TRAFFIC DATA

ROUTE I-57
MISSISSIPPI COUNTY

Tine Dimensions - 0.022" T x 0.064" W

Date Tested	FN_{40}	FN_{50}	AADT /Lane	Age in Months	Est. Acc. Traffic
Section 8 - Position 3 - 3/4" Wire Comb preceded by a Burlap Drag					
9/15/77	50.2	46.2	0	0	0
4/27/78	57.8	51.1	0	0	0
10/ 3/78	51.6	46.5	320	3	29,000
5/31/79	53.2	47.7	380	11	115,000
9/ 5/79	50.0	46.3	380	14	149,000
4/15/80	56.9	50.7	368	21	227,000
9/25/80	51.6	47.8	368	27	294,000
3/10/81	48.4	43.7	368	32	349,000
9/15/81	52.5	50.0	368	39	426,000
Section 9 - Position 2 - 3/4" Wire Comb					
9/15/77	57.9	51.4	0	0	0
4/27/78	62.3	54.0	0	0	0
10/ 3/78	50.0	45.1	2877	3	259,000
5/31/79	51.6	46.5	3416	11	1,030,000
9/ 5/79	51.7	48.5	3416	14	1,338,000
4/15/80	52.4	47.9	3312	21	2,046,000
9/25/80	52.3	47.8	3312	27	2,642,000
3/10/81	46.3	44.1	3312	32	3,139,000
9/15/81	50.1	47.1	3312	39	3,834,000
Section 9 - Position 3 - 3/4" Wire Comb					
9/15/77	56.1	51.6	0	0	0
4/27/78	56.7	49.5	0	0	0
10/ 3/78	53.7	48.1	320	3	29,000
5/31/79	52.8	47.9	380	11	115,000
9/ 5/79	51.3	46.5	380	14	149,000
4/15/80	56.7	52.3	368	21	227,000
9/25/80	52.5	48.6	368	27	294,000
3/10/81	43.6	39.6	368	32	349,000
9/15/81	53.8	50.7	368	39	426,000

TABLE IV-A (Continued)

FRICTION TESTS AND TRAFFIC DATA

ROUTE I-57
MISSISSIPPI COUNTY

Tine Dimensions - 0.022" T x 0.064" W

Date Tested	FN_{40}	FN_{50}	AADT /Lane	Age in Months	Est. Acc. Traffic
Section 10 - Position 2 - 1" Wire Comb preceded by a Burlap Drag					
8/11/77	68.7	54.6	0	0	0
9/15/77	63.1	54.6	0	0	0
4/27/78	55.6	50.3	0	0	0
10/ 3/78	51.6	46.7	2877	3	259,000
5/31/79	52.3	48.3	3325	11	1,017,000
9/ 5/79	51.5	48.4	3325	14	1,316,000
4/15/80	55.1	50.8	3312	21	2,046,000
9/25/80	52.7	49.8	3312	27	2,642,000
3/10/81	47.5	44.9	3312	32	3,139,000
9/15/81	52.1	48.3	3312	39	3,834,000
Section 10 - Position 3 - 1" Wire Comb preceded by a Burlap Drag					
9/15/77	62.3	56.2	0	0	0
4/27/78	57.1	50.4	0	0	0
10/ 3/78	51.0	46.6	320	3	29,000
5/31/79	51.1	47.5	380	11	115,000
9/ 5/79	49.1	45.8	380	14	149,000
4/15/80	55.1	50.1	368	21	227,000
9/25/80	49.9	45.9	368	27	294,000
3/10/81	47.6	42.8	368	32	349,000
9/15/81	51.3	49.2	368	39	426,000
Section 11 - Position 2 - 1" Wire Comb					
8/11/77	68.1	59.5	0	0	0
9/15/77	66.6	59.5	0	0	0
4/27/78	60.8	54.1	0	0	0
10/ 3/78	53.2	48.3	2877	3	259,000
5/31/79	52.3	47.1	3416	11	1,030,000
9/ 5/79	50.0	46.8	3416	14	1,338,000
4/15/80	53.9	49.0	3312	21	2,046,000
9/25/80	52.5	48.8	3312	27	2,642,000
3/10/81	48.3	43.6	3312	32	3,139,000
9/15/81	51.5	47.4	3312	39	3,834,000

TABLE IV-A (Continued)

FRICTION TESTS AND TRAFFIC DATA

ROUTE I-57
MISSISSIPPI COUNTY

Tine Dimensions - 0.022" T x 0.064" W

Date Tested	FN_{40}	FN_{50}	AADT /Lane	Age in Months	Est. Acc. Traffic
Section 11 - Position 3 - 1" Wire Comb					
9/15/77	63.5	56.0	0	0	0
4/27/78	61.3	54.1	0	0	0
10/ 3/78	53.3	48.0	320	3	29,000
5/31/79	53.8	47.5	380	11	115,000
9/ 5/79	50.4	45.3	380	14	149,000
4/15/80	56.8	50.0	368	21	227,000
9/25/80	52.0	46.9	368	27	294,000
3/10/81	45.2	40.2	368	32	349,000
9/15/81	52.1	48.4	368	39	426,000
Section 12 - Position 2 - 1/2" Wire Comb					
9/15/77	70.0	65.0	0	0	0
4/27/78	63.0	55.5	0	0	0
10/ 3/78	53.6	50.0	2877	3	259,000
5/31/78	52.4	49.2	3416	11	1,030,000
9/ 5/79	51.9	47.7	3416	14	1,338,000
4/15/80	55.4	50.6	3312	21	2,046,000
9/25/80	53.0	49.8	3312	27	2,642,000
3/10/81	49.4	46.9	3312	32	3,139,000
9/15/81	54.0	49.1	3312	39	3,834,000
Section 12 - Position 3 - 1/2" Wire Comb					
9/15/77	66.8	61.1	0	0	0
4/27/78	62.1	57.4	0	0	0
10/ 3/78	55.2	51.5	320	3	29,000
5/31/79	53.4	50.4	380	11	115,000
9/ 5/79	52.3	47.7	380	14	149,000
4/15/80	57.7	52.6	368	21	227,000
9/25/80	53.2	49.6	368	27	294,000
3/10/81	48.8	45.4	368	32	349,000
9/15/81	53.4	51.5	368	39	426,000

TABLE IV-B

TEXTURE DEPTH OF EACH TEXTURE

ROUTE I-57
MISSISSIPPI COUNTY

Tine Dimensions - 0.025" T x 0.123" W

	Position 3			Position 2		
Date Tested	Avg. Texture Depth, TX	Std. Dev.	Est. Acc. Traffic	Avg. Texture Depth, TX	Std. Dev.	Est. Acc. Traffic
Section 1 - 1/2" Wire Comb						
7/26/77	.050	.019	0	.045	.021	0
8/ 1/78	.034	.013	11,000	.028	.012	103,000
7/29/80	.025	.011	278,000	.018	.007	2,509,000
Section 2 - 1" Wire Comb						
7/21/77	.070	.006	0	.073	.016	0
8/ 1/78	.051	.010	11,000	.050	.014	103,000
7/29/80	.038	.007	278,000	.035	.011	2,509,000
Section 3 - 1" Wire Comb preceded by a Burlap Drag						
7/21/77	.054	.019	0	.054	.004	0
8/ 1/78	.037	.008	11,000	.033	.005	103,000
7/29/80	.028	.008	278,000	.023	.004	2,509,000
Section 4 - 3/4" Wire Comb						
7/20/77	.058	.009	0	.061	.014	0
8/ 1/78	.043	.014	11,000	.039	.006	103,000
7/29/80	.032	.011	278,000	.028	.007	2,509,000
Section 5 - 3/4" Wire Comb preceded by a Burlap Drag						
6/21/77	.066	.012	0	.070	.024	0
8/ 2/78	.044	.015	11,000	.049	.025	103,000
7/29/80	.037	.012	278,000	.038	.022	2,509,000
Section 6 - 1/2" Wire Comb preceded by a Burlap Drag						
7/20/77	.077	.016	0	.069	.014	0
8/ 2/78	.057	.012	11,000	.044	.009	103,000
7/29/80	.047	.010	278,000	.031	.009	2,509,000

TABLE IV-B (Continued)

TEXTURE DEPTH OF EACH TEXTURE

ROUTE I-57
MISSISSIPPI COUNTY

Tine Dimensions - 0.022" T x 0.064" W

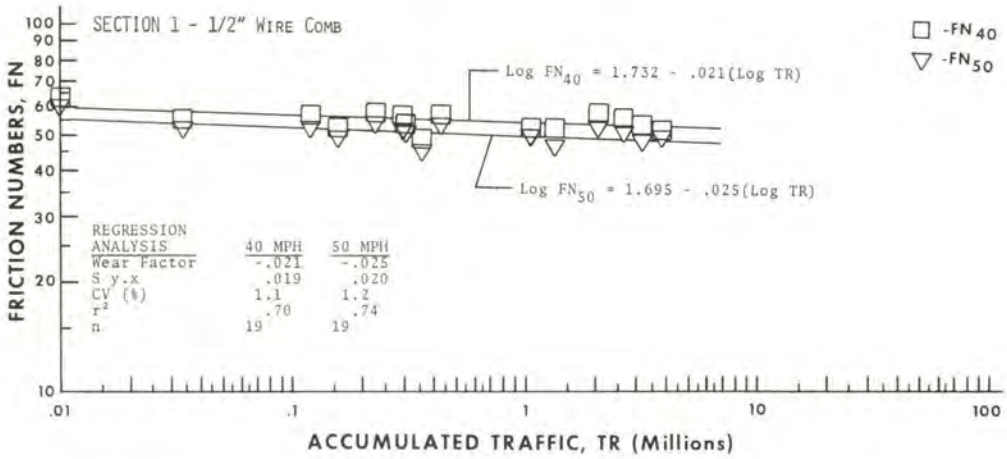
	Position 3			Position 2		
Date Tested	Avg. Texture Depth, TX	Std. Dev.	Est. Acc. Traffic	Avg. Texture Depth, TX	Std. Dev.	Est. Acc. Traffic
Section 12 - 1/2" Wire Comb						
7/26/77	.055	.007	0	.060	.011	0
8/ 1/78	.038	.006	10,000	.037	.010	86,000
7/31/80	.030	.006	272,000	.028	.006	2,443,000
Section 11 - 1" Wire Comb						
7/26/77	.047	.004	0	.043	.004	0
8/ 1/78	.035	.003	10,000	.033	.002	86,000
7/31/80	.031	.002	272,000	.027	.004	2,443,000
Section 10 - 1" Wire Comb preceded by a Burlap Drag						
7/26/77	.050	.005	0	.043	.007	0
8/ 2/78	.031	.007	10,000	.025	.003	86,000
7/31/80	.024	.004	272,000	.024	.010	2,443,000
Section 9 - 3/4" Wire Comb						
8/10/77	.047	.006	0	.043	.005	0
8/ 2/78	.034	.007	10,000	.030	.004	86,000
7/31/80	.029	.006	272,000	.025	.004	2,443,000
Section 8 - 3/4" Wire Comb preceded by a Burlap Drag						
8/10/77	.046	.002	0	.046	.008	0
8/ 2/78	.030	.007	10,000	.029	.006	86,000
7/30/80	.028	.007	272,000	.025	.007	2,443,000
Section 7 - 1/2" Wire Comb preceded by a Burlap Drag						
8/10/77	.055	.006	0	.047	.008	0
8/ 2/78	.040	.006	10,000	.029	.006	86,000
7/30/80	.029	.005	272,000	.022	.007	2,443,000

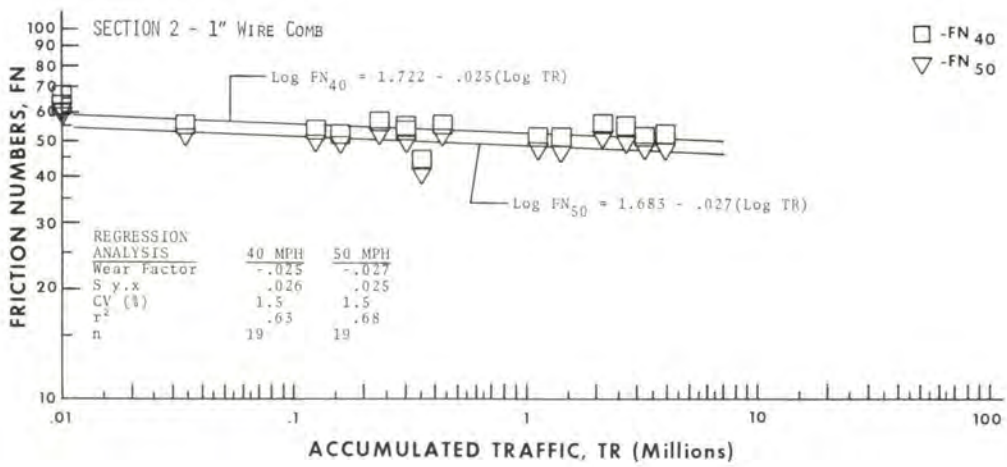
Figure IV

EFFECTS OF TRAFFIC ON FRICTION NUMBERS

ROUTE I-57

MISSISSIPPI COUNTY





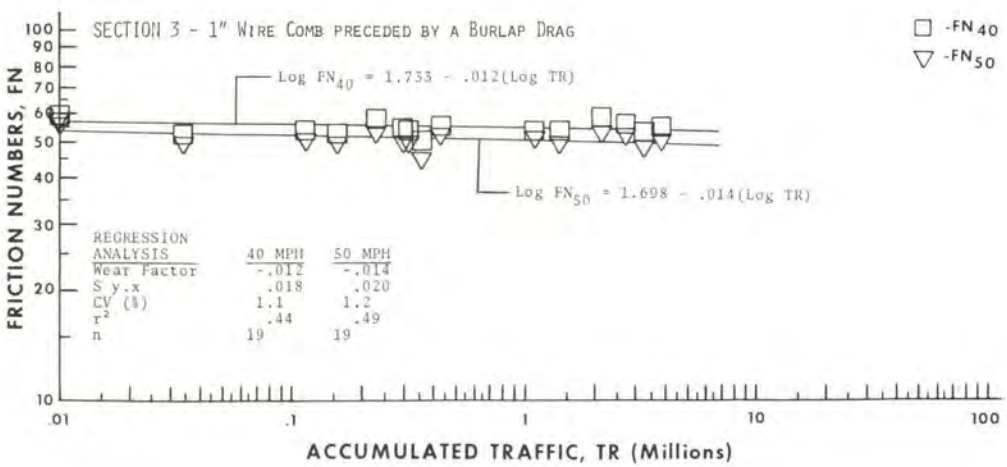
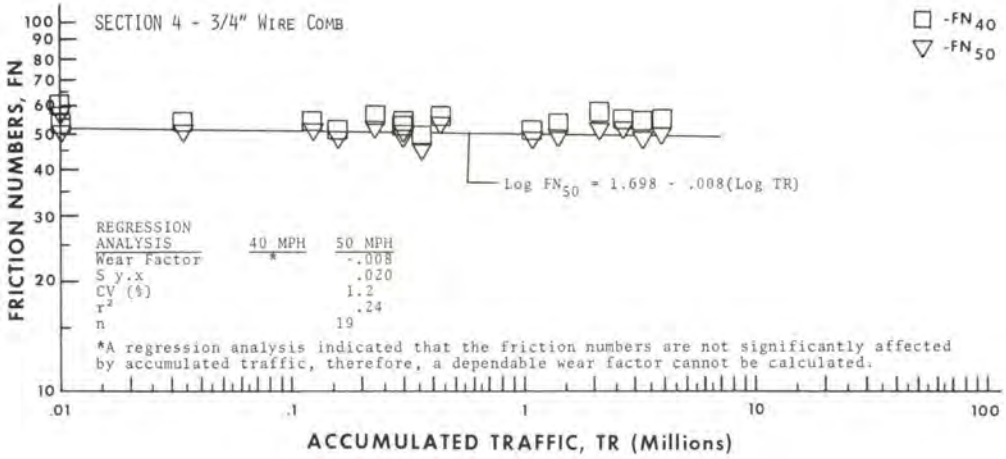


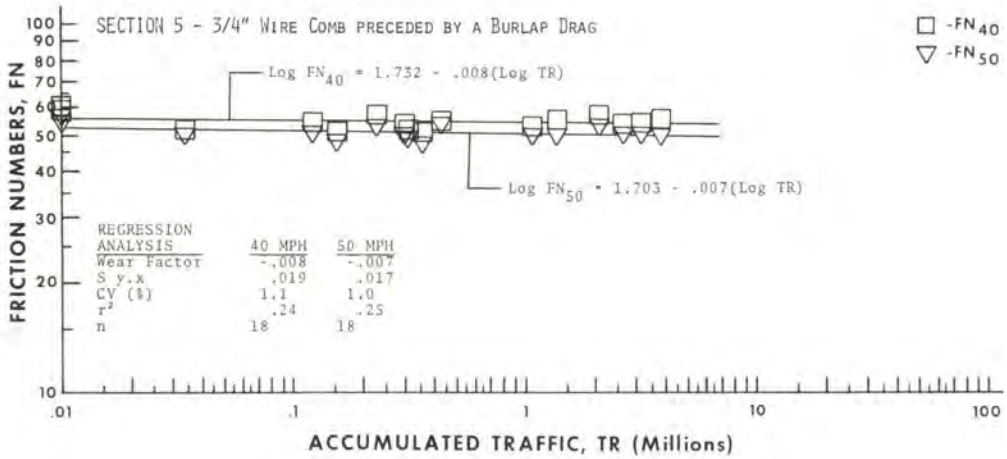
Figure IV (Continued)

EFFECTS OF TRAFFIC ON FRICTION NUMBERS

ROUTE I-57

MISSISSIPPI COUNTY





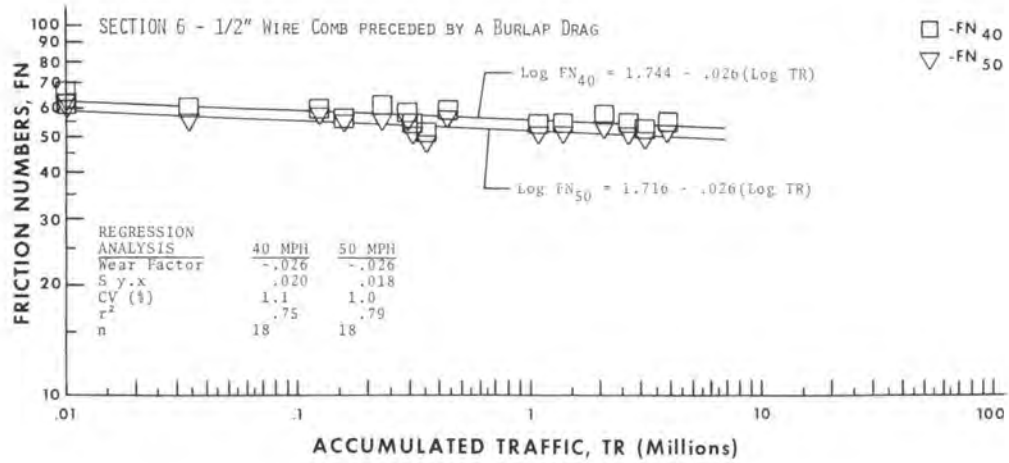
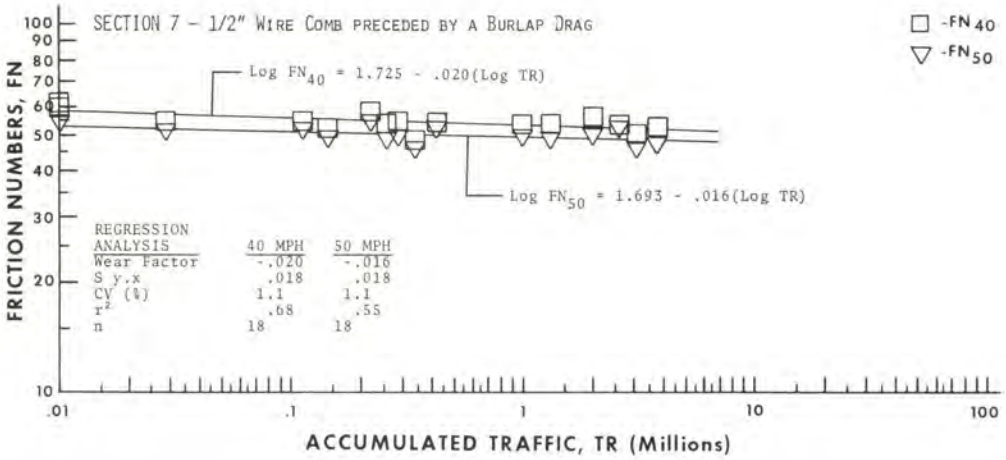


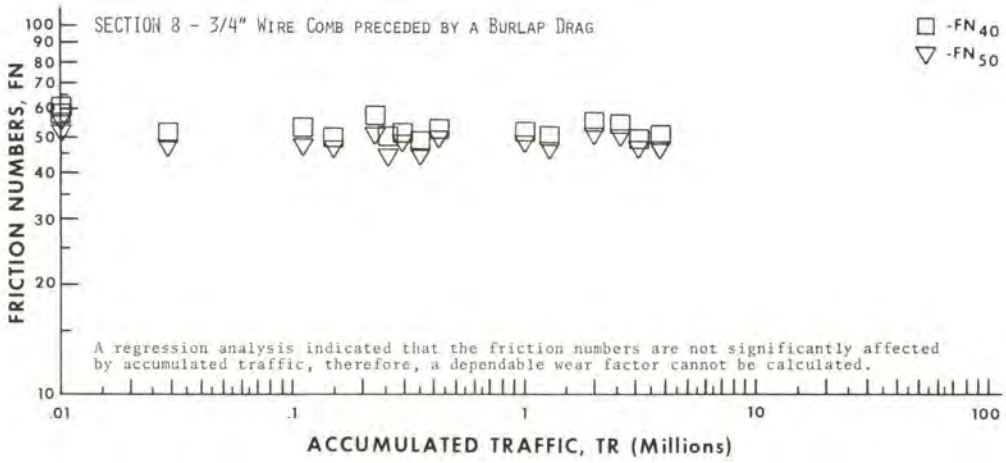
Figure IV (Continued)

EFFECTS OF TRAFFIC ON FRICTION NUMBERS

ROUTE I-57

MISSISSIPPI COUNTY





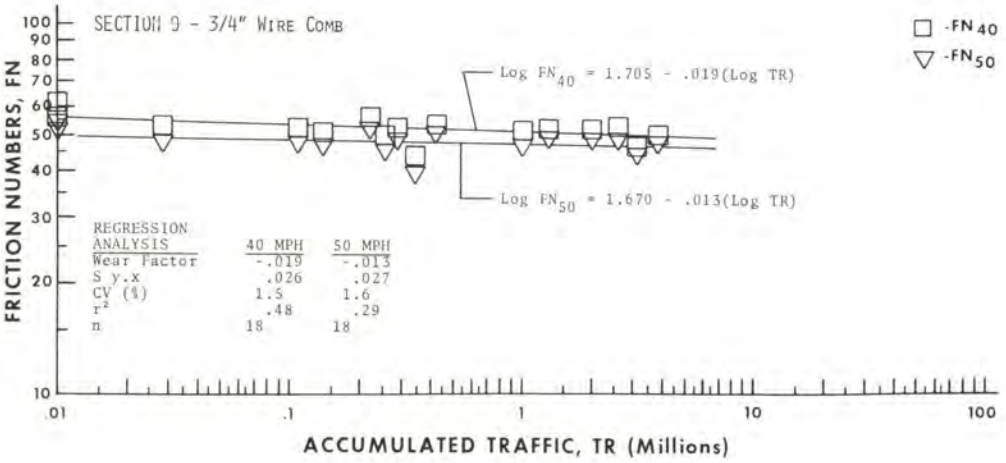
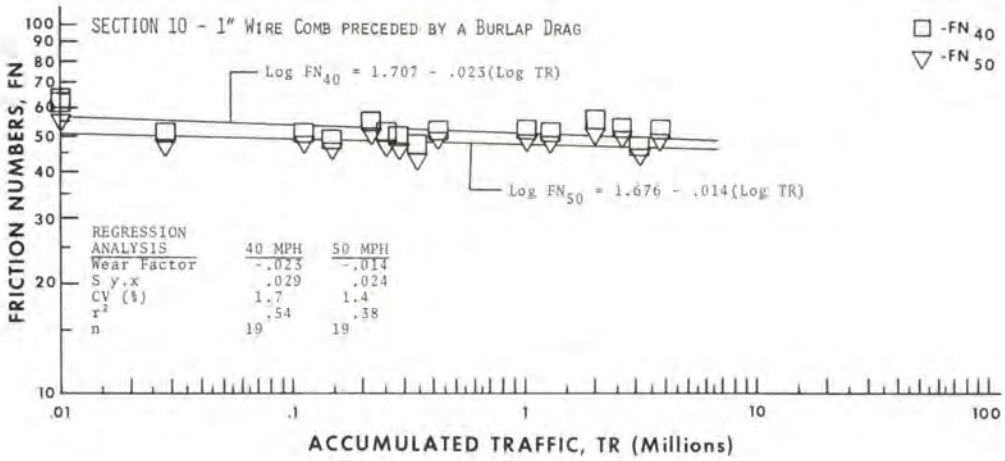


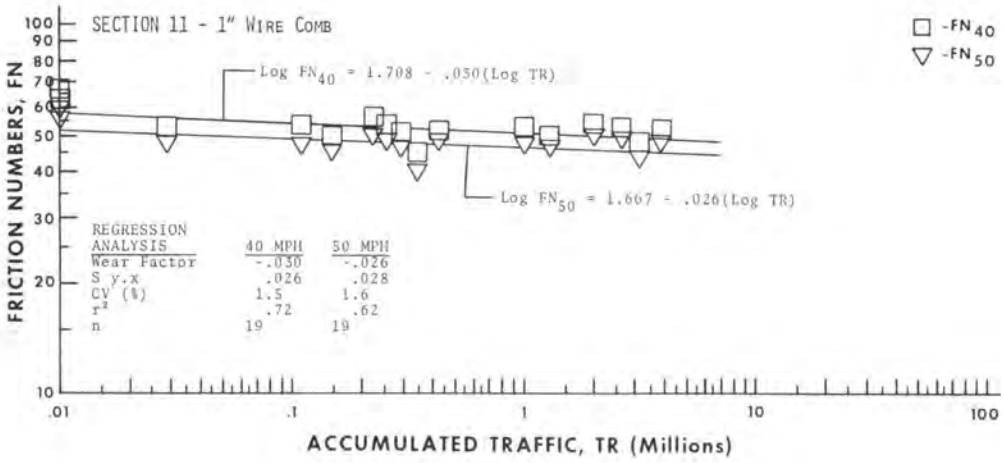
Figure IV (Continued)

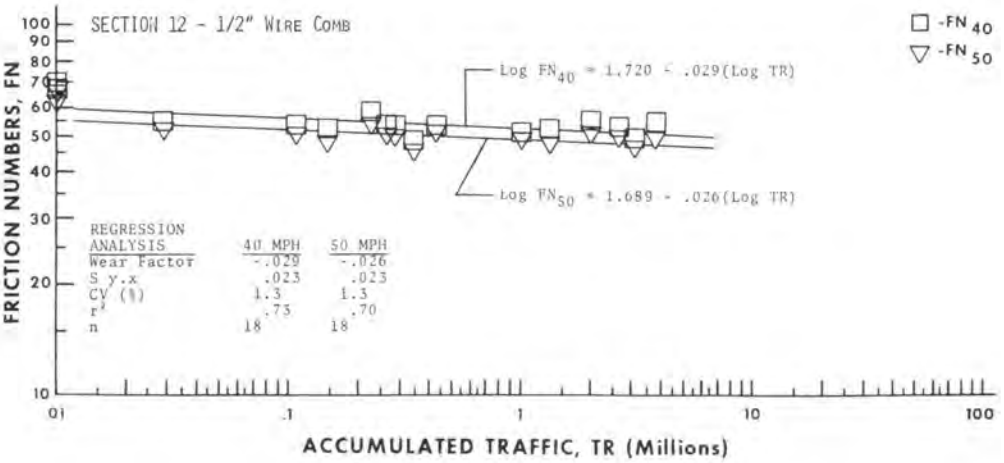
EFFECTS OF TRAFFIC ON FRICTION NUMBERS

ROUTE I-57

MISSISSIPPI COUNTY







V.

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

Description of Project

This test project included two sections in the northbound lanes of a four-lane-divided highway which was opened to traffic in November, 1975. Transverse texturing was accomplished by wire comb alone. The wire comb tines were specified to be 0.028" thick by 0.0625" wide spaced at 1/2" or 3/4" center to center.

Friction tests and sand-patch texture tests were performed in positions 2 and 3. Noise level ratings by a four-man panel were performed in the driving lane during July, 1979.

Fine aggregate in the PCCP mixture was a well-rounded river sand.

TABLE V-A

FRICTION TESTS AND TRAFFIC DATA

ROUTE 63
BOONE COUNTY

Date Tested	FN_{30}	FN_{40}	FN_{50}	AADT /Lane	Age in Months	Est. Acc. Traffic
Section 1 - Position 2 - 1/2" Wire Comb						
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	2531	17	1,273,000
8/ 5/77	48.8	44.6	39.8	2531	21	1,577,000
4/ 7/78		44.3	41.2	2684	29	2,198,000
10/18/78	43.4	40.3	36.2	2684	36	2,762,000
5/10/79	41.8	38.1	36.7	3398	42	3,331,000
10/31/79	43.2	40.7	37.2	3398	48	3,942,000
3/26/80	44.7	40.9	37.3	3297	53	4,443,000
8/11/80	48.2	42.4	36.4	3297	57	4,839,000
3/26/81	47.9	42.4	38.4	3297	65	5,630,000
9/10/81	51.8	46.3	40.0	3297	70	6,125,000
Section 1 - Position 3 - 1/2" Wire Comb						
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	352	21	219,000
4/ 7/78		58.2	54.9	374	29	306,000
10/18/78	59.9	55.0	51.7	374	36	384,000
5/10/79	57.6	53.2	49.3	473	42	464,000
10/31/79	61.4	57.7	52.6	473	48	549,000
3/26/80	57.3	52.3	48.1	459	53	618,000
8/11/80	58.2	53.3	48.9	459	57	673,000
3/26/81	60.7	55.4	51.6	459	65	784,000
9/10/81	62.9	56.5	51.6	459	70	852,000

TABLE V-A (Continued)

FRICTION TESTS AND TRAFFIC DATA

ROUTE 63
BOONE COUNTY

Date Tested	FN_{30}	FN_{40}	FN_{50}	AADT /Lane	Age in Months	Est. Acc. Traffic
Section 2 - Position 2 - 3/4" Wire Comb						
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	2531	17	1,273,000
8/ 5/77	48.4	43.9	39.6	2531	21	1,577,000
4/ 7/78		43.1	40.2	2684	29	2,198,000
10/18/78	38.6	36.8	33.9	2684	36	2,762,000
5/10/79	40.2	36.0	34.0	3398	42	3,331,000
10/31/79	40.9	38.9	34.6	3398	48	3,942,000
3/26/80	42.3	39.0	36.5	3297	53	4,443,000
8/11/80	44.4	39.4	34.5	3297	57	4,839,000
3/26/81	45.2	40.7	35.8	3297	65	5,630,000
9/10/81	50.5	43.8	39.9	3297	70	6,125,000
Section 2 - Position 3 - 3/4" Wire Comb						
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	352	21	219,000
4/ 7/78		57.2	53.0	374	29	306,000
10/18/78	58.6	52.9	47.4	374	35	384,000
5/10/79	54.1	49.5	47.1	473	42	464,000
10/31/79	59.7	54.2	50.8	473	48	549,000
3/26/80	53.9	51.2	45.0	459	53	618,000
8/11/80	55.2	49.8	44.4	459	57	673,000
3/26/81	60.0	54.4	50.2	459	65	784,000
9/10/81	59.5	54.5	49.5	459	70	852,000

TABLE V-B

TEXTURE DEPTH OF EACH TEXTURE

ROUTE 63
BOONE COUNTY

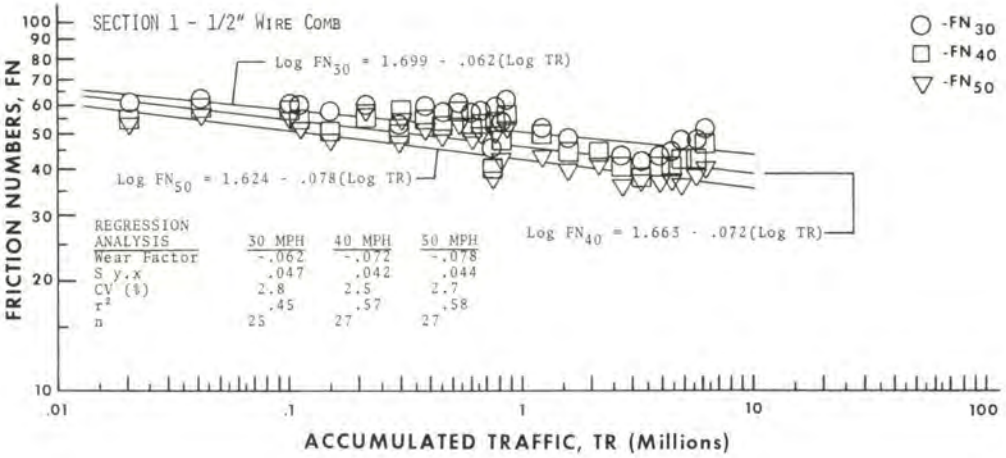
Date Tested	Position 3 Avg. Texture Depth, TX	Position 3 Std. Dev.	Position 3 Est. Acc. Traffic	Position 2 Avg. Texture Depth, TX	Position 2 Std. Dev.	Position 2 Est. Acc. Traffic
Section 1 - 1/2" Wire Comb						
9/25/75	.043	.011	0	.054	.012	0
12/ 5/75	.035	.012	11,000	.037	.014	76,000
7/ 6/76	.028	.011	83,000	.029	.013	599,000
12/ 3/76				.030	.015	971,000
5/26/77	.031	.011	198,000	.034	.012	1,425,000
7/27/78	.024	.011	351,000	.026	.015	2,520,000
9/19/80	.020	.011	701,000	.021	.015	5,037,000
Section 2 - 3/4" Wire Comb						
10/14/75	.052	.009	0	.057	.019	0
12/ 5/75	.041	.006	11,000	.041	.007	76,000
7/ 6/76	.034	.006	83,000	.033	.010	599,000
12/ 1/76				.038	.013	971,000
5/26/77	.039	.009	198,000	.036	.014	1,425,000
7/27/78	.033	.008	351,000	.033	.012	2,520,000
9/19/80	.025	.006	701,000	.028	.012	5,037,000

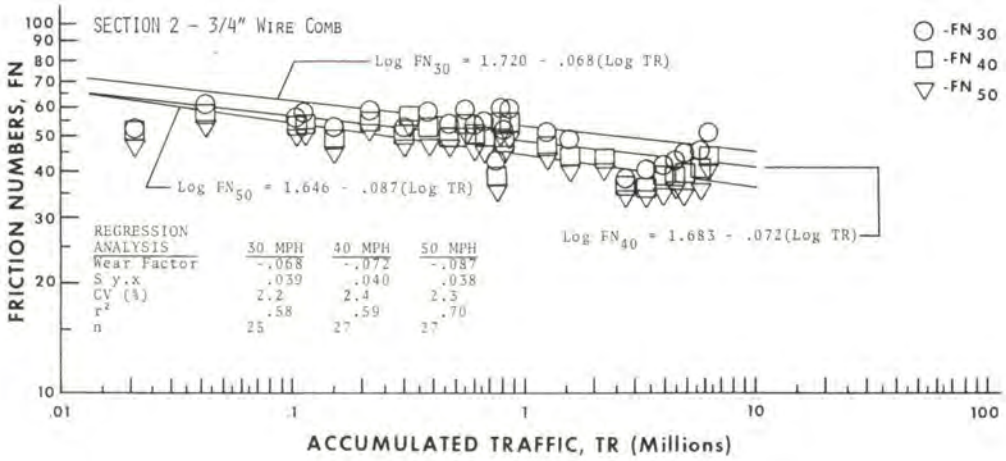
Figure V

EFFECTS OF TRAFFIC ON FRICTION NUMBERS

ROUTE 63

BOONE COUNTY





VI.

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

Description of Project

This test project included five sections in the southbound lanes of a four-lane-divided highway which was opened to traffic in September, 1978. Transverse texturing was accomplished by wire comb alone, or by a burlap drag followed by a wire comb. The wire comb tines were 0.032" thick by 0.082" wide spaced at 1/2", 3/4", or 1" center to center.

Friction tests and sand-patch texture tests were performed in positions 2 and 3. Noise level ratings by a four-man panel were performed in the driving lane during July, 1979.

Fine aggregate in the PCCP mixture was a well-rounded river sand.

TABLE VI-A

FRICTION TESTS AND TRAFFIC DATA

ROUTE 65
CHRISTIAN COUNTY

Date Tested	FN_{30}	FN_{40}	FN_{50}	AADT /Lane	Age in Months	Est. Acc. Traffic
Section 1 - Position 2 - 1" Wire Comb preceded by a Burlap Drag						
10/24/78	55.0	50.1	44.6	5503	1	165,000
5/24/79	--	50.3	44.6	5864	8	1,375,000
10/ 2/79	44.1	40.0	36.2	5864	12	2,078,000
5/19/80	48.8	43.3	38.9	5817	20	3,479,000
9/23/80	46.1	42.2	37.9	5817	24	4,177,000
4/20/81	50.9	46.6	39.6	5817	31	5,398,000
9/ 4/81	52.0	47.5	41.6	5817	35	6,096,000
Section 1 - Position 3 - 1" Wire Comb preceded by a Burlap Drag						
10/24/78	58.1	52.6	46.9	750	1	22,000
5/24/78	--	57.5	52.7	800	8	188,000
10/ 2/79	56.3	50.0	45.3	800	12	284,000
9/23/80	60.3	54.3	50.6	793	24	570,000
4/20/81	63.8	58.2	52.8	793	31	736,000
9/ 4/81	65.6	60.9	55.3	793	35	831,000
Section 2 - Position 2 - 1/2" Wire Comb						
10/24/78	50.3	47.5	42.9	4383	1	132,000
5/24/79	--	50.2	46.8	5414	8	1,206,000
10/ 2/79	44.3	42.4	38.2	5414	12	1,856,000
5/19/80	50.5	47.0	42.6	5431	20	3,158,000
9/23/80	50.2	45.9	41.0	5431	24	3,810,000
4/20/81	54.2	49.8	44.4	5431	31	4,950,000
9/ 4/81	57.3	51.1	47.1	5431	35	5,602,000
Section 2 - Position 3 - 1/2" Wire Comb						
10/24/78	57.8	54.0	49.6	598	1	18,000
5/24/79	--	57.3	54.6	598	8	164,000
10/ 2/79	55.8	50.2	46.5	738	12	253,000
9/23/80	59.3	54.6	51.9	741	24	519,000
4/20/81	62.8	56.8	53.4	741	31	675,000
9/ 4/81	63.3	59.8	53.9	741	35	764,000

TABLE VI-A (Continued)

FRICTION TESTS AND TRAFFIC DATA

ROUTE 65
CHRISTIAN COUNTY

Date Tested	FN_{30}	FN_{40}	FN_{50}	AADT /Lane	Age in Months	Est. Acc. Traffic
Section 3 - Position 2 - 3/4" Wire Comb						
10/24/78	51.8	46.8	41.6	3641	1	109,000
5/24/79		47.9	43.8	5113	8	1,095,000
10/ 2/79	45.1	41.2	36.5	5113	12	1,708,000
5/19/80	45.9	44.5	39.0	5149	20	2,941,000
9/23/80	47.8	41.6	37.6	5149	24	3,559,000
4/20/81	51.0	47.2	42.1	5149	31	4,640,000
9/ 4/81	55.4	50.7	43.7	5149	35	5,258,000
Section 3 - Position 3 - 3/4" Wire Comb						
10/24/78	60.6	55.5	50.8	497	1	15,000
5/24/79		56.1	52.8	697	8	149,000
10/ 2/79	55.2	50.4	45.9	697	12	233,000
9/23/80	60.0	53.5	49.6	702	24	485,000
4/20/81	63.3	56.4	52.9	702	31	633,000
9/ 4/81	64.0	60.4	53.8	702	35	717,000
Section 4 - Position 2 - 1" Wire Comb						
10/24/78	50.0	44.0	38.9	3641	1	109,000
5/24/79		46.3	40.7	5113	8	1,095,000
10/ 2/79	43.7	38.6	34.1	5113	12	1,708,000
5/19/80	44.7	41.8	36.1	5149	20	2,941,000
9/23/80	44.2	40.7	34.6	5149	24	3,559,000
4/20/81	49.8	45.2	39.6	5149	31	4,640,000
9/ 4/81	52.6	47.0	40.9	5149	35	5,258,000
Section 4 - Position 3 - 1" Wire Comb						
10/24/78	56.2	49.8	43.9	497	1	15,000
5/24/79		55.3	49.9	697	8	149,000
10/ 2/79	54.4	49.0	42.8	697	12	233,000
9/23/80	58.1	51.4	48.1	702	24	485,000
4/20/81	61.3	54.8	49.9	702	31	633,000
9/ 4/81	62.4	59.6	51.3	702	35	717,000

TABLE VI-A (Continued)

FRICTION TESTS AND TRAFFIC DATA

ROUTE 65
CHRISTIAN COUNTY

Date Tested	FN_{30}	FN_{40}	FN_{50}	AADT /Lane	Age in Months	Est. Acc. Traffic
Section 5 - Position 2 - 1" Wire Comb						
10/24/78	55.1	46.5	41.5	3641	1	109,000
5/24/79		52.8	45.3	3941	8	919,000
10/ 2/79	47.8	43.6	39.0	3941	12	1,392,000
5/19/80	50.0	47.1	42.0	4097	20	2,361,000
9/23/80	49.7	44.4	38.6	4097	24	2,853,000
4/20/81	54.1	50.2	43.2	4097	31	3,713,000
9/ 4/81	58.7	53.8	47.3	4097	35	4,205,000
Section 5 - Position 3 - 1" Wire Comb						
10/24/78	58.2	49.1	45.2	497	1	15,000
5/24/79		54.3	49.0	537	8	125,000
10/ 2/79	53.8	48.6	44.7	537	12	190,000
9/23/80	57.9	54.2	48.7	559	24	389,000
4/20/81	60.4	54.9	48.8	559	31	506,000
9/ 4/81	63.0	56.5	52.6	559	35	573,000

TABLE VI-B

TEXTURE DEPTH OF EACH TEXTURE

ROUTE 65
CHRISTIAN COUNTY

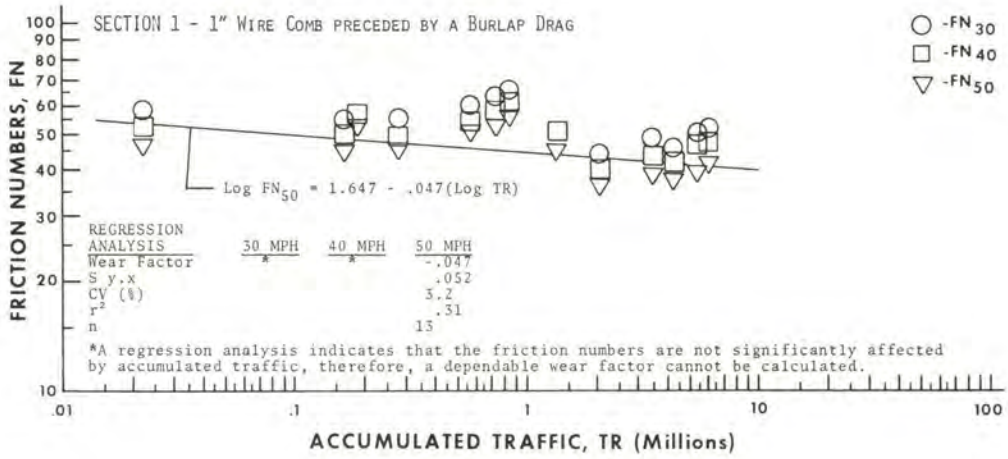
	Position 3			Position 2		
Date Tested	Avg. Texture Depth, TX	Std. Dev.	Est. Acc. Traffic	Avg. Texture Depth, TX	Std. Dev.	Est. Acc. Traffic
Section 1 - 1" Wire Comb preceded by a Burlap Drag						
8/ 2/78	.034	.005	0	.041	.010	0
8/14/80	.032	.003	522,000	.028	.008	3,828,000
Section 2 - 1/2" Wire Comb						
8/ 1/78	.043	.021	0	.046	.014	0
8/14/80	.040	.018	475,000	.031	.008	3,484,000
Section 3 - 3/4" Wire Comb						
8/ 1/78	.032	.011	0	.028	.007	0
8/14/80	.027	.009	443,000	.023	.006	3,250,000
Section 4 - 1" Wire Comb						
7/31/78	.025	.005	0	.028	.002	0
8/14/80	.026	.001	443,000	.023	.004	3,250,000
Section 5 - 1" Wire Comb						
7/31/78	.026	.005	0	.026	.004	0
8/14/80	.036	.009	355,000	.031		2,607,000

Figure VI

EFFECTS OF TRAFFIC ON FRICTION NUMBERS

ROUTE 65

CHRISTIAN COUNTY



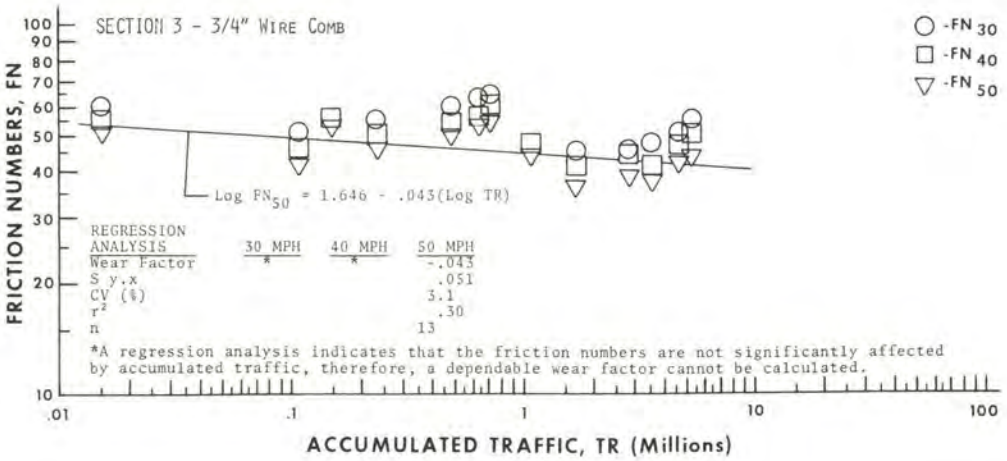
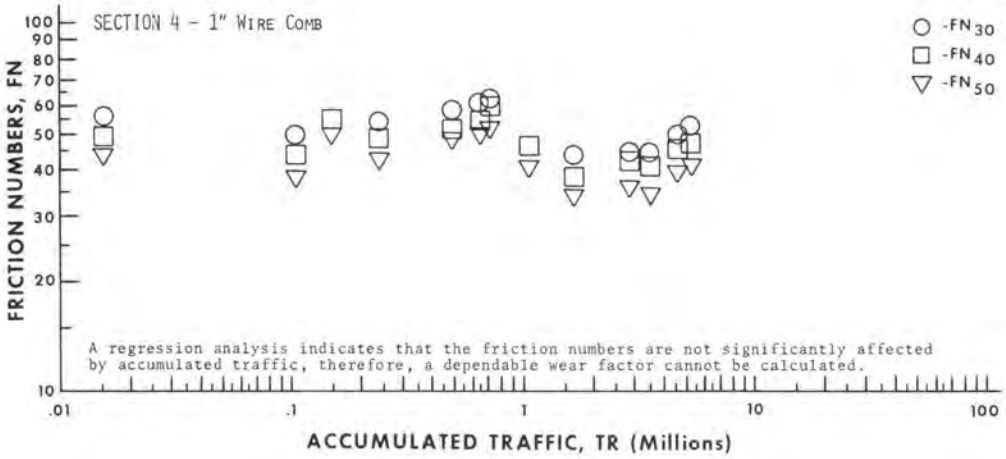


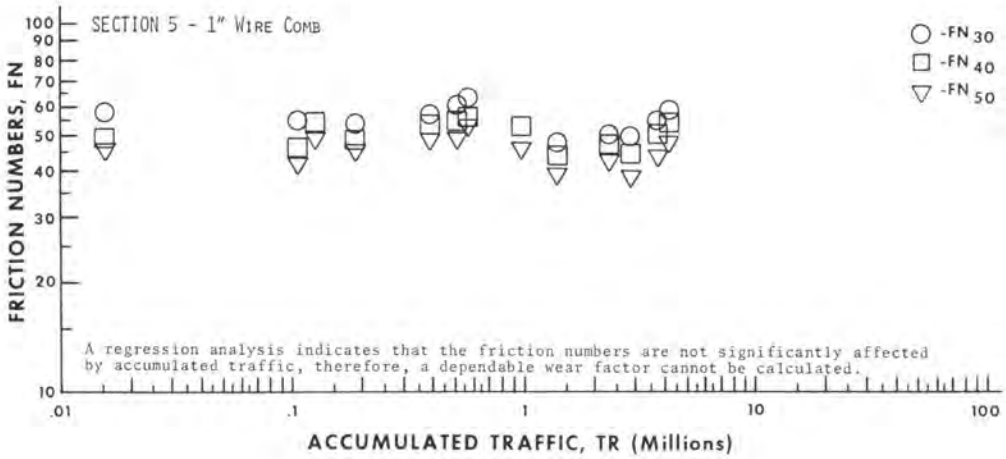
Figure VI (Continued)

EFFECTS OF TRAFFIC ON FRICTION NUMBERS

ROUTE 65

CHRISTIAN COUNTY





VII.

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

Description of Project

This test project included eight sections in a four-lane-divided highway which was opened to traffic at various times during 1974. Some sections temporarily carried two-way traffic during construction. Transverse texturing was accomplished by wire comb alone, while one section received longitudinal texturing with an AstroTurf drag. The wire comb tines were specified to be 0.028" thick by 0.0625" wide spaced at 1/4" or 1/2" center to center and ranging in length from 3" to 5".

Friction tests were performed in position 2. Sand-patch texture tests were performed in positions 2 and 3. Sound level (dbA) determinations were performed near the pavement with a vehicle in the driving lane on three sections, with readings of 79 or 80 in each case. The operator performing sound level measurements reported no objectionable noise was noted on any of the sections.

Fine aggregate in the PCCP mixture was a rounded river sand.

TABLE VII-A

FRICTION TESTS AND TRAFFIC DATA

ROUTE 71
BARTON COUNTY

Date Tested	FN_{30}	FN_{40}	FN_{50}	AADT /Lane	Age in Months	Est. Acc. Traffic
Section 1 - 3" x 1/2" Wire Comb						
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	2362	30	1,951,000
8/24/77	45.5	43.0	40.0	2362	35	2,305,000
5/21/80	41.1	39.0	35.3	2286	68	4,982,000
4/28/81	42.9	41.7	34.1	2286	79	5,736,000
Section 2 - 3" x 1/4" Wire Comb						
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	2193	30	1,780,000
8/24/77	53.0	48.2	42.8	2193	35	2,109,000
5/21/80	47.0	41.9	36.9	2293	68	4,347,000
4/28/81	45.5	43.3	36.0	2293	79	5,104,000
Section 3 - AstroTurf Drag						
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	2193	30	1,780,000
8/24/77	47.3	40.1	37.6	2193	35	2,109,000
5/21/80	43.3	36.8	32.2	2293	68	4,347,000
4/28/81	42.7	40.5	32.3	2293	79	5,104,000

TABLE VII-A (Continued)

FRICTION TESTS AND TRAFFIC DATA

ROUTE 71
BARTON COUNTY

Date Tested	FN_{30}	FN_{40}	FN_{50}	AADT /Lane	Age in Months	Est. Acc. Traffic
Section 4 - 3" x 1/4" Wire Comb						
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	2148	34	2,169,000
8/24/77	49.5	44.9	42.0	2148	39	2,491,000
5/21/80	47.2	41.9	37.9	2372	72	4,723,000
4/28/81	48.2	44.2	38.2	2372	83	5,506,000
Section 5 - 3" x 1/2" Wire Comb						
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	2148	34	2,169,000
8/24/77	55.2	46.2	44.0	2148	39	2,491,000
5/21/80	48.2	41.8	38.8	2372	72	4,723,000
4/28/81	45.6	46.6	38.0	2372	83	5,506,000
Section 6 - 5" x 1/2" Wire Comb						
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	2148	34	2,169,000
8/24/77	53.7	46.6	41.1	2148	39	2,491,000
5/21/80	46.3	39.1	36.4	2372	72	4,723,000
4/28/81	45.1	42.6	36.4	2372	83	5,506,000

TABLE VII-A (Continued)

FRICTION TESTS AND TRAFFIC DATA

ROUTE 71
BARTON COUNTY

Date Tested	FN_{30}	FN_{40}	FN_{50}	AADT /Lane	Age in Months	Est. Acc. Traffic
Section 7 - 5" x 1/4" Wire Comb						
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	2148	30	1,870,000
8/24/77	51.3	46.8	43.0	2148	35	2,192,000
5/21/80	46.3	39.9	37.0	2372	68	4,496,000
4/28/81	47.5	43.4	36.6	2372	79	5,279,000
Section 8 - 3" x 1/2" Wire Comb						
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	2240	30	1,941,000
8/24/77	50.5	45.0	43.8	2240	35	2,277,000
5/21/80	41.7	36.9	34.0	2337	68	4,946,000
4/28/81	41.6	40.0	31.6	2337	79	5,718,000

TABLE VII-B

TEXTURE DEPTH OF EACH TEXTURE

ROUTE 71
BARTON COUNTY

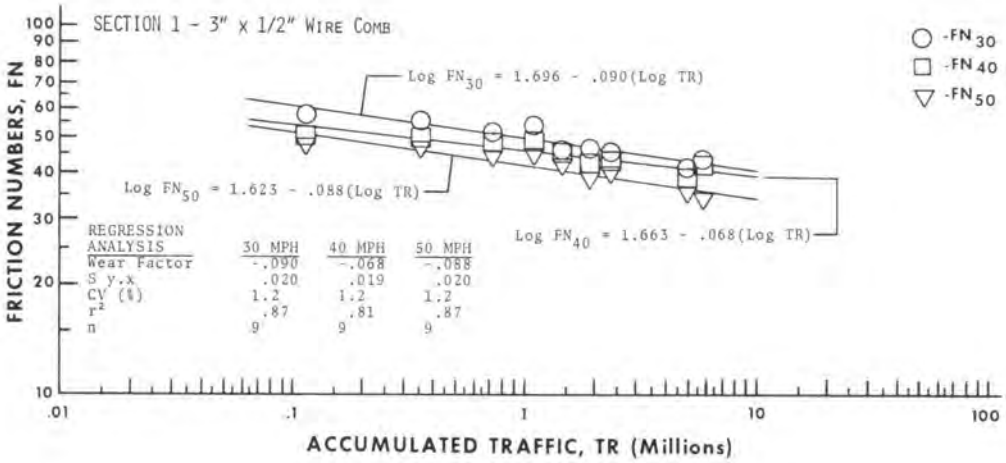
	Position 3			Position 2		
Date	Average Texture Depth, TX	Std. Dev.	Est. Acc. Traffic	Average Texture Depth, TX	Std. Dev.	Est. Acc. Traffic
Section 3 - AstroTurf Drag						
5/ /74	.050	.010	0	.053	.018	0
6/25/75	.022	.004	53,000	.020	.005	519,000
7/22/76	.021	.003	129,000	.017	.004	1,271,000
6/15/77	.022	.004	192,000	.017	.003	1,895,000
Section 4 - 3" x 1/4" Wire Comb						
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
Section 5 - 3" x 1/2" Wire Comb						
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
Section 6 - 5" x 1/2" Wire Comb						
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
Section 7 - 5" x 1/4" Wire Comb						
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

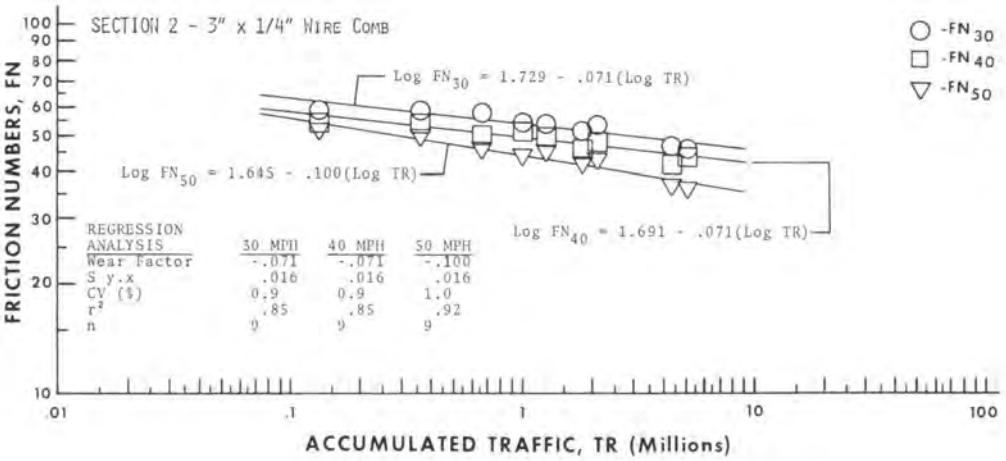
Figure VII

EFFECTS OF TRAFFIC ON FRICTION NUMBERS

ROUTE 71

BARTON COUNTY





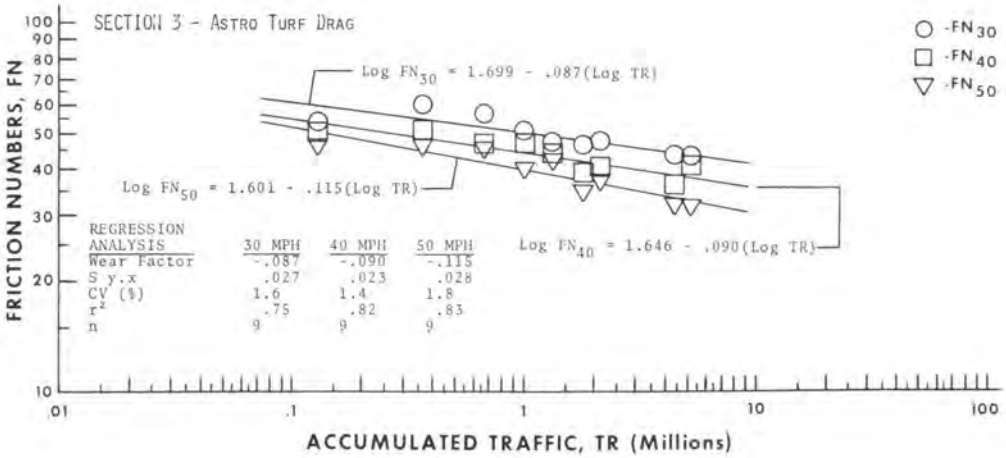
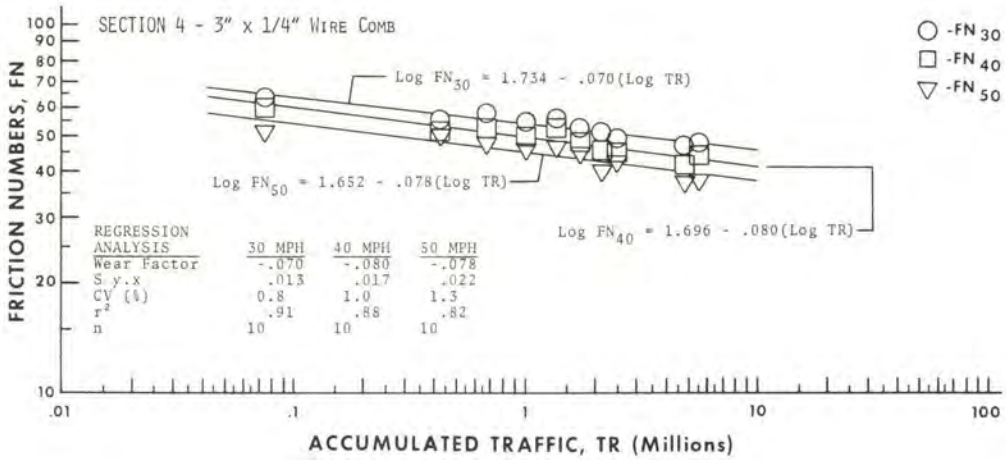


Figure VII (Continued)

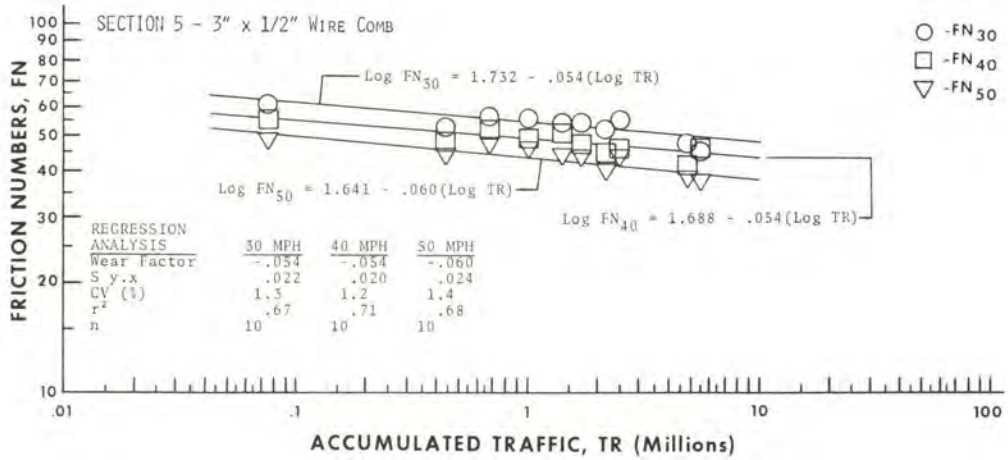
EFFECTS OF TRAFFIC ON FRICTION NUMBERS

ROUTE 71

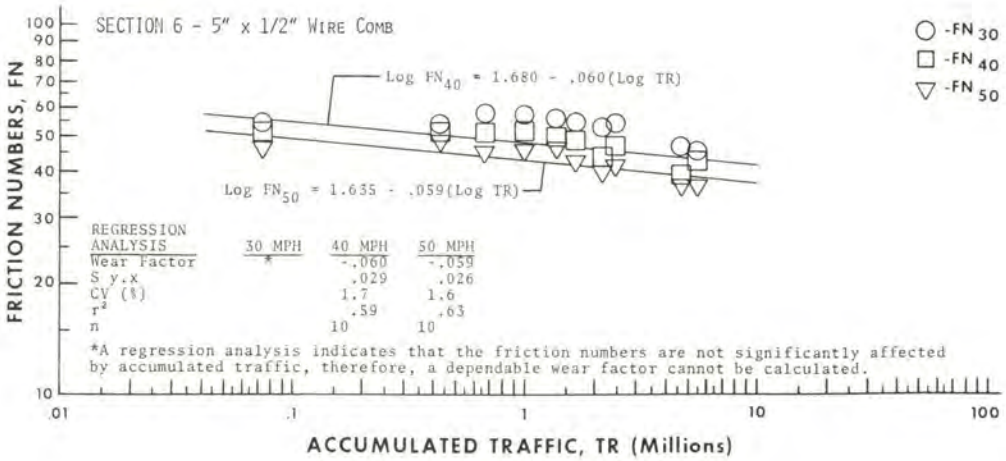
BARTON COUNTY



REGRESSION ANALYSIS	30 MPH	40 MPH	50 MPH
Wear Factor	-.070	-.080	-.078
S y.x	.013	.017	.022
CV (%)	0.8	1.0	1.3
r^2	.91	.88	.82
n	10	10	10



REGRESSION ANALYSIS	30 MPH	40 MPH	50 MPH
Wear Factor	-.054	-.054	-.060
S y.x	.022	.020	.024
CV (%)	1.3	1.2	1.4
r^2	.67	.71	.68
n	10	10	10



REGRESSION ANALYSIS	30 MPH	40 MPH	50 MPH
Wear Factor	*	-.060	-.059
S y.x		.029	.026
CV (%)		1.7	1.6
r^2		.59	.63
n		10	10

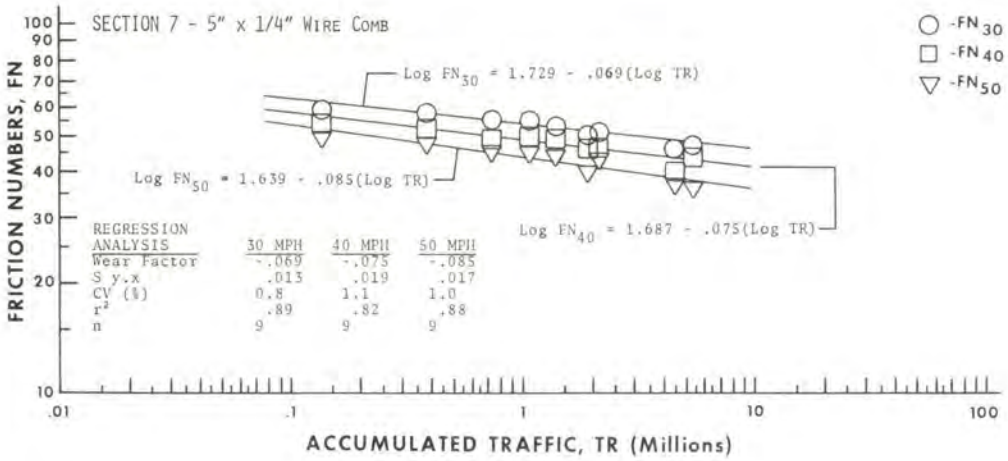
*A regression analysis indicates that the friction numbers are not significantly affected by accumulated traffic, therefore, a dependable wear factor cannot be calculated.

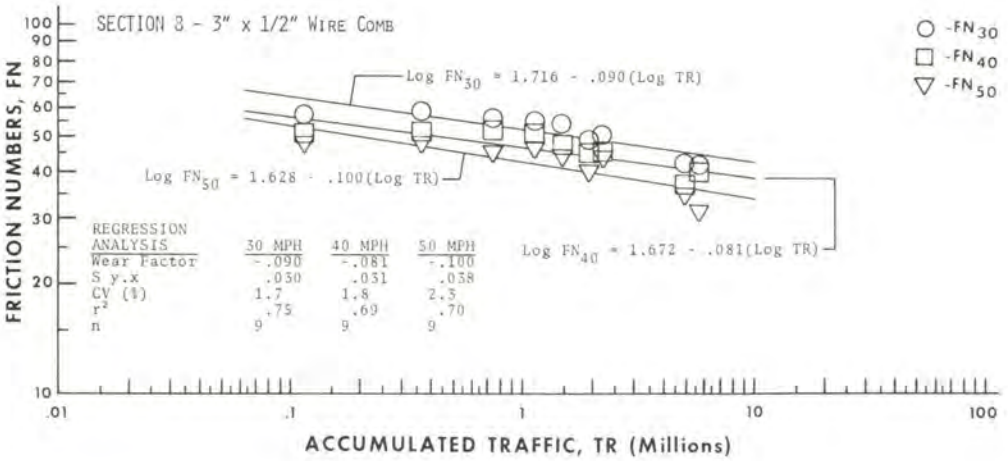
Figure VII (Continued)

EFFECTS OF TRAFFIC ON FRICTION NUMBERS

ROUTE 71

BARTON COUNTY





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