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16. Abstract

During 1971 and 1973 two construction jobs were performed in which concrete paving was placed. Several types of texturing were used on portions of the surface of these jobs. The special texturing was accomplished at the request of research project 2-6-70-141 personnel. The research project staff obtained skid resistance and texture measurements periodically until the close of the project. As a result of the measurements and analysis, the state adopted new specifications using metal tines spaced at 1/2-inch centers. This report contains additional measurements performed on the same surfaces. These data substantiate the decision to change to the new specifications.

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FOLLOW UP REPORT ON EVALUATION OF FULL SCALE EXPERIMENTAL HIGHWAY FINISHES

by

Kenneth D. Hankins

Supervising Research Engineer

Research Report 187-2

Research Study 1-10-77-187

Demonstration and Field Test Support

Conducted by

Transportation Planning Division
Research Section

State Department of Highways
and Public Transportation

In Cooperation with the
U.S. Department of Transportation
Federal Highway Administration

August, 1977

The contents of this report reflect the views of the authors who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the views or policies of the Federal Highway Administration. This report does not constitute a standard, specification or regulation.

The United States Government does not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the object of this report.

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The research reported herein was conducted under the supervision of Mr. John F. Nixon, Engineer of Research, and the general supervision of Mr. Phillip L. Wilson, State Planning Engineer, Transportation, Transportation Planning Division.

Acknowledgement is given to the Field Test Support Group of the Research Section for the technical aid received in this study.

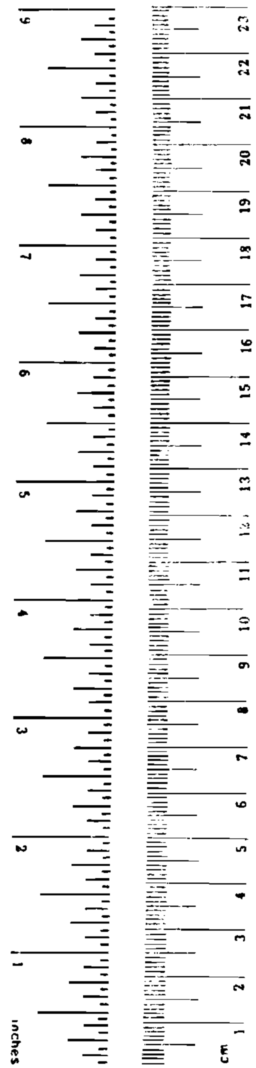
Acknowledgement is given to the personnel of District 17 (Bryan) and District 24 (El Paso) for the traffic protection services, planning, and technical support received in this study.

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

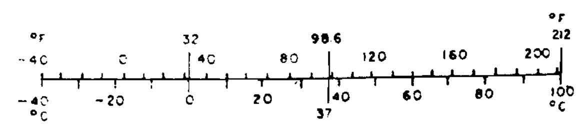
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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ABSTRACT

During 1971 and 1973 two construction jobs were performed in which concrete paving was placed. Several types of texturing were used on portions of the surface of these jobs. The special texturing was accomplished at the request of research project 2-6-70-141 personnel. The research project staff obtained skid resistance and texture measurements periodically until the close of the project. As a result of the measurements and analysis, the state adopted new specifications using metal tines spaced at 1/2-inch centers. This report contains additional measurements performed on the same surfaces. These data substantiate the decision to change to the new specifications.

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SUMMARY

This report describes follow-up measurements and analysis of texture and skid resistance on experimentally textured Portland cement concrete paving. The data indicated the loss of texture due to microabrasion or polish of traffic had generally stabilized at about 35 to 40 percent of the "as constructed" values. Skid resistance values remained relatively high on heavily textured surfaces.

IMPLEMENTATION

The implementation of this report will probably be of the form of reassurance to the Administration in approving and Districts in using Special Provision 360---013 (to concrete paving). This special provision to the standard specifications uses 1/8 inch wide transverse metal tines spaced not less than one-quarter inch nor more than one-half inch. The average sand patch texture is required to be not less than 0.060 inch with a minimum texture depth of 0.050 inch. It should be noted, however, that the special provision was developed as implementation to Research Report 141-4F written by Ledbetter, Meyer, and Ballard at Texas Transportation Institute, College Station, Texas.

BACKGROUND - PROJECT 2-6-70-141

The small study reported herein contains follow-up measurements on experimental pavement sections established for Research Project No. 2-6-70-141. Project 2-6-70-141 was entitled "Quality of Portland Cement Concrete Pavement as Related to Environmental Factors and Handling Practices." The project investigators for the 2-6-70-141 project were Dr. W. B. Ledbetter and Dr. A. H. Meyer with Texas Transportation Institute (TTI) and the study was sponsored by the department's Construction Division.

The TTI project studied admixtures and curing methods used in concrete pavement construction by utilizing both laboratory testing and field test sections. In addition to the study of admixtures and curing, a large phase of the study was devoted to P.C. concrete surface properties related to skid resistance and hydroplaning. This phase of the TTI project is of concern in this report.

The following abstract of TTI's final report (141-4F) briefly explains the study:

> "Results on an evaluation of two sets of full-scale experimental concrete test sections are summarized. Eighteen experimental concrete finishes were evaluated in terms of skid resistance under standard trailer water conditions and under simulated rainfall conditions. In addition the change in texture depths and skid values with time were measured. Results indicate that (1) texture depths of 0.060 in. or greater can easily and economically be constructed with 1/8 in. metal tines spaced closer than 1/2 in. apart, (2) under normal traffic conditions all concrete textures can be expected to wear down approximately 25 to 35 percent during the first 1/2 year and then remain relatively unchanged for a prolonged period, (3) skid measurements made under standard trailer water conditions may not be indicative of real life conditions in wet weather, (4) low skid values could be obtained in almost any rainfall in which the pavement is completely wetted, and (5) under simulated rain conditions deep transverse texturing will result in the greatest improvement in skid values."

The two sets of test sections mentioned in the abstract above were (1) SH-6 in Bryan, Texas and (2) IH-10 approximately nine miles east of Van Horn, Texas. Figures 2-1 and 2-2 show the sections and finishes used on the test sections. Both SH-6 and IH-10 were under construction at the time the test sections were formed and the remaining length of the construction jobs was completed using a burlap drag which was standard at that time.

Recently the Federal Highway Administration requested the sections be retested in order to determine if changes had occurred since the close of the research project. This testing was accomplished in July and August, 1977, some three years after the close of the project. This report describes the results of the later tests.

DATA COLLECTION

The data consisted of skid resistance tests, texture tests and rut depth measurements. Skid tests were performed at 20 mph, 40 mph, and 60 mph. Five tests were obtained in each section at each speed. Skid tests were performed in both travel and passing lanes.

Both sand patch (Tex 436-A) and putty impression methods were used to obtain texture similar to that reported in 141-4F. Texture values were collected in the right wheel paths of both travel and passing lanes. Generally, five tests were performed by each method in each section. Test locations were selected at evenly spaced intervals along the roadway. Both sand and putty tests at any one location were obtained closely together, being spaced about 18 inches apart.

Generally, rut depth measurements were obtained at each spot where texture data were collected. The rut depth equipment was borrowed from Texas Transportation Institute and included a six-foot aluminum bar used as a straight edge and a calibrated wedge. The bar is placed transversely across the pavement and the wedge is inserted between the pavement and bar. Rut depths are "read" directly from the wedge. Originally it was believed rut depths would be a measure of wear or abrasion of the surface finish, particularly noted in the wheel path. However, it is probable the rut depth measurements shown herein reflect temperature curl or some unusual finish near the edge rather than wear loss caused by traffic abrasion. Therefore rut depth measurements were disregarded in the analysis.

ANALYSIS

These data are presented and analyzed in four groups as follows:

1. "Experimental Concrete Highway Finishes" may be found in Tables I and II. These tables show the average values of the various types of data collected for each of the sections. Table I is related to the Bryan construction job and Table II to the Van Horn job.

2. "Field Test Measurements" are found in Tables III and IV. These tables show texture and skid resistance values in chronological order, forming a data history. Table III concerns SH-6 in Bryan and is actually a continuation of Table 4-3 in report 141-4F. Table IV concerns IH-10 in Van Horn and is a continuation of Table 4-4 in report 141-4F.

   Figures 19 through 24 show a graphical representation of the data found in Tables III and IV. Figure 19 shows two points with zero traffic applications which occurred in December 1971 and in June 1972. Considerable white pigmented curing compound remained on the SH-6 surface during the December 1971 tests. A considerable skid testing program was conducted on the SH-6 surfaces under simulated rainfall during June 1972. The simulated rainfall tests occurred in December 1973 on the IH-10 surfaces. The simulated rainfall tests occurred on both SH-6 and IH-10 before the highway was opened to traffic.

3. "SN versus Speed - Before and After" may be found in Figures 1 through 18. Figures 1 through 7 related to the Bryan job and Figures 8 through 18 show data from the Van Horn job. The intent of these data are to show the change in the so-called "speed gradient" (or change in SN with speed) after a three to five year period of service. The before tests in Bryan were obtained in 1973, and the after were obtained in 1977. The initial SN values on the Bryan sections may be in error. At the time they were obtained, it was believed the the water output of the skid unit was too low, especially at higher speeds. Ordinarily, lower SN values are found as test speed increases. In the tests in Bryan several of the sections show increases in SN values with speed increases.

4. "Average Percent Texture Loss - Before and After" can be found in Tables V and VI. These tables are similar to Tables 3-1 and 3-2 found in Report 141-4F. In Tables 3-1 and 3-2 Ledbetter, et al, attempted to show the percent loss in texture after definite time periods. From these measurements it was estimated that the wear down or texture

loss in the life of a concrete pavement would be 25 to 35 percent based on initial texture depth. The original values found in Tables 3-1 and 3-2 of 141-4F are the "before" values. The after values were calculated in a similar manner except the 1977 data were used.

Visual observations of the sections indicated no unusual surface damage due to the style or type of finish. Some spalling was evident in the areas with special finishes but this type of spalling is visible throughout the job. Likewise, wear or abrasion of the surface in the wheel path area is generally not visible.

DISCUSSION

The 1977 data indicate additional loss in skid resistance and texture as compared to the 1974 data. However, this loss is small and the values could be stabilizing.

The texture depths and finish types interact to an extent such that it is difficult to analyze the effect of finish type. There seems to be no significant difference between a longtitudinal finish as compared to a transverse finish; however, the tines' finishes generally have better friction values.

The average texture values shown in Table V indicate the Bryan job lost 31.9 percent of the texture in about 31 months of service and only 31.2 percent in 5 years and 8 months of service. The texture loss on the sections has probably stabilized and the slight "increase" in texture depth noted is probably due to measurement error. The average texture values shown in Table VI indicate a continued loss in texture based on the 1974 measurements. The percent loss in 1974 was 34.3 after 8 months of service. The percent loss in 1977 was 39.0% after 3 years and 9 months of service. It should be noted that the percent loss on individual sections varied from 0 percent to 71 percent.

The DHT now requires a transverse surface finish on concrete to be developed by metal tines spaced (approximately) at 1/2-inch intervals. These data substantiate this requirement. The skid resistance and texture of the tines' finish are better as compared to the burlap drag finish originally required.

(After Ledbetter, Meyer and Ballard,
TTI Report 141-4F)

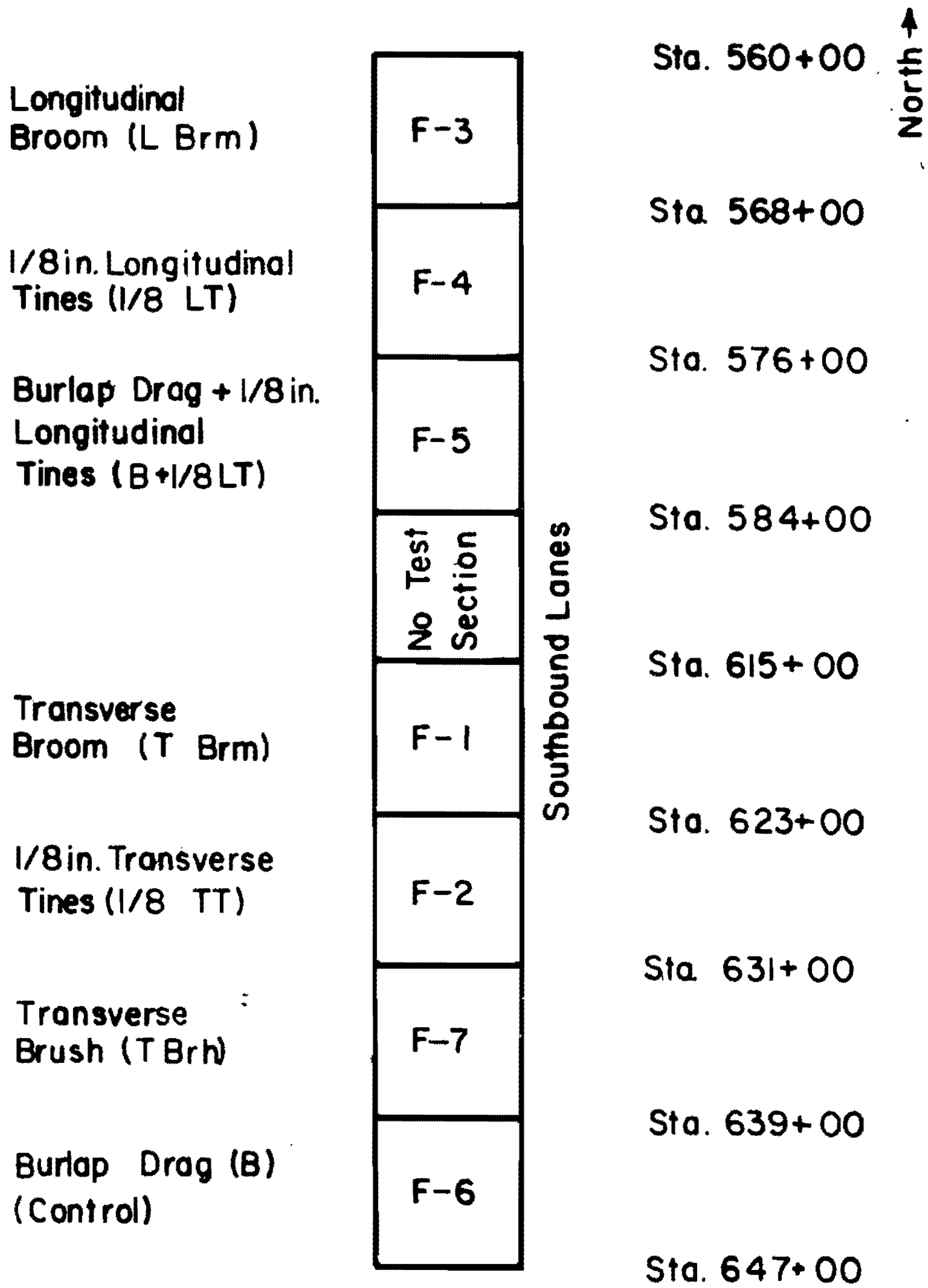


Fig. 2-1 Location of Test Sections on SH 6 in College Station, Texas

(After Ledbetter, Meyer and Ballard.
TTI Report 141-4F)

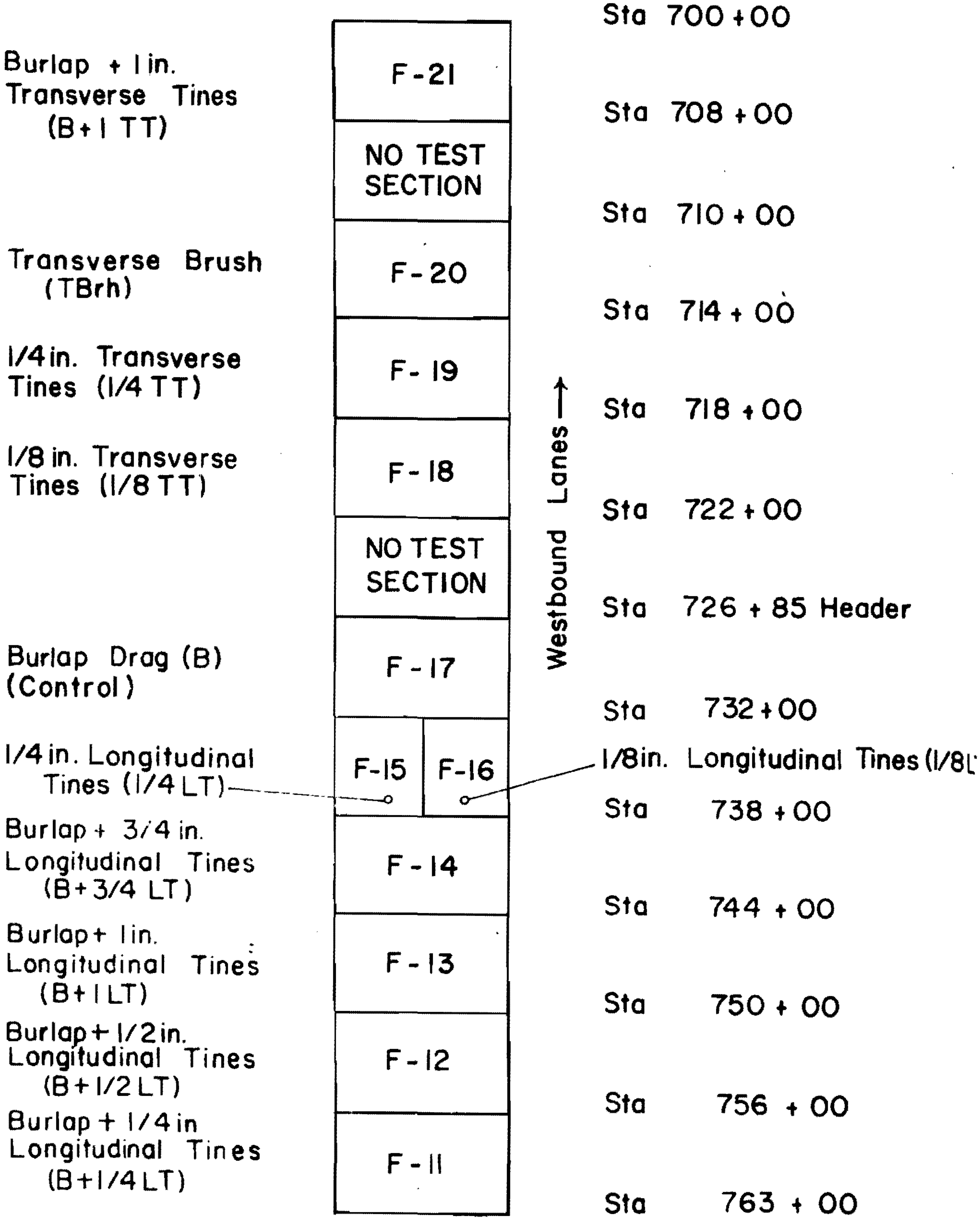


Fig. 2-2 Location of Test Sections IH 10
Near Van Horn, Texas

FIGURES

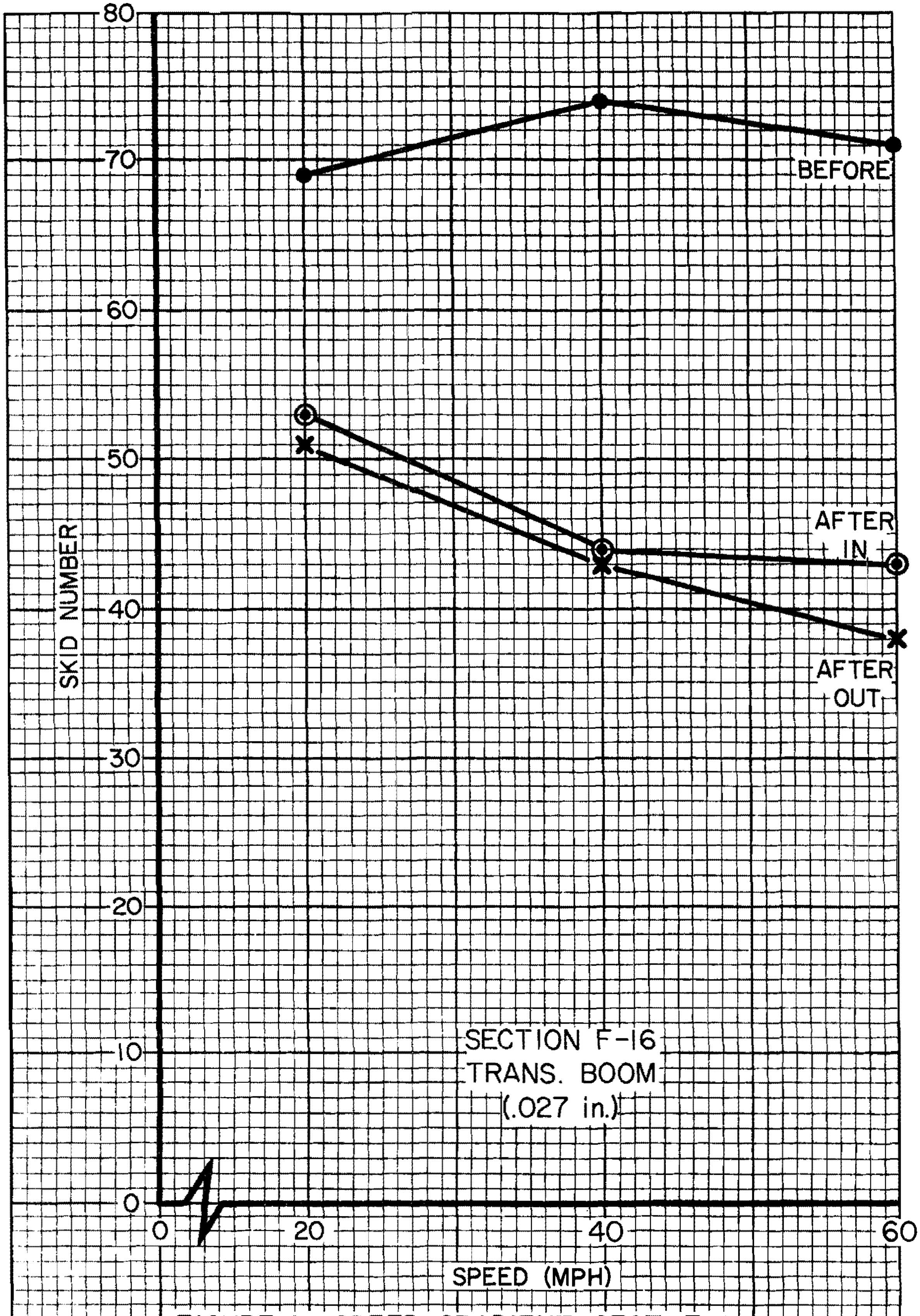


FIGURE 1—SPEED GRADIENT SECT. F-1

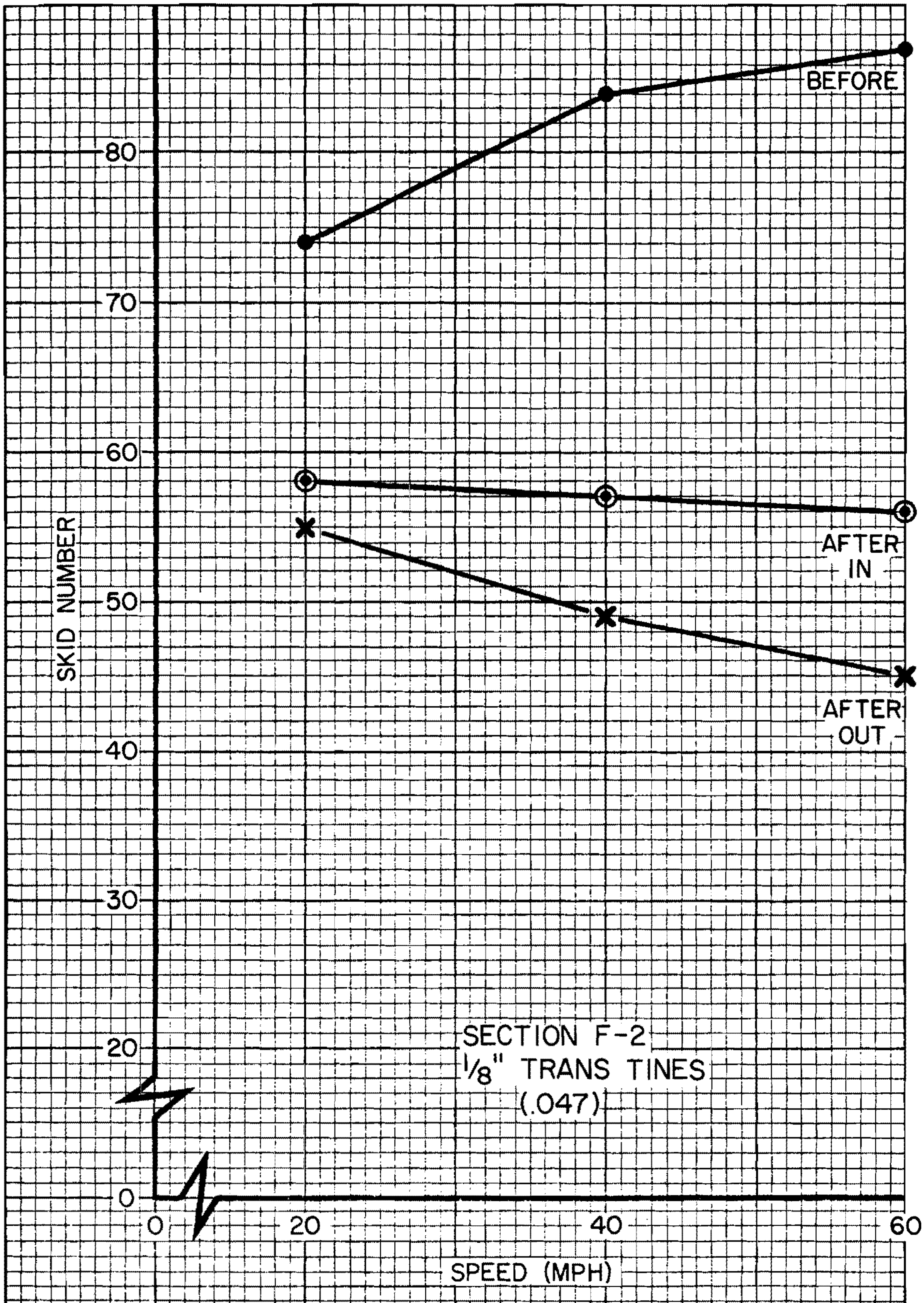


FIGURE 2—SPEED GRADIENT-SECT. F-2

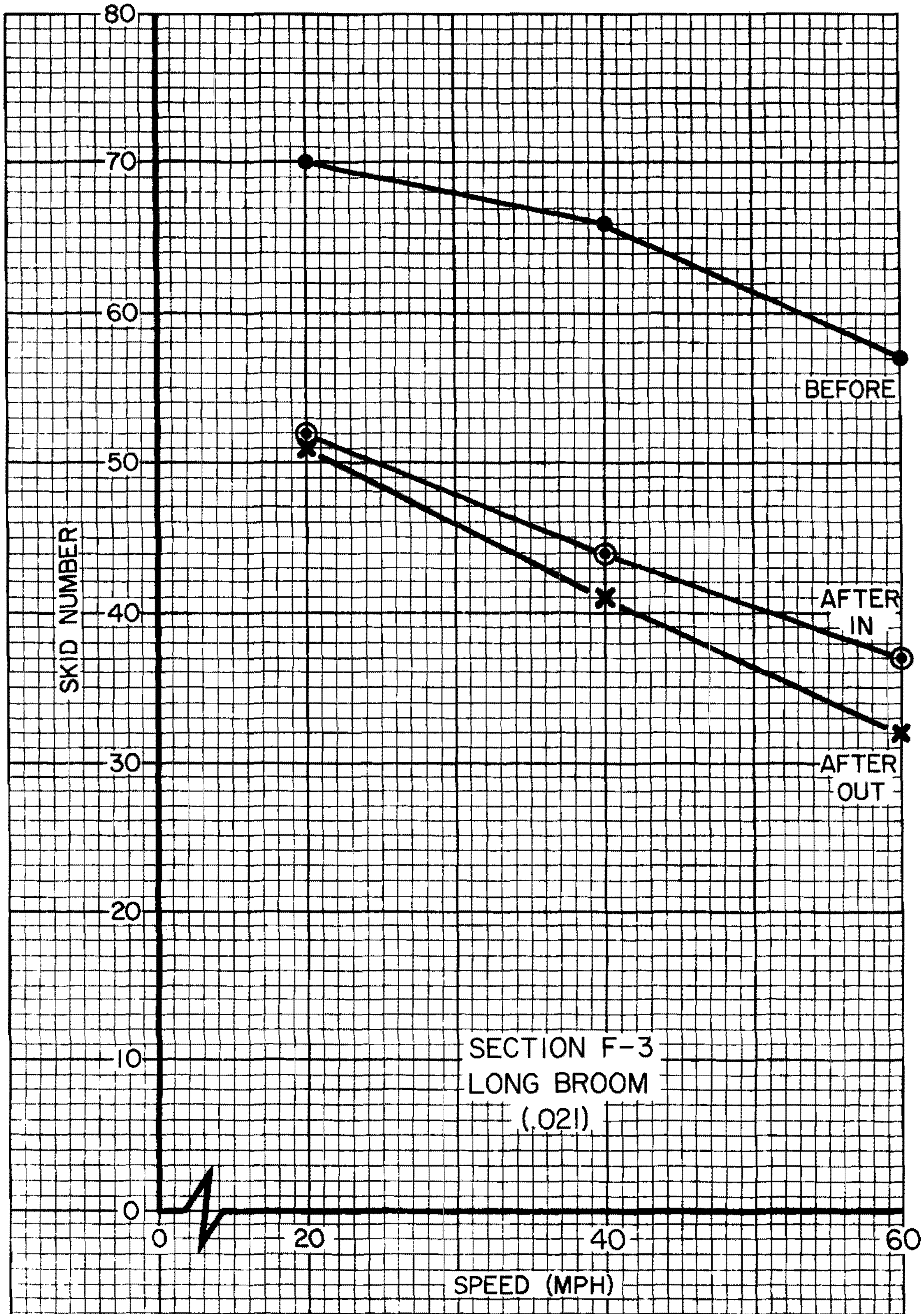


FIGURE 3—SPEED GRADIENT-SECT. F-3

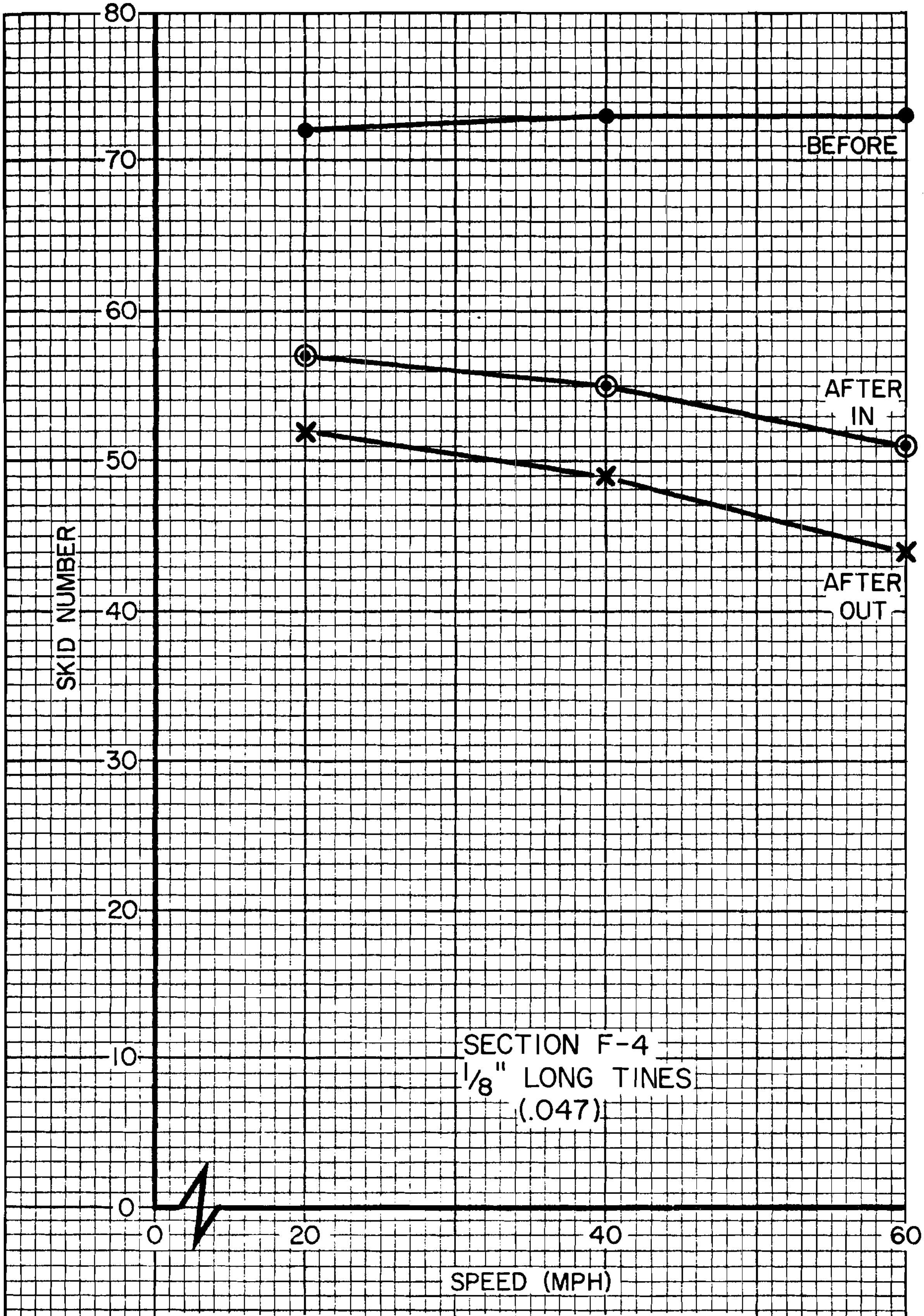


FIGURE 4—SPEED GRADIENT-SECT. F-13

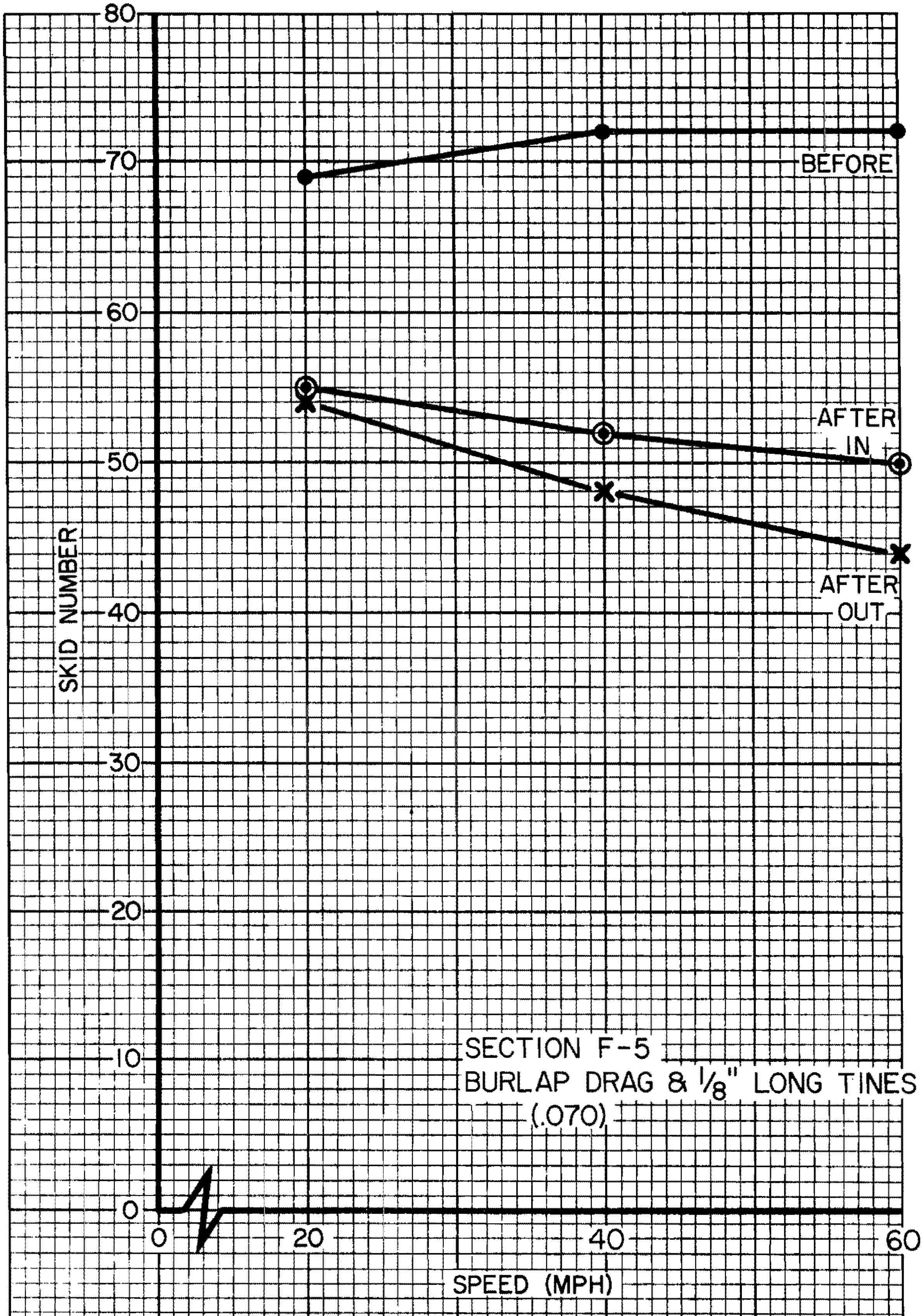


FIGURE 5—SPEED GRADIENT–SECT. F-5

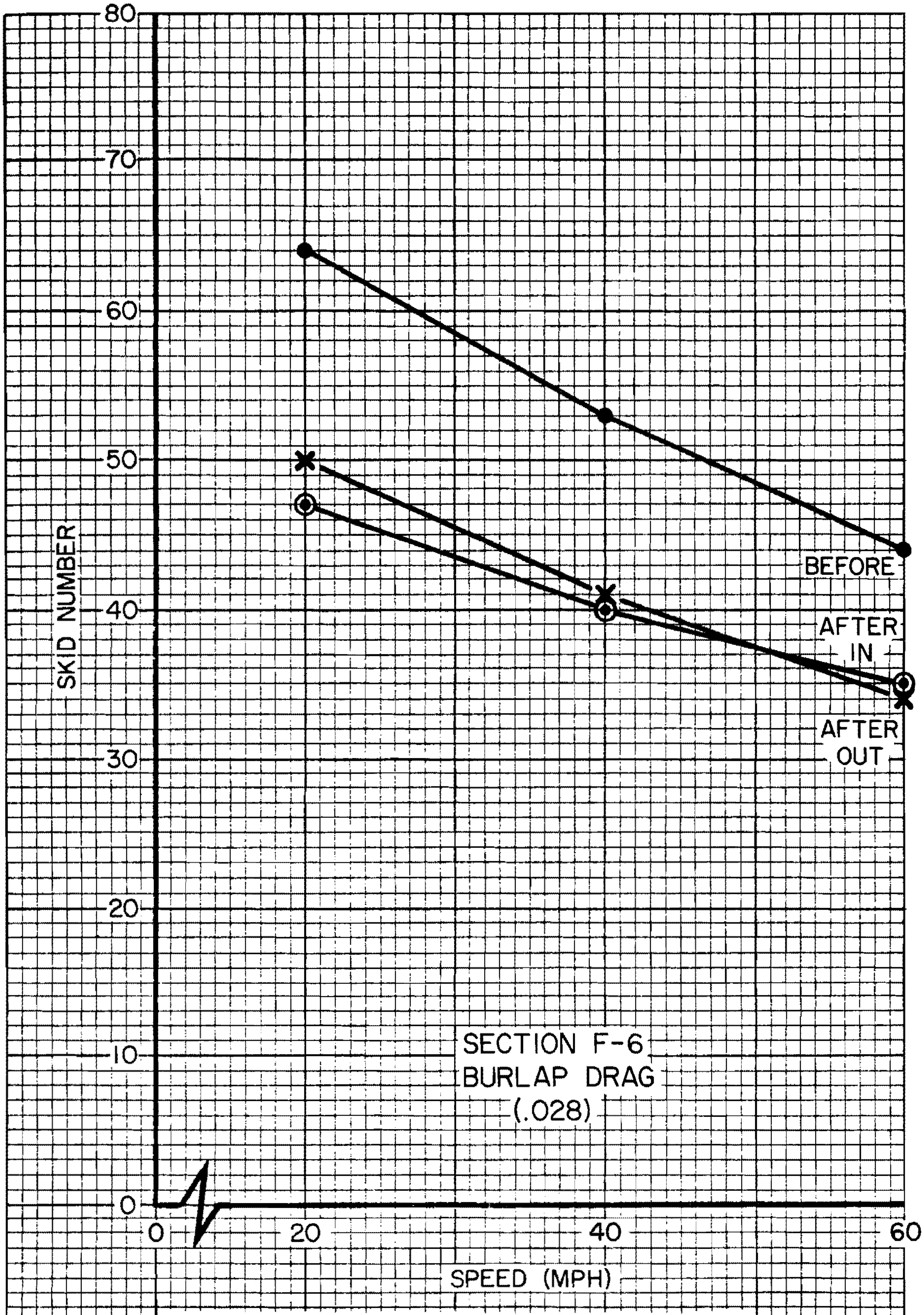


FIGURE 6—SPEED GRADIENT-SECT. F-6

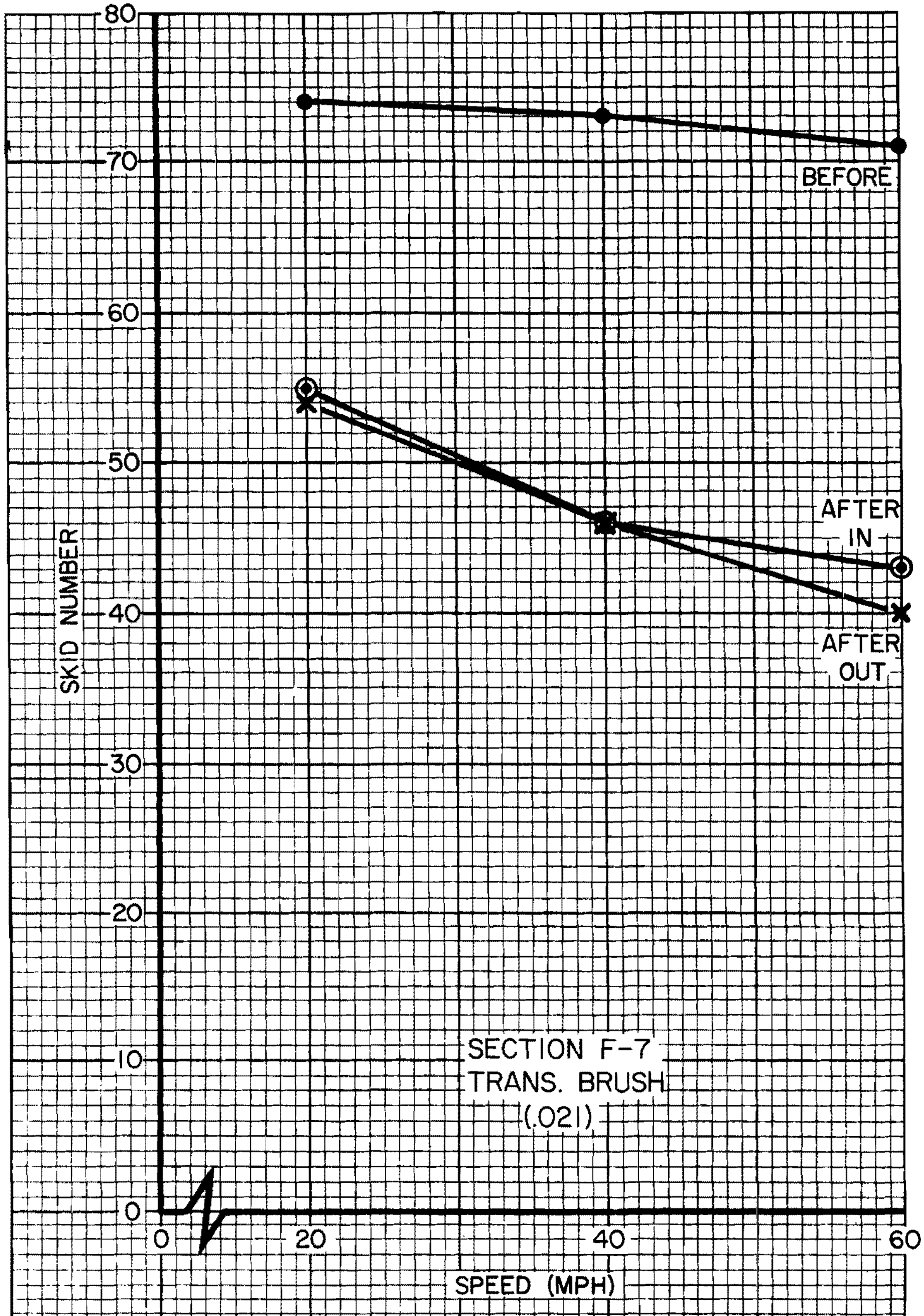


FIGURE 7—SPEED GRADIENT-SECT. F-7

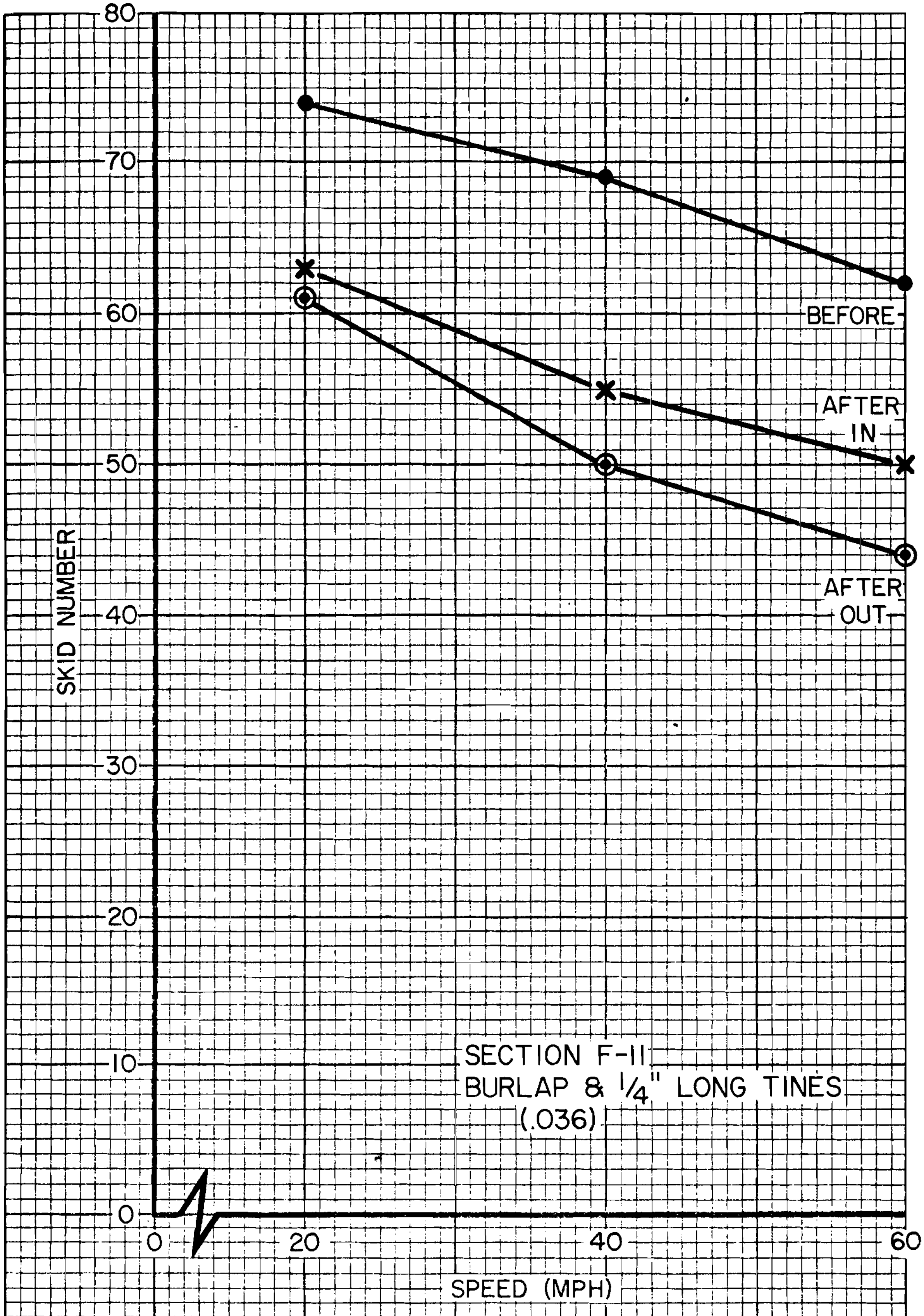


FIGURE 8—SPEED GRADIENT-SECT. F-11

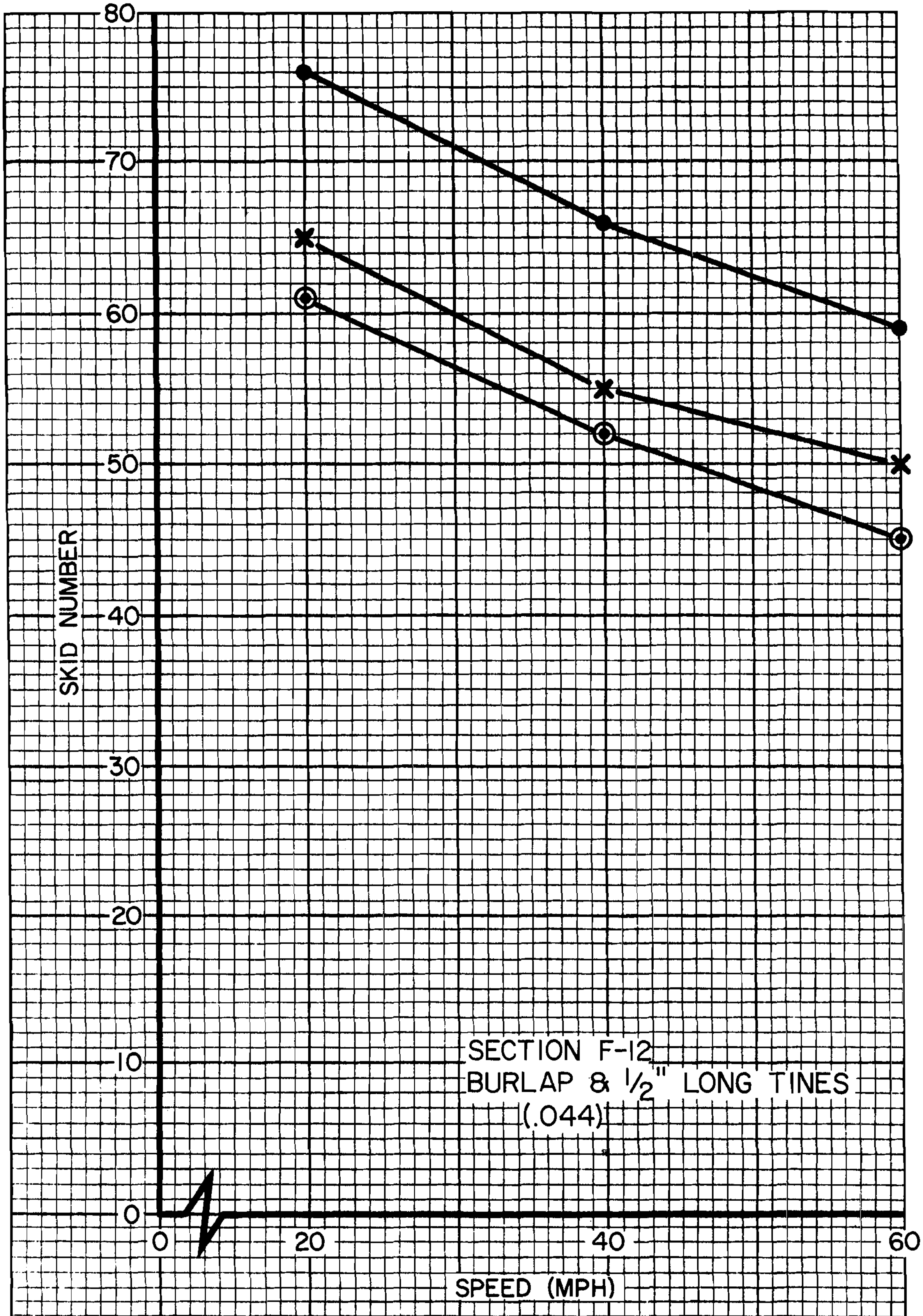


FIGURE 9—SPEED GRADIENT-SECT. F-12

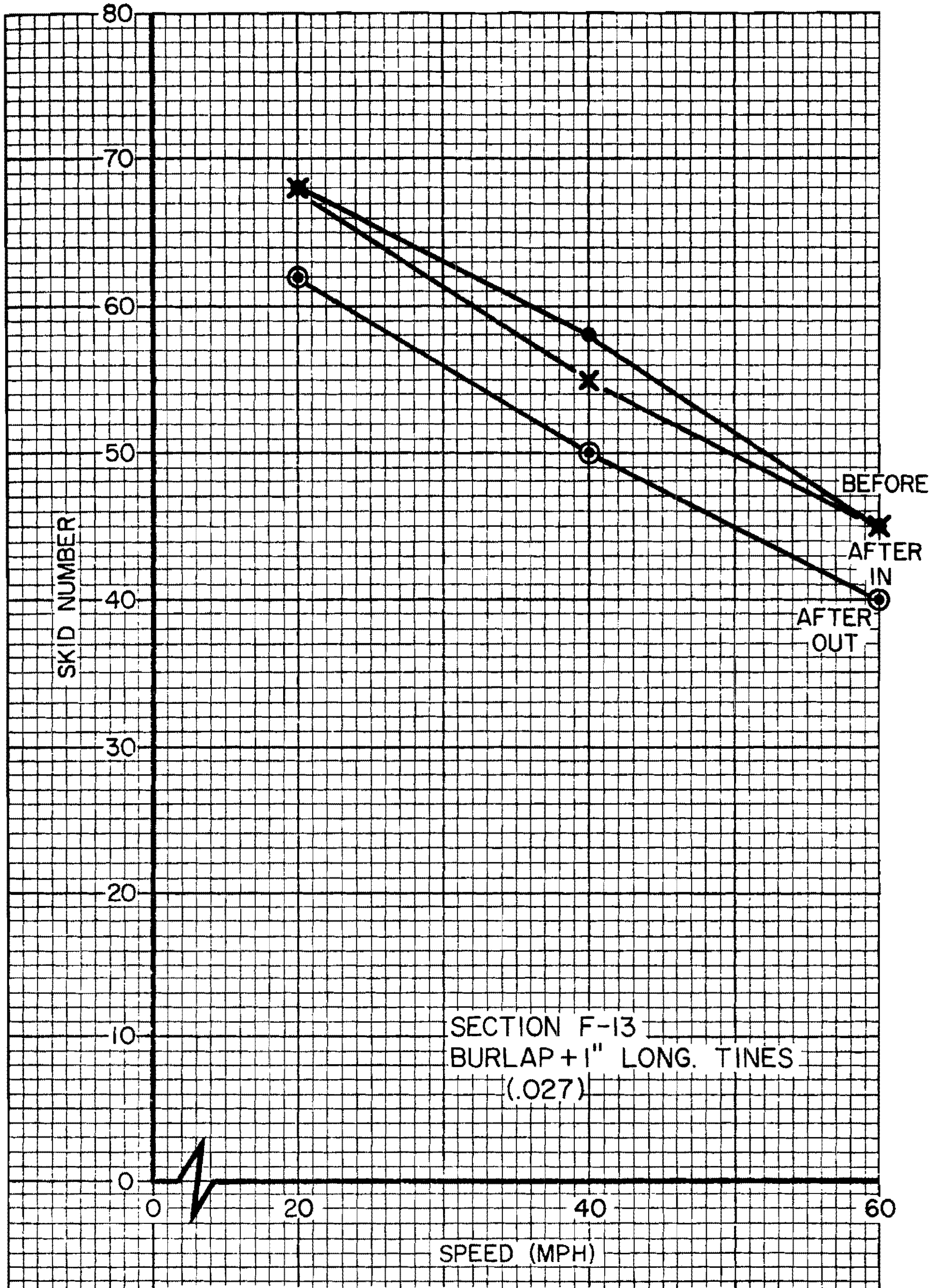


FIGURE 10—SPEED GRADIENT-SECT. F-13

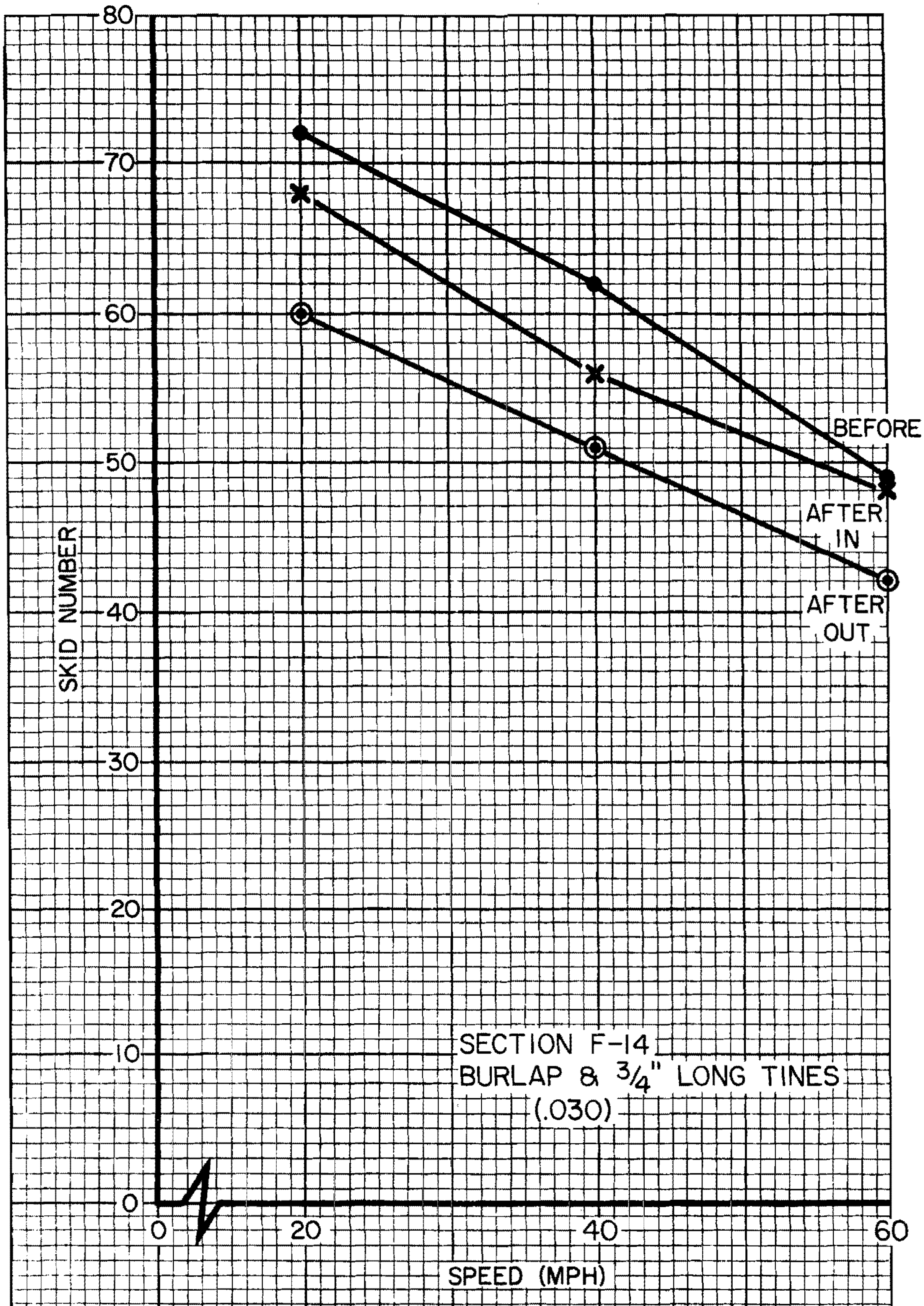


FIGURE 11—SPEED GRADIENT—SECT. F-14

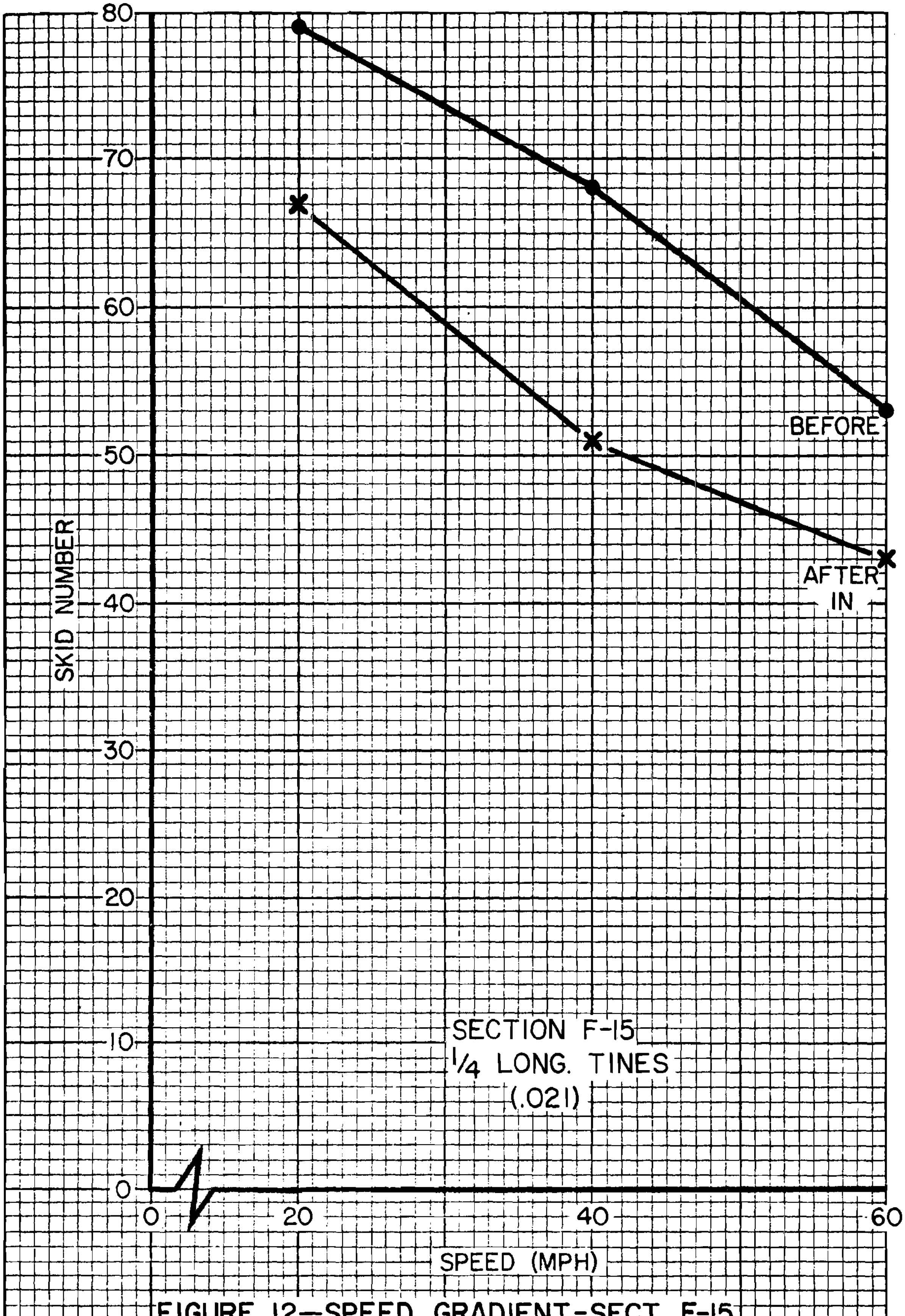


FIGURE 12—SPEED GRADIENT-SECT. F-15

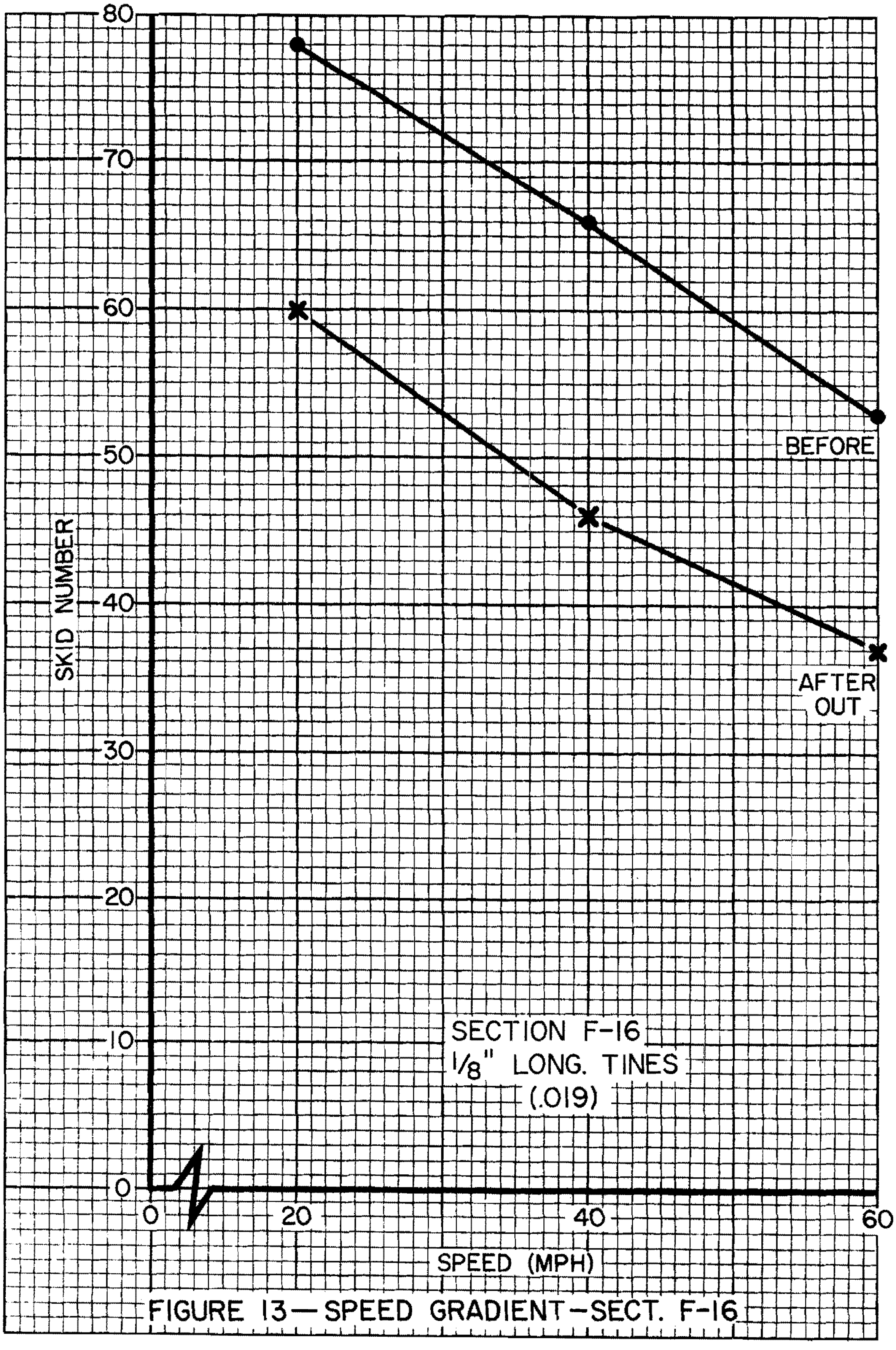


FIGURE 13—SPEED GRADIENT-SECT. F-16

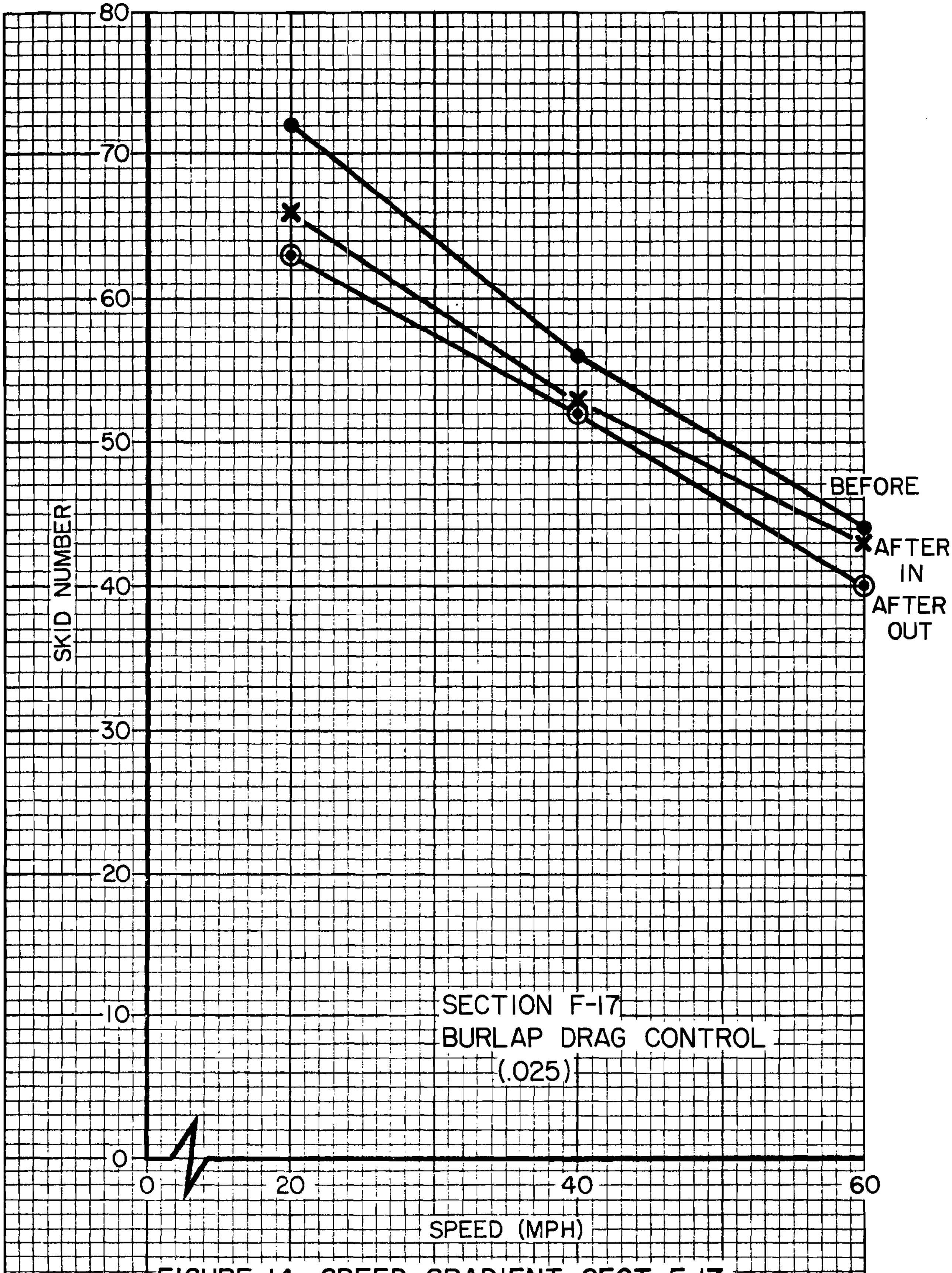


FIGURE 14—SPEED GRADIENT-SECT F-17

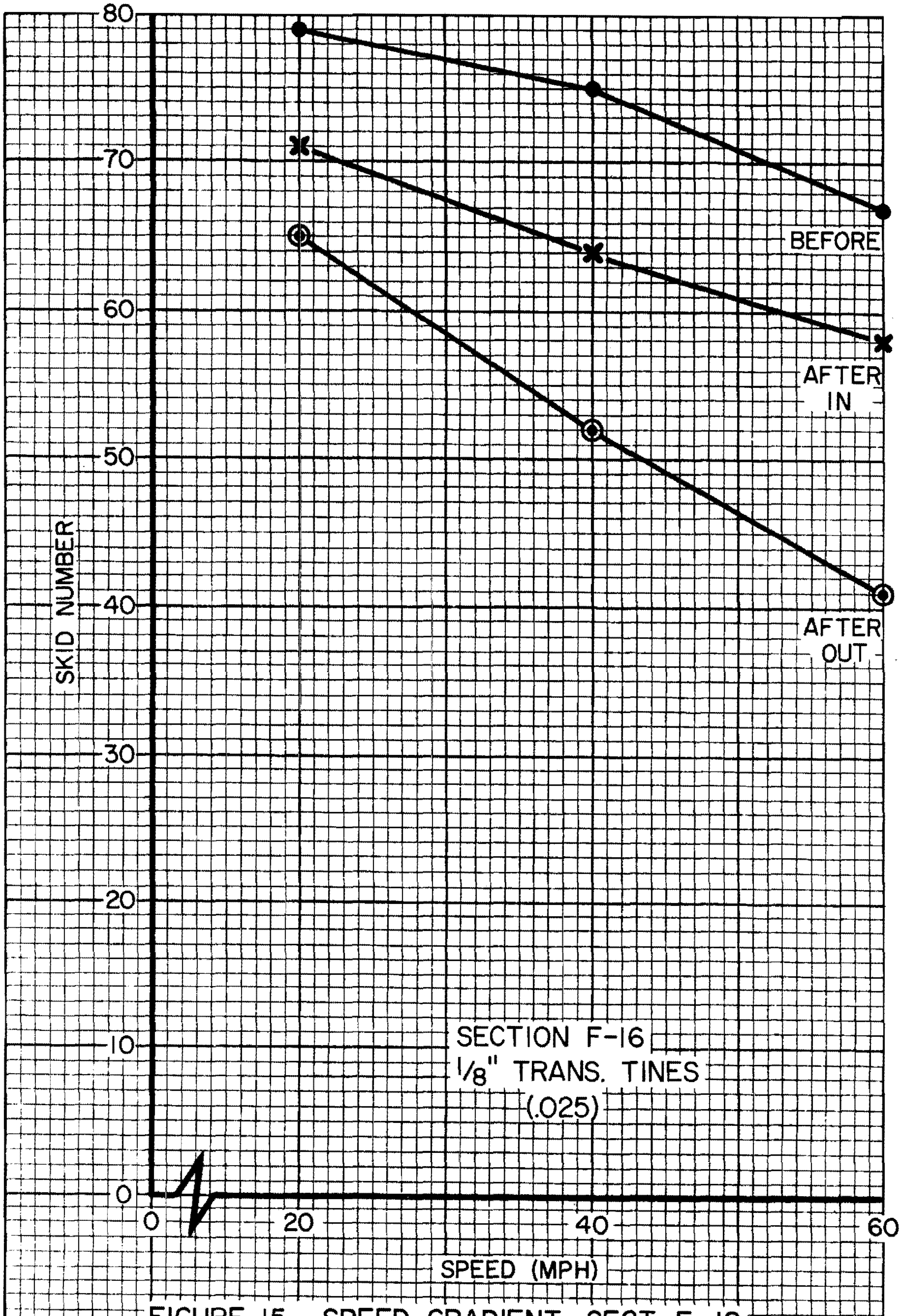


FIGURE 15—SPEED GRADIENT—SECT. F-18

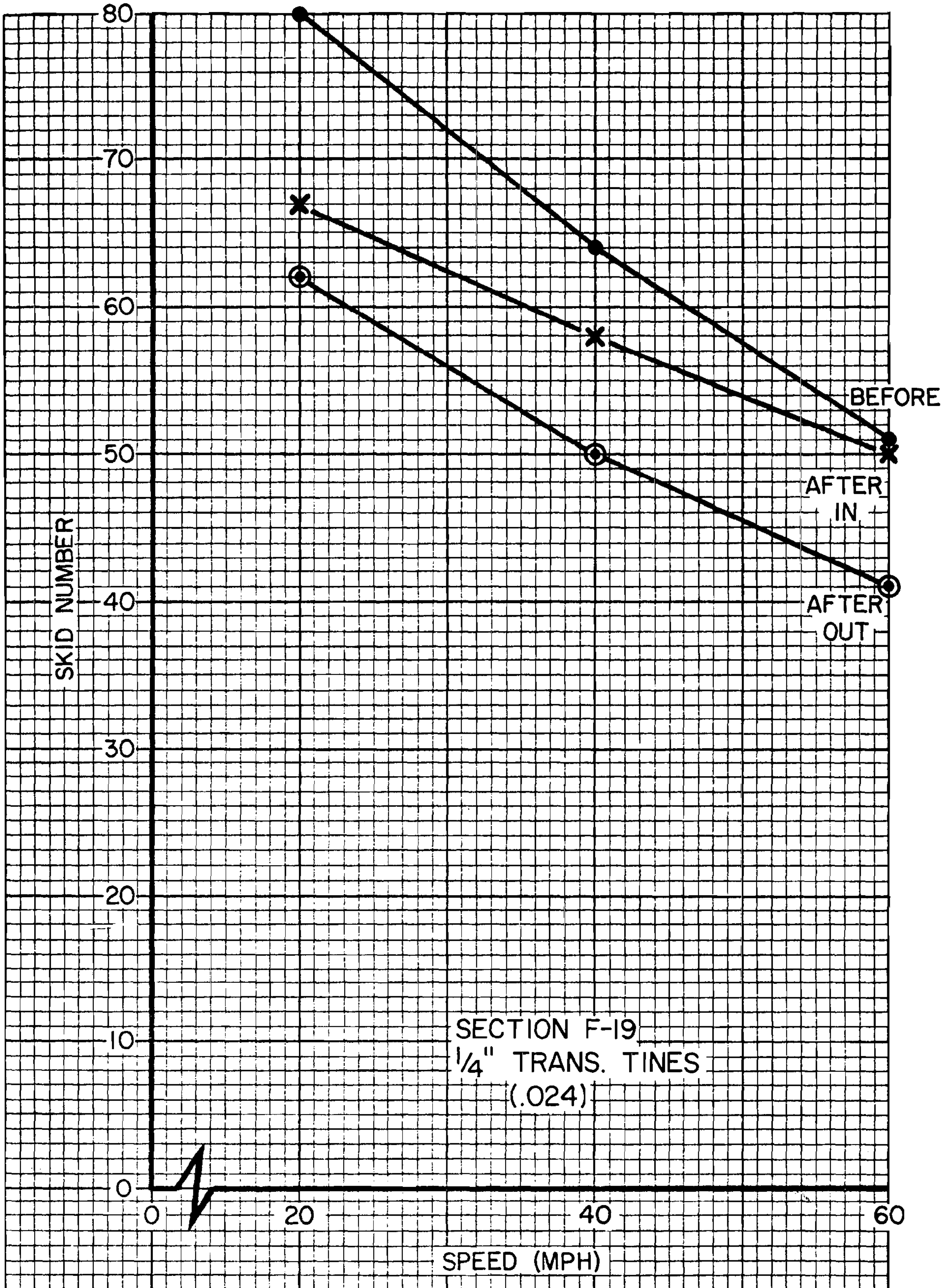


FIGURE 16—SPEED GRADIENT-SECT. F-19

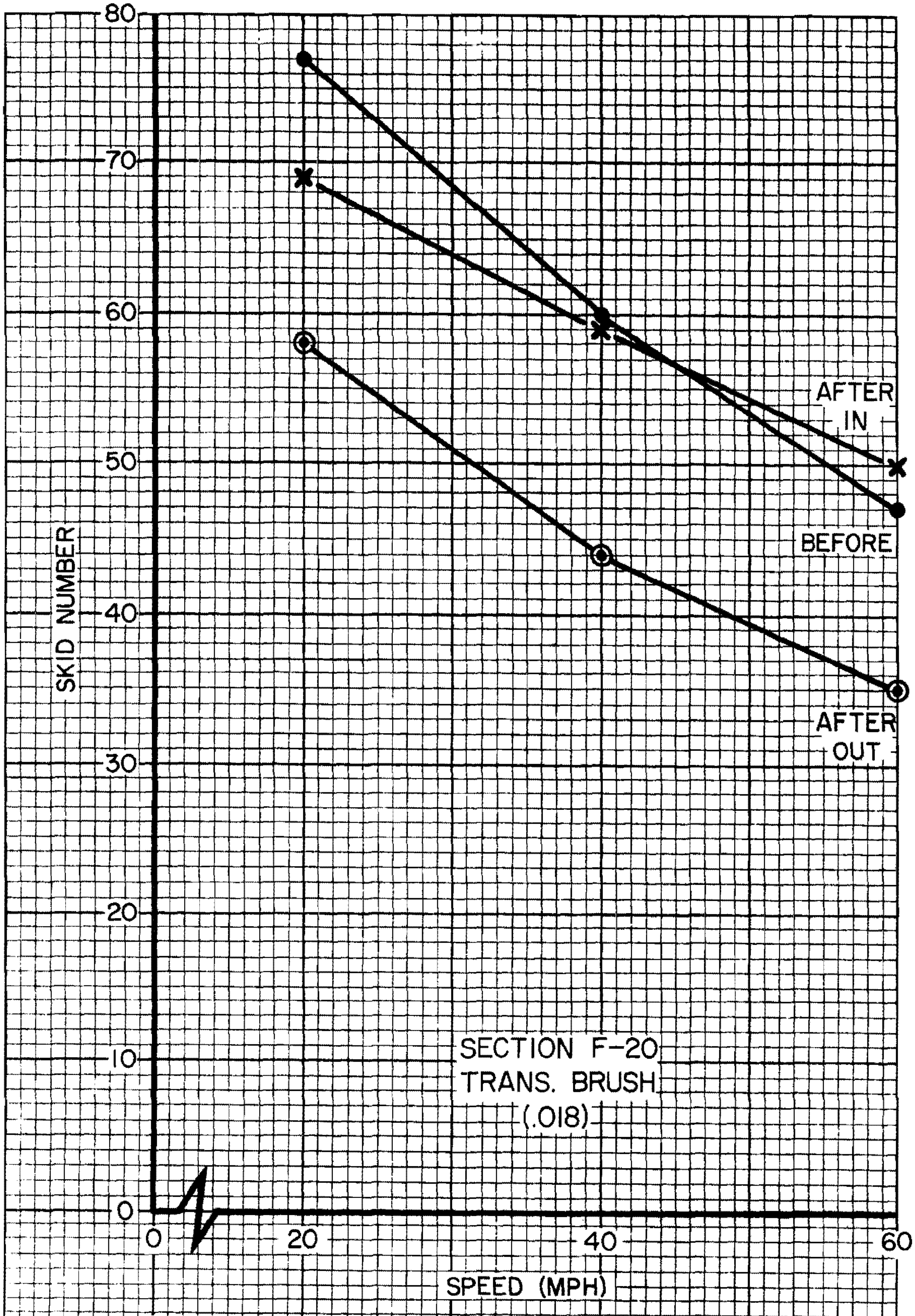


FIGURE 17—SPEED GRADIENT-SECT. F-20

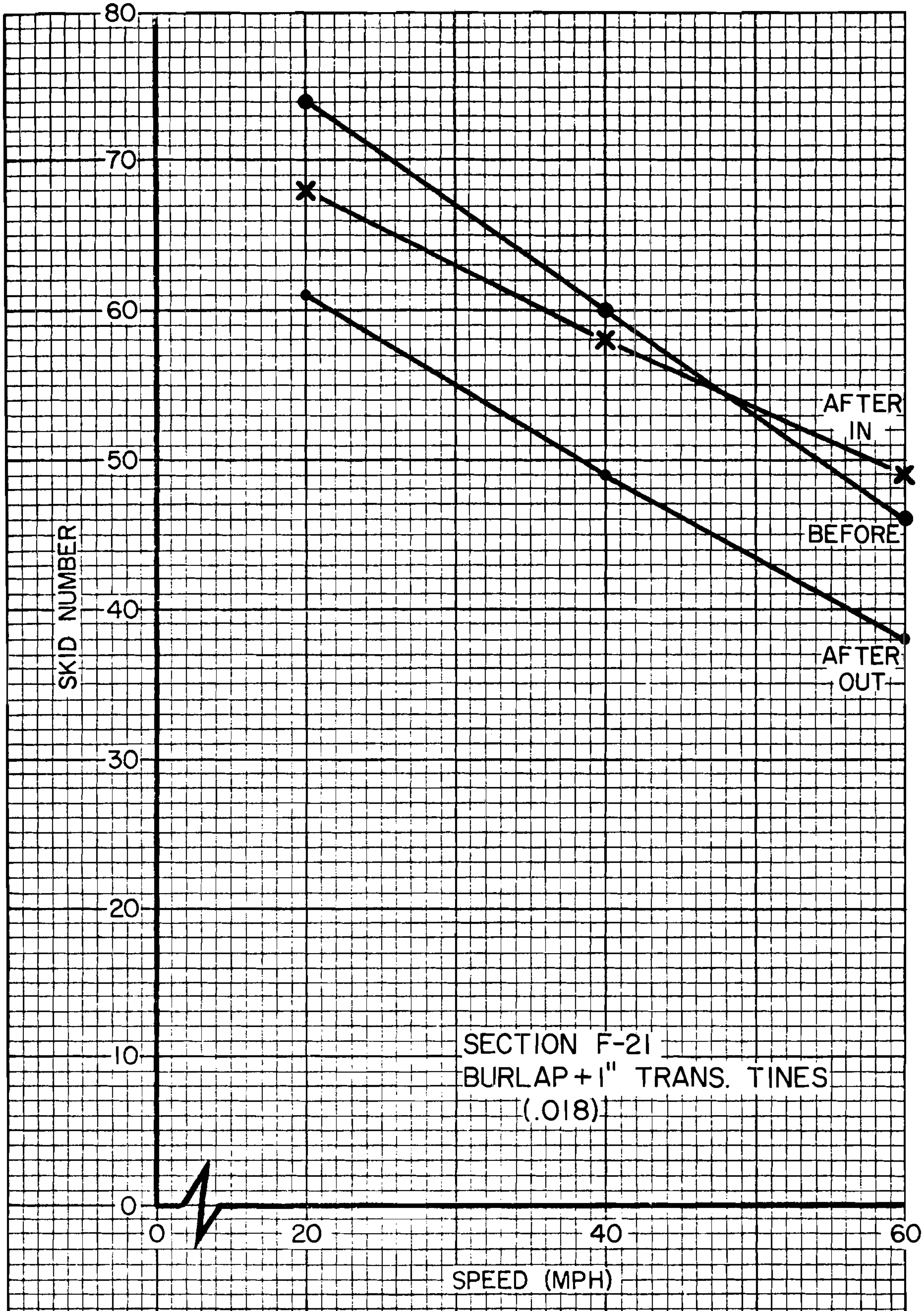


FIGURE 18—SPEED GRADIENT-SECT. F-21

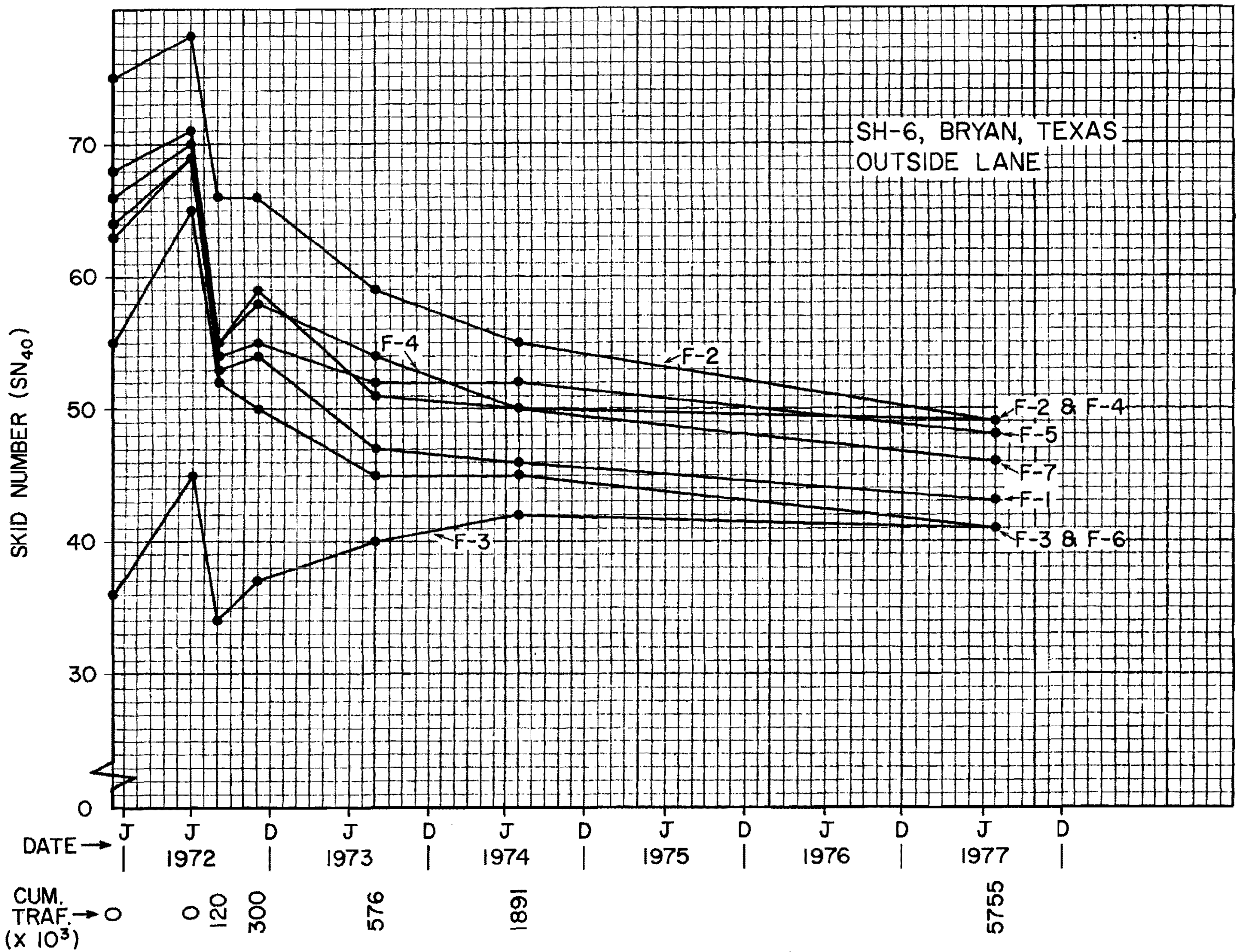


FIGURE 19—SKID RESISTANCE PERFORMANCE ON SH-6

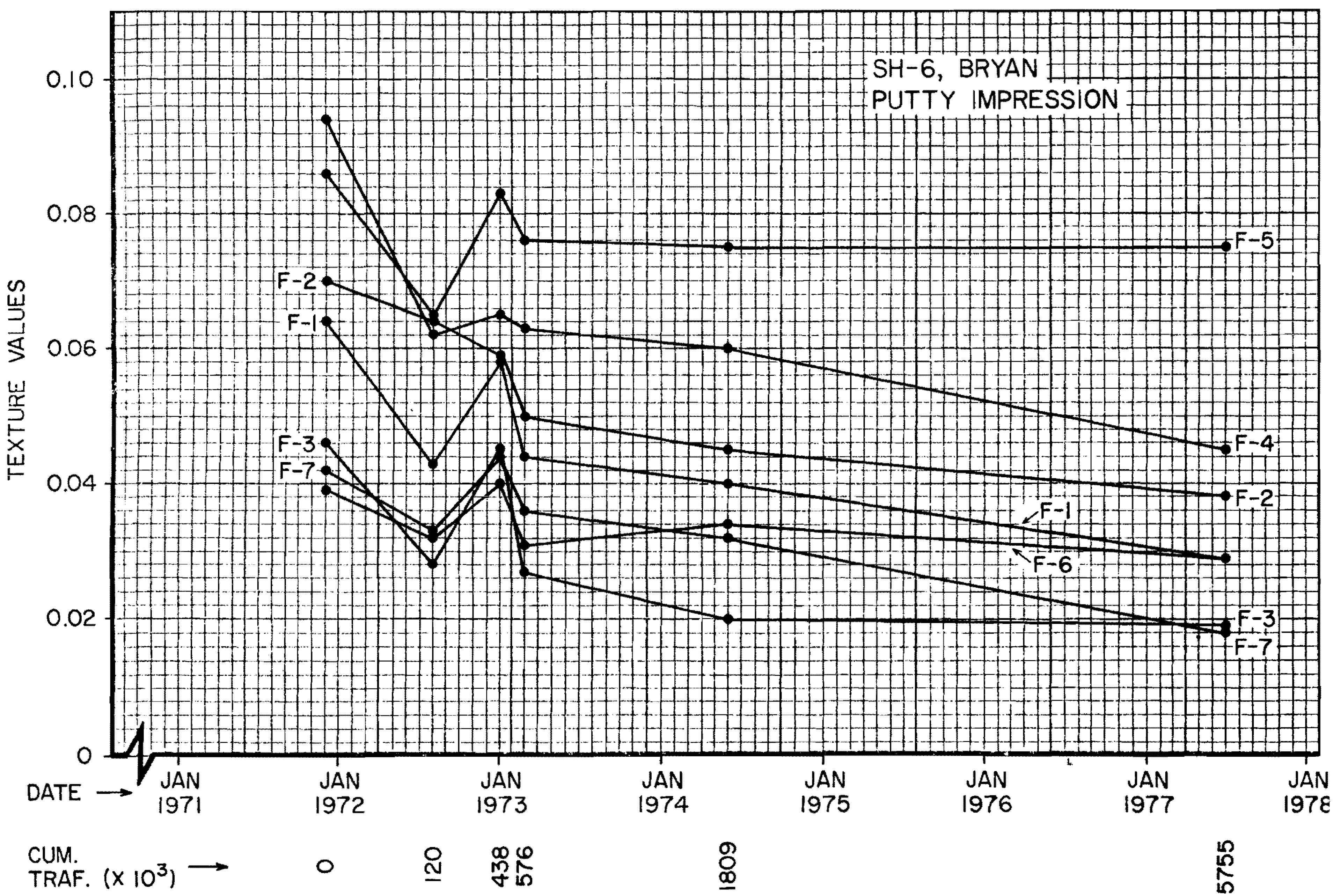


FIGURE 20—TEXTURE PERFORMANCE ON SH-6 BY PUTTY IMPRESSION

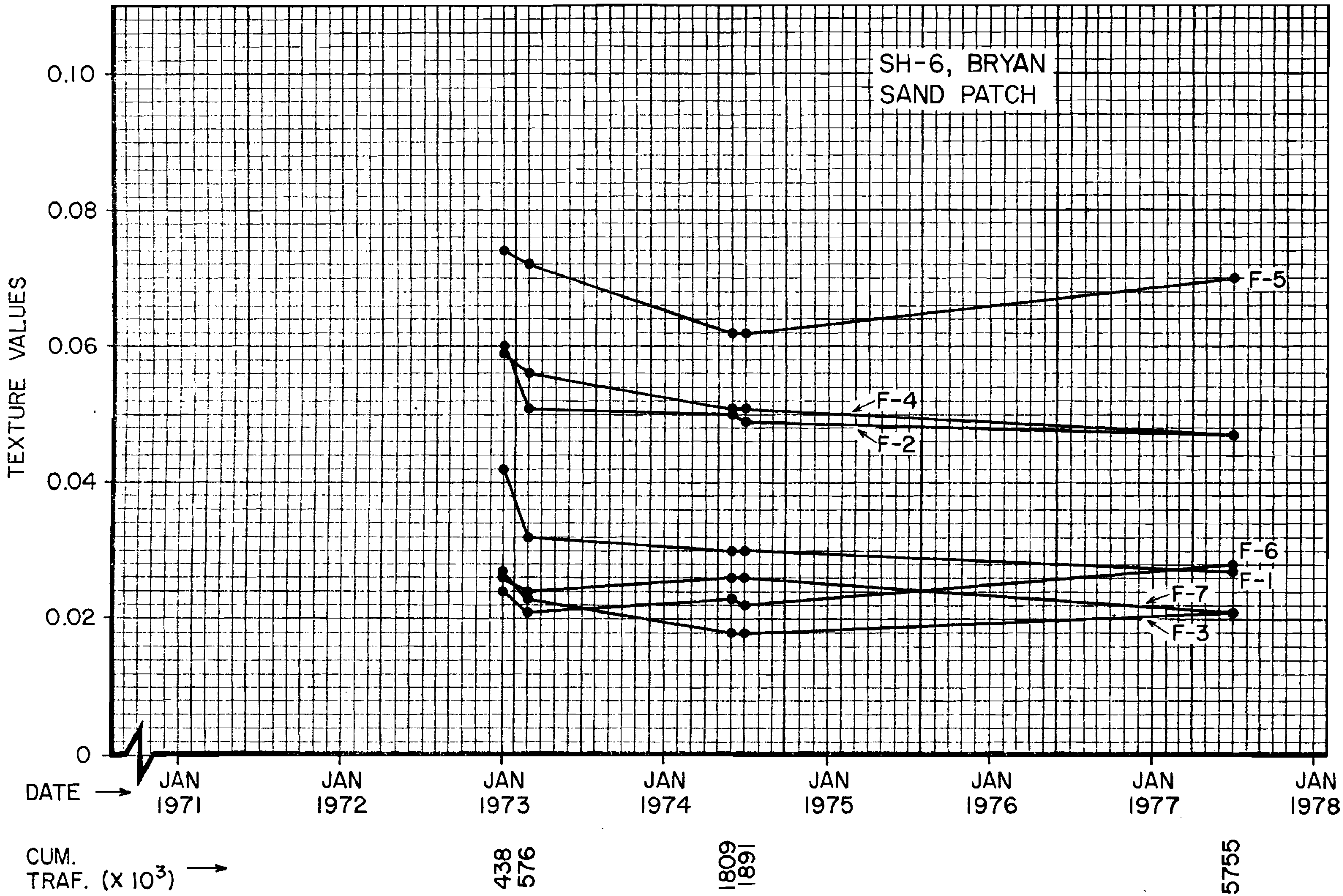


FIGURE 21—TEXTURE PERFORMANCE ON SH-6 BY SAND PATCH

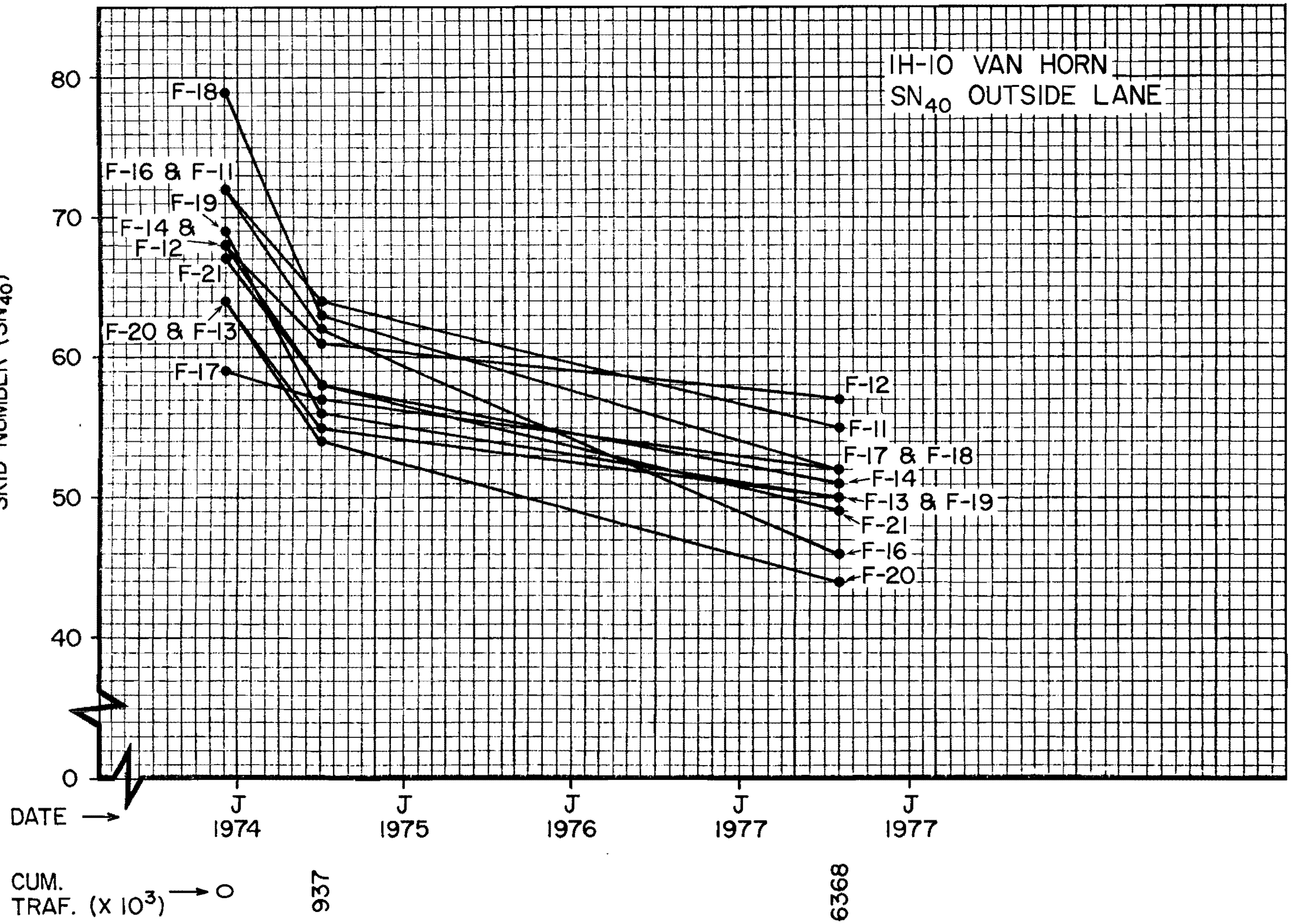


FIGURE 22—SKID RESISTANCE PERFORMANCE ON IH-10

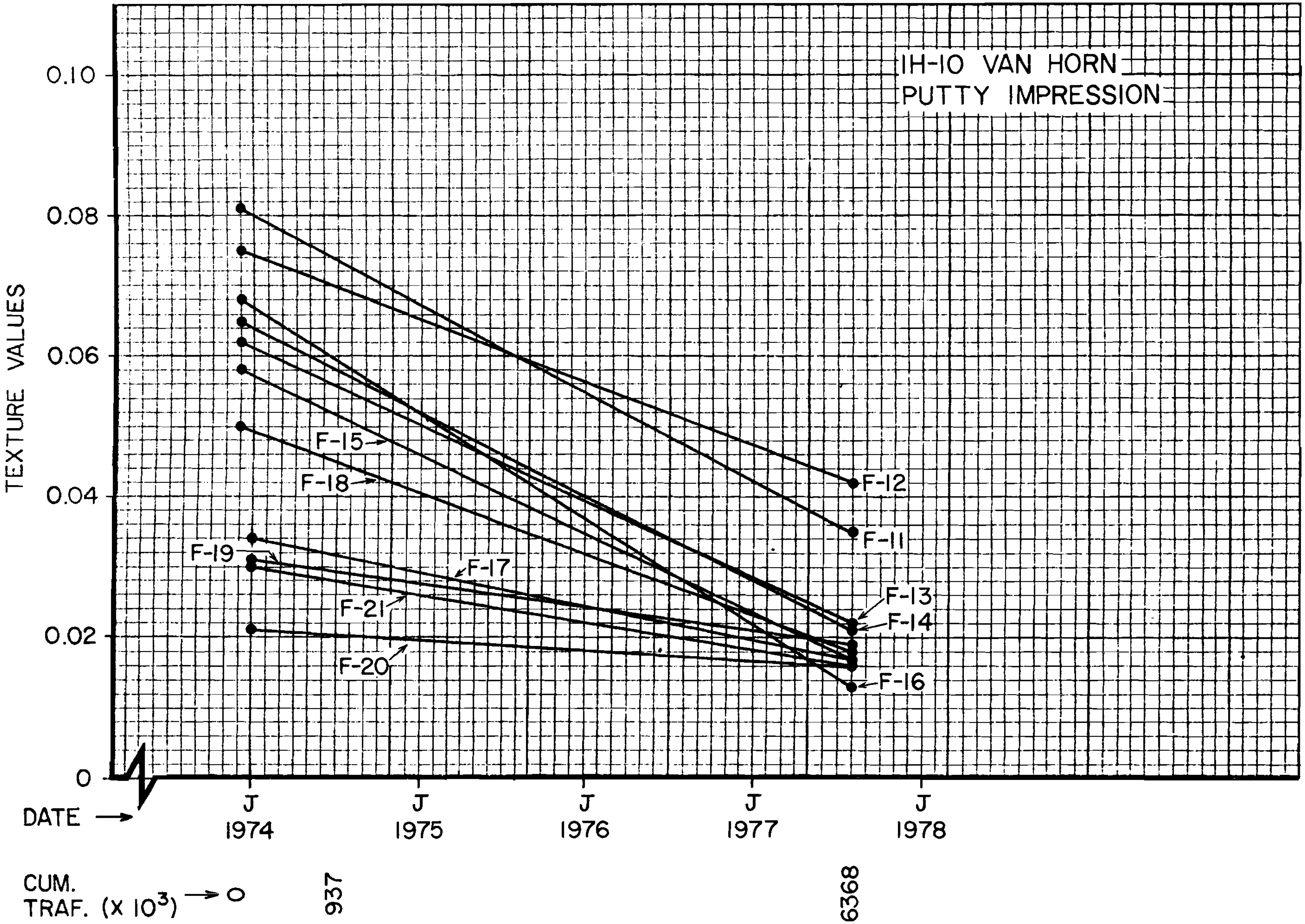


FIGURE 23—TEXTURE PERFORMANCE ON IH-10 BY PUTTY IMPRESSION

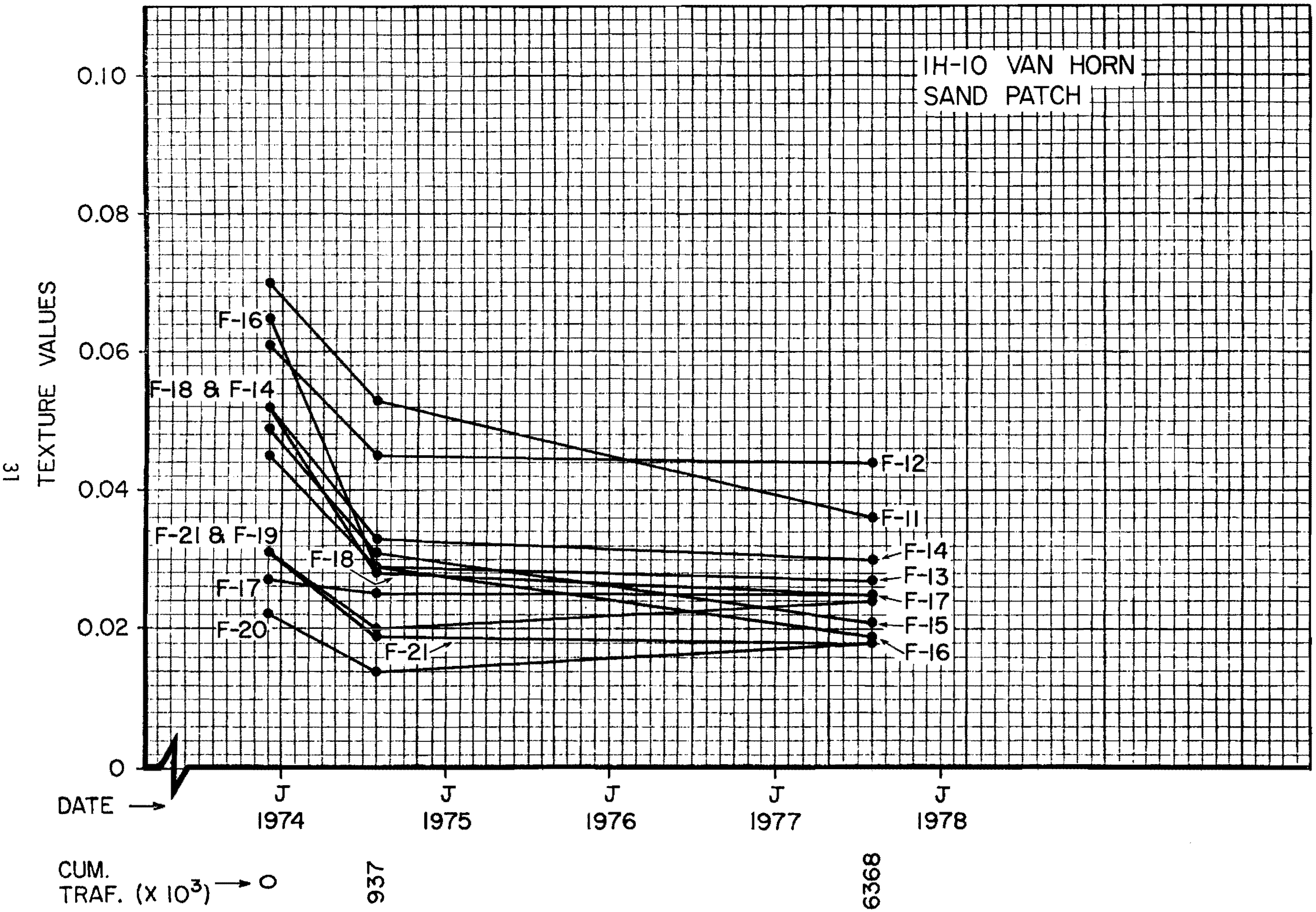


FIGURE 24—TEXTURE PERFORMANCE ON SH-6 BY SAND PATCH

TABLES

TABLE I

EXPERIMENTAL CONCRETE HIGHWAY FINISHES

SH-6 COLLEGE STATION

Section	SN_{20}	SN_{40}	SN_{60}	Sand Patch	Putty Impress.	Max. Rut Depth
F-1 Trans. Broom	51	43	38	0.027	0.029	2 mm
F-2 1/8" Trans. Tines	55	49	45	0.047	0.038	2 mm
F-3 Long. Broom	51	41	32	0.021	0.019	2 mm
F-4 1/8" Long.Tines	52	49	44	0.047	0.045	2 mm
F-5 Bur.Drag 1/8" Long. Tines	54	48	44	0.070	0.075	2 mm
F-6 Burlap Drag	50	41	34	0.028	0.029	2 mm
F-7 Trans. Brush	54	46	40	0.021	0.018	2 mm

INSIDE LANE July 19, 20, 21, 1977

TABLE I (CONT.)

EXPERIMENTAL CONCRETE HIGHWAY FINISHES

SH-6 COLLEGE STATION

Section	SN_{20}	SN_{40}	SN_{60}	Sand Patch	Putty Impress.	Max. Rut Depth
F-1 Trans. Broom	53	44	43	0.038	0.056	2 mm
F-2 1/8" Trans. Tines	58	57	56	0.061	0.054	4 mm
F-3 Long. Broom	52	44	37	0.026	0.035	4 mm
F-4 1/8" Long. Tines	57	55	51	0.074	0.072	2 mm
F-5 Bur. Drag 1/8" Long. Tines	55	52	50	0.060	0.063	2 mm
F-6 Burlap Drag	47	40	35	0.022	0.027	2 mm
F-7 Trans. Brush	55	46	43	0.024	0.029	2 mm

TABLE II

EXPERIMENTAL CONCRETE HIGHWAY FINISHES

IH-10 VAN HORN

Section	SN_{20}	SN_{40}	SN_{60}	Sand Patch	Putty Impress.	Max. Rut Depth.	
F-11 Burlap + 1/4" Long.	63	55	50	.032 .043	.030 .042		RWP BWP
F-12 Burlap + 1/2" Long.	65	55	50	.041 .048	.038 .038		RWP BWP
F-13 Burlap + 1" Long.	68	55	45	.029 .030	.029 .032		RWP BWP
F-14 Burlap + 3/4" Long.	68	56	48	.038 .048	.030 .031		RWP BWP
F-15 1/4" Long	67	51	43	.021 .023	.017 .018	2 mm	RWP BWP
F-17 Burlap Control	66	53	43	.028 .025	.021 .026		RWP BWP
F-18 1/8" Trans.	71	64	58	.030 .030	.023 .021		RWP BWP
F-19 1/4" Long.	67	58	50	.020 .029	.014 .012		RWP BWP
F-20 Trans. Brush	69	59	50	.018 .018	.012 .017		RWP BWP
F-21 Burlap + 1" Trans.	68	58	49	.024 .027	.018 .018		RWP BWP

RWP = Right Wheel Path BWP = Between Wheel Paths

TABLE II (Cont.)

EXPERIMENTAL CONCRETE HIGHWAY FINISHED

IH-10 VAN HORN

Section	SN_{20}	SN_{40}	SN_{60}	Sand Patch	Putty Impress.	Max. Rut Depth	
F-11 Burlap + 1/4" Long.	62	50	44	0.036 0.042	0.035 0.044	4 mm	RWP BWP
F-12 Burlap + 1/2" Long.	61	52	45	0.044 0.047	.042 .039	2 mm	RWP BWP
F-13 Burlap + 1" Long.	62	50	40	.027 .032	.022 .024	2 mm	RWP BWP
F-14 Burlap + 3/4" Long.	60	51	42	.030 .037	.021 .033	2 mm	RWP BWP
F-16 1/8" Long.	60	46	37	.019 .022	.013 .016	2 mm	RWP BWP
F-17 Burlap Control	63	52	40	.025 .027	.017 .019	4 mm	RWP BWP
F-18 1/8" Trans.	65	52	41	.025 .031	.018 .024	2 mm	RWP BWP
F-19 1/4" Trans.	62	50	41	.024 .025	.019 .018	4 mm	RWP BWP
F-20 Trans. Brush	58	44	35	.018 .019	.016 .014	2 mm	RWP BWP
F-21 Burlap + 1" Trans.	61	49	38	.018 .022	.016 .022	4 mm	RWP BWP

TABLE III

FIELD TEST MEASUREMENTS ON SH-6

Test Section	Date	Putty Impress.	Sand Patch	SN_{40} In Lane	SN_{40} Out Lane
F-1 Trans. Broom	Dec. 71	.064	-	61	63
	June 72	-	-	74	69
	Aug. 72	.043	-	60	53
	Nov. 72	-	-	58	54
	Jan. 73	.058	.042	-	-
	Mar. 73	.044(11/73)	.032	58	47
	June 74	.040	.030	51	46
	July 74	-	.030	-	-
	July 77	.029	.027	44	43
F-2 1/8" Trans. Tines	Dec. 71	.070	-	71	75
	June 72	-	-	83	78
	Aug. 72	.064	-	72	66
	Nov. 72	-	-	73	66
	Jan. 73	.059	.060	-	-
	Mar. 73	.050(11/73)	.051	72	59
	June 74	.045	.050	52	55
	July 74	-	.049	-	-
	July 77	.038	.047	57	49
F-3 Long. Broom	Dec. 71	.046	-	57	55
	June 72	-	-	61	65
	Aug. 72	.028	-	59	52
	Nov. 72	-	-	57	50
	Jan. 73	.045	.027	-	-
	Mar. 73	.027(11/73)	.023	54	45
	June 74	.020	.018	47	45
	July 74	-	.018	-	-
	July 77	.019	.021	44	41

TABLE III (Cont.)

FIELD TEST MEASUREMENTS ON SH-6

Test Section	Date	Putty Impress.	Sand Patch	SN_{40} In Lane	SN_{40} Out Lane
F-4 1/8" Long. Tines	Dec. 71	.094	-	67	68
	June 72	-	-	68	71
	Aug. 72	.062	-	67	55
	Nov. 72	-	-	66	58
	Jan. 73	.065	.059	-	-
	Mar. 73	.063(11/73)	.056	63	54
	June 74	.060	.051	55	50
	July 74	-	.051	-	-
	July 77	.045	.047	55	49
F-5 Burlap + 1/8" Long. Tine	Dec. 71	.086	-	66	66
	June 72	-	-	68	70
	Aug. 72	.065	-	64	54
	Nov. 72	-	-	63	55
	Jan. 73	.083	.074	-	-
	Mar. 73	.076(11/73)	.072	61	52
	June 74	.075	.062	54	52
	July 74	-	.062	-	-
	July 77	.075	.070	52	48
F-6 Burlap Drag Control	Dec. 71	.039	-	33	36
	June 72	-	-	54	45
	Aug. 72	.032	-	44	34
	Nov. 72	-	-	43	37
	Jan. 73	.040	.024	-	-
	Mar. 73	.031(11/73)	.021	45	40
	June 74	.034	.023	51	42
	July 74	-	.022	-	-
	July 77	.029	.028	40	41

TABLE III (Cont.)

FIELD TEST MEASUREMENTS ON SH-6

Test Section	Date	Putty Impress.	Sand Patch	SN_{40} In Lane	SN_{40} Out Lane
F-7	Dec. 71	.042	-	62	64
Trans.	June 72	-	-	71	69
Brush	Aug. 72	.033	-	60	55
	Nov. 72	-	-	63	59
	Jan. 73	.044	.026	-	-
	Mar. 73	.036(11/73)	.024	58	51
	June 74	.032	.026	40	50
	July 74	-	.026	-	-
	July 77	.018	.021	46	46

TABLE IV

FIELD TEST MEASUREMENTS ON IH-10

Test Section	Date	Putty Impress.	Sand Patch	SN_{40} In Lane	SN_{40} Out Lane
F-11	Dec. 73	.081	.070	66	72
Burlap +	July 74	-	.053	67	64
1/4" Long.	Aug. 77	.035	.036	55	50
F-12	Dec. 73	.075	.061	65	68
Burlap +	July 74	-	.045	63	61
1/2" Long.	Aug. 77	.042	.044	55	52
F-13	Dec. 73	.062	.045	53	64
Burlap +	July 74	-	.029	51	55
1" Long.	Aug. 77	.022	.027	55	50
F-14	Dec. 73	.065	.052	57	68
Burlap +	July 74	-	.033	52	58
3/4" Long.	Aug. 77	.021	.030	56	51
F-15	Oct. 73	.058	.049	68	-
1/4" Long.	July 74	-	.031	55	-
Tines	Aug. 77	.017	.021	51	
F-16	Dec. 73	.068	.065	59	72
1/8" Long.	July 74	-	.029		62
Tines	Aug. 77	.013	.019		46
F-17	Dec. 73	.034	.027	52	59
Burlap	July 74	-	.025	58	57
Control	Aug. 77	.017	.025	53	52

TABLE IV (CONT.)

FIELD TEST MEASUREMENTS ON IH-10

Test Section	Date	Putty Impress.	Sand Patch	SN_{40} In Lane	SN_{40} Out Lane
F-18	Dec. 73	.050	.052	73	79
1/8" Trans.	July 74	-	.028	68	63
Tines	Aug. 77	.018	.025	64	52
F-19	Dec. 73	.031	.031	58	69
1/4" Trans.	July 74	-	.020	60	56
Tines	Aug. 77	.019	.024	58	50
F-20	Dec. 73	.021	.022	59	64
Trans.	July 74	-	.014	59	54
Brush	Aug. 77	.016	.018	59	44
F-21 Burlap +	Dec. 73	.030	.031	55	67
1" Trans.	July 74	-	.019	61	58
Tines	Aug. 77	.016	.018	58	49

TABLE V

AVERAGE PERCENT TEXTURE LOSS BEFORE, AFTER

	Section	Dec. 71	June 74	% Loss Before	Text. Depth July 77		% Loss After
T. Br.	F-1	.057	.030	47	0.027	.030	53
1/8" T. Tine	F-2	.064	.050	22	0.047	.017	27
L. Br.	F-3	.036	.018	50	0.021	.015	42
1/8" L.Tine	F-4	.093	.051	45	0.047	.046	49
Bur. + 1/8" L. Tine	F-5	.083	.062	25	0.070	.013	16
Bur. Drag	F-6	.028	.023	18	0.028	0	0
T.Brush	F-7	.031	.026	16	0.021	.010	32
				31.9%			31.2%

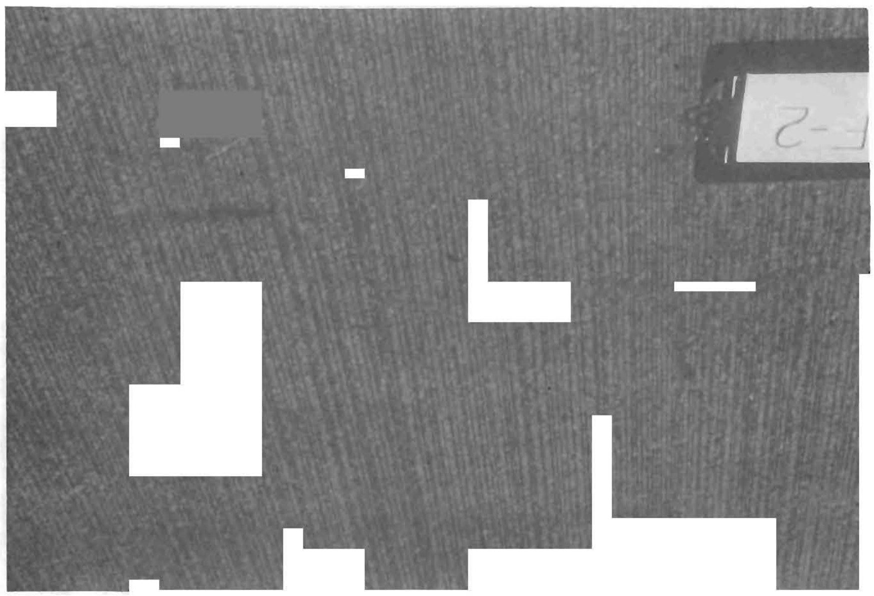
TABLE VI

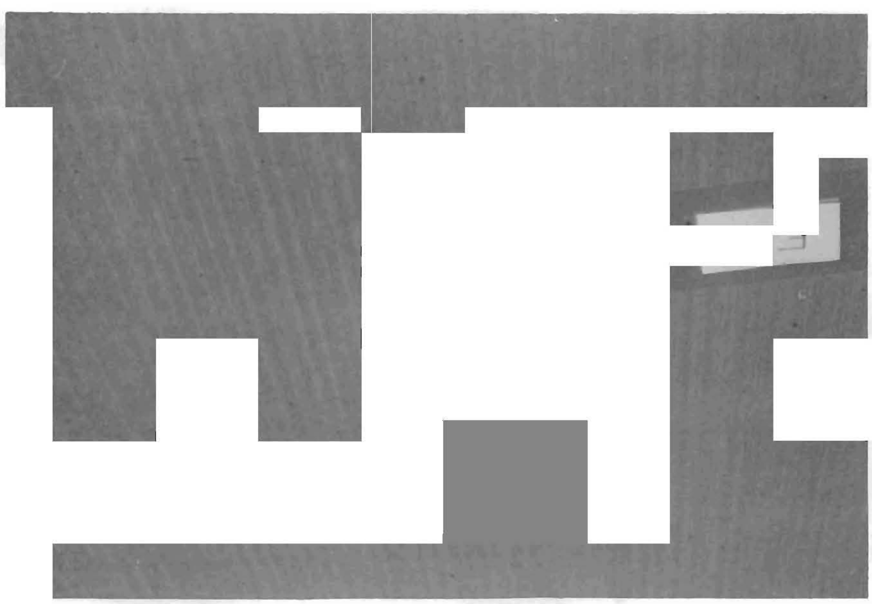
AVERAGE PERCENT TEXTURE LOSS BEFORE, AFTER

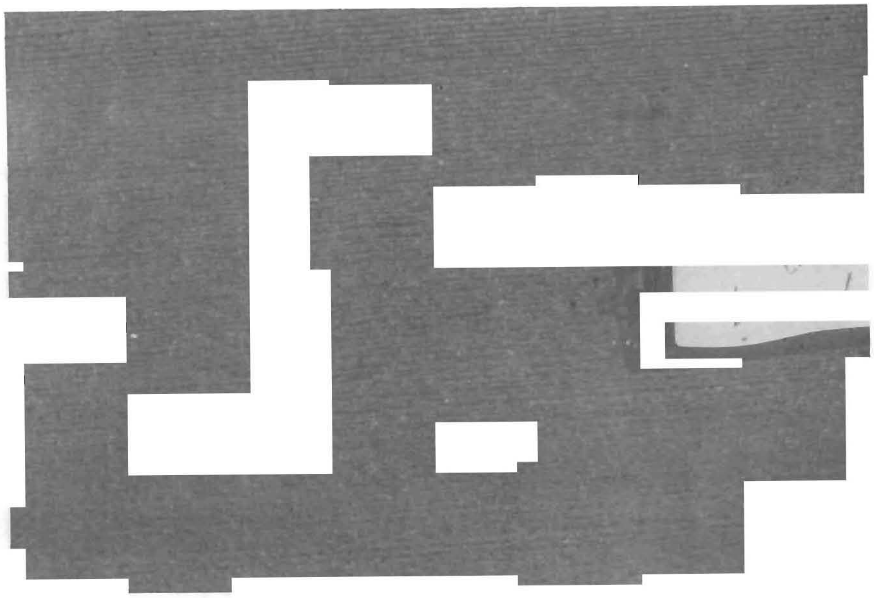
	Section	Texture Depth Dec. 73	Texture Depth July 74	% Loss Before	Text. Depth Aug. 77	% Loss After
Bur. + 1/4" L.	F-11	.070	.053	24	.036	49
Bur. + 1/2" L.	F-12	.061	.045	26	.044	28
Bur. + 1" L.	F-13	.045	.029	36	.027	40
Bur. + 3/4" L.	F-14	.052	.033	36	.030	42
1/4" L.	F-15	.049	.031	37	.021	57
1/8" L.	F-16	.065	.029	55	.019	71
Burlap	F-17	.027	.025	7	.025	7
1/8" Trans.	F-18	.052	.028	46	.025	52
1/4" T.	F-19	.031	.020	35	.024	23
Trans. Brush	F-20	.022	.014	36	.018	18
Bur. + 1" T.	F-21	.031	.019	39	.018	42
				34.3		39.0

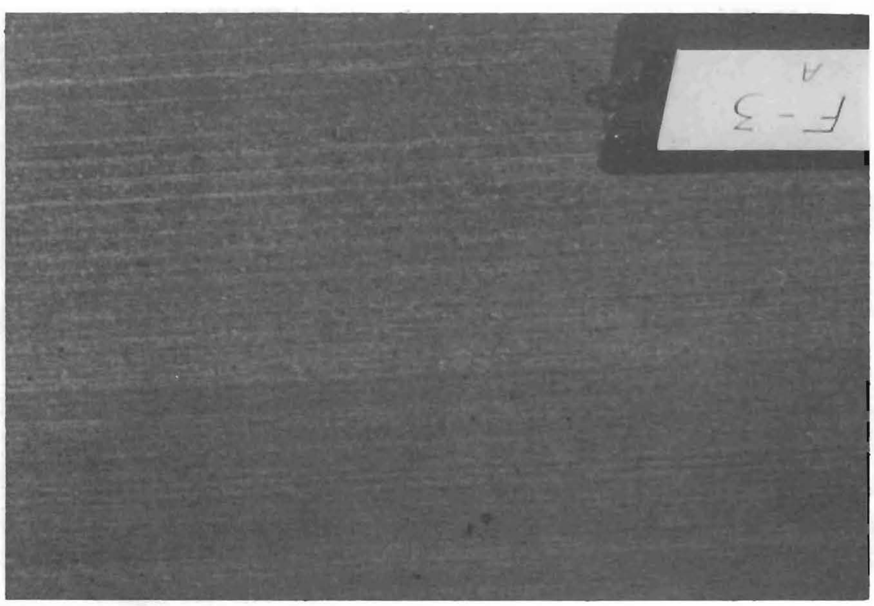
APPENDIX

Pictures of the Test Sections
Obtained July & August, 1977





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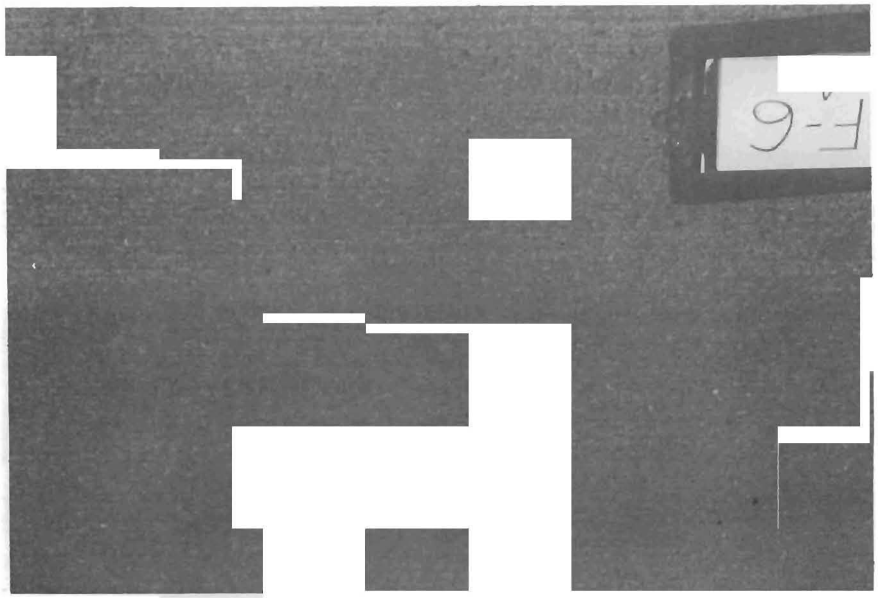
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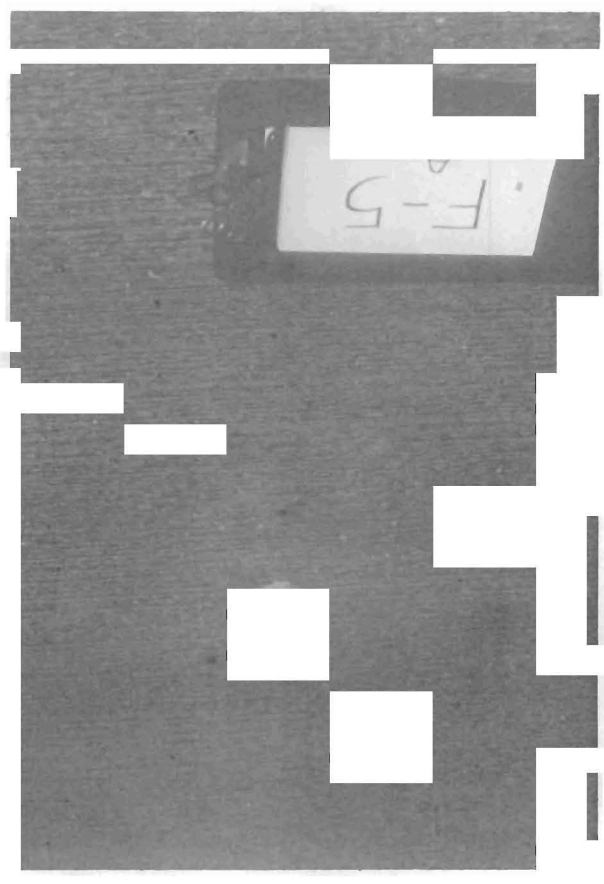
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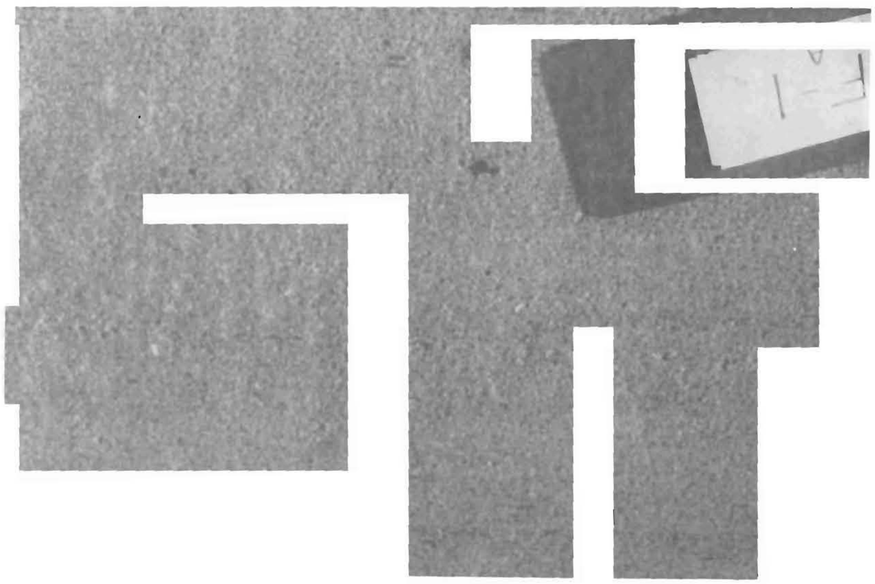

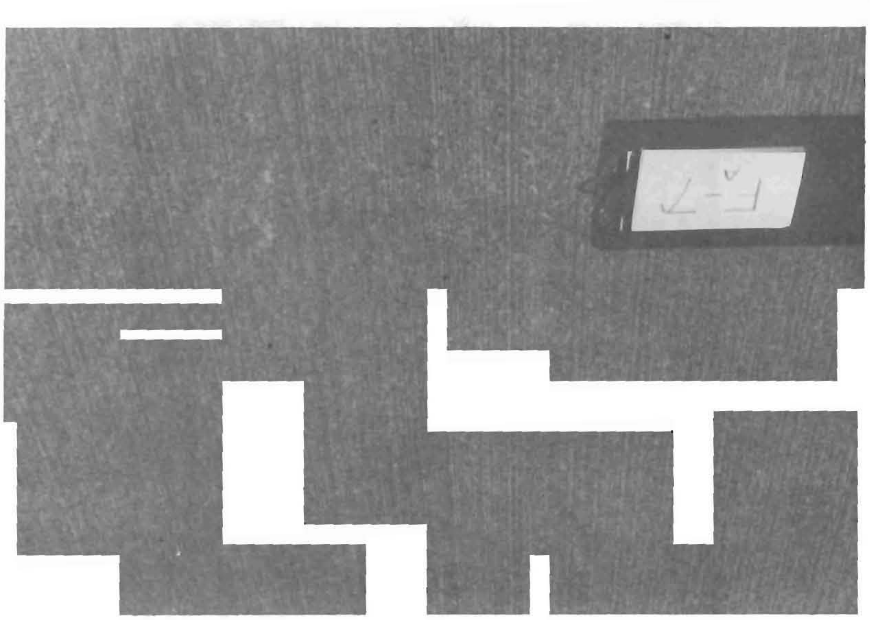

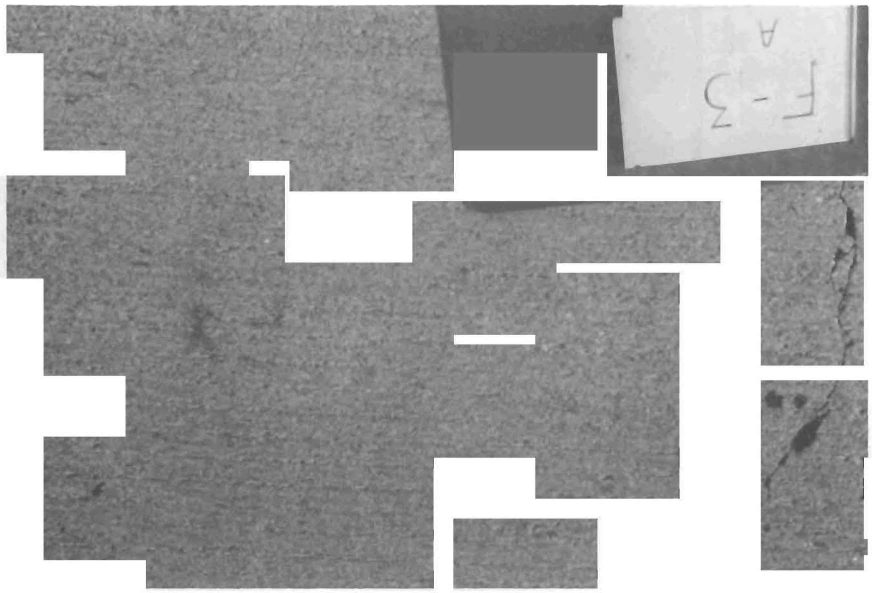
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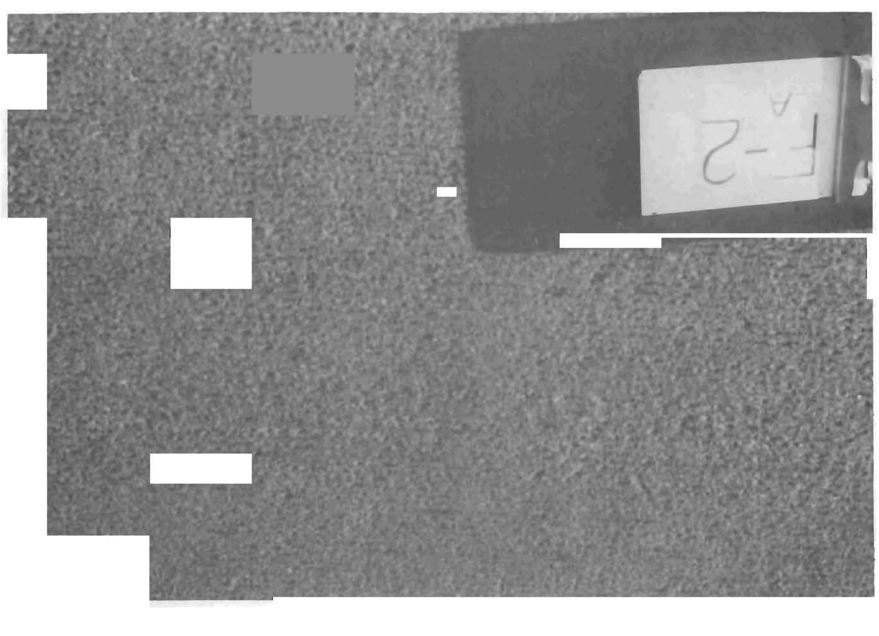
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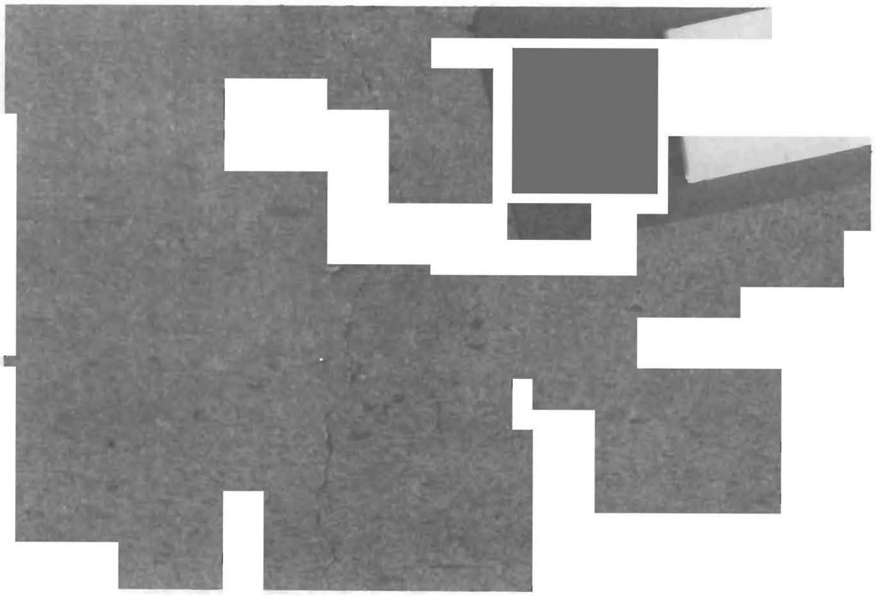

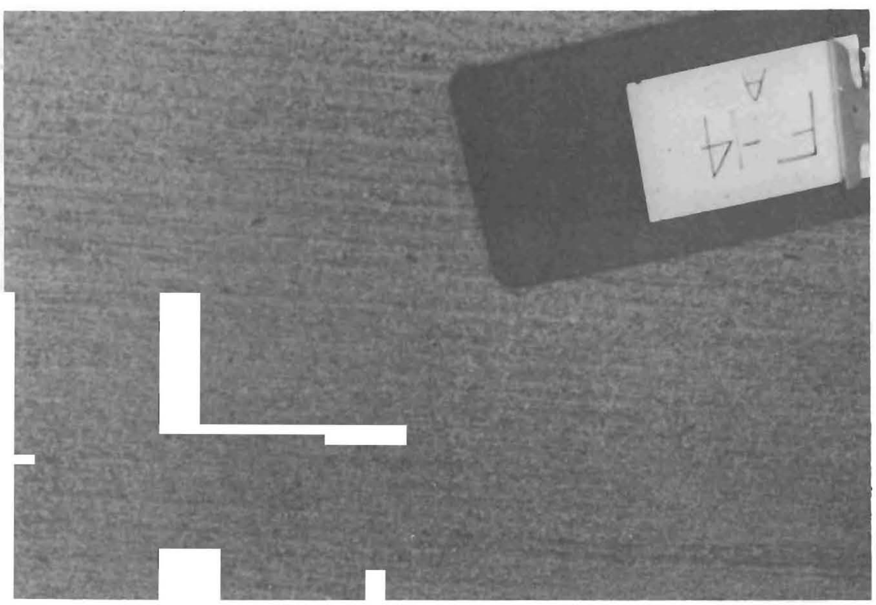
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