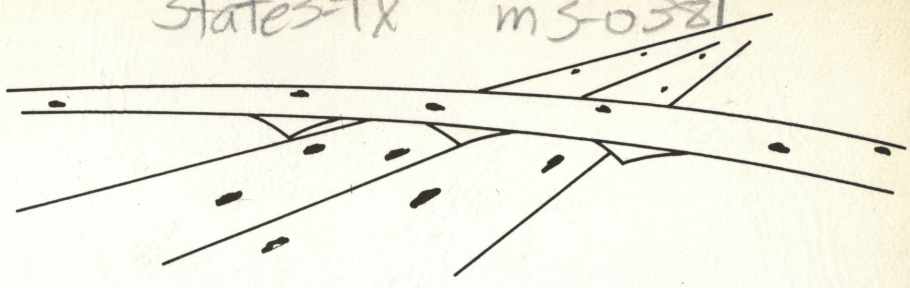

DEPARTMENTAL RESEARCH

Report Number

Skid Resistance of Trap Mix

by

Ken Hankins

TEXAS HIGHWAY DEPARTMENT

CEC

Skid Resistance of Trap Mix

by

Kenneth D. Hankins

Texas Highway Department

Highway Design Division - Research Section

February 1972

Texas Highway Department
Form 433-B

47407—1259—50m

INTEROFFICE MEMORANDUM

TO: Mr. R. L. Lewis

Date February 29, 1972

FROM: John Nixon and Ken Hankins

Responsible

SUBJECT: Skid Resistance of Trap Mix

Desk D-8 R 720.33

In response to your recent request concerning Trap Mix, we have collected the following information. As you know Trap Mix is composed of Knippa Trap Rock and Limestone Rock Asphalt. It is placed cold and a laydown machine can be used. As closely as we can determine the Trap Mix has been placed in two Districts as follows:

District 15 - a. US 90 near Hondo
b. IH 410 near the District Office in San Antonio

District 20 - a. IH 10 near Pine Street in Beaumont
b. US 69 near Port Arthur

We will attempt to analyze the skid resistance of the material by first studying the two material components and second by indicating the skid resistance of the Trap Mix. FHWA is presently participating in safety overlays on interstate highways when the skid number is 35 or lower, therefore we have selected an SN = 35 as a friction value with which to compare materials.

I. Material Components

A. Limestone Rock Asphalt

Limestone Rock Asphalt has been used for years in seals and has been placed as a cold lay asphaltic concrete with both a a machine and by blade. Recently it was used as a coarse aggregate in a hot mix asphaltic concrete near Brownwood. The Materials and Tests Division reports the following.

Polish Value - 50
Percent Insoluble - 4.0%
L. A. Abrasion - Data Unavailable

The "Percent Insoluble" is determined with the acid leaching Insoluble Residue Test. It is unusual to find materials with high friction values where low insoluble residue contents are found (values above 40 to 50% generally produce lasting skid resistance). However, the Polish Value is rather high. This would indicate that the skid resistance is not developed from the sand sized particles in the aggregate, but rather from the holes or blib structure left when the asphalt weathers away or leachs out with the heat of the sun. The same appears true in the field.

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INTEROFFICE MEMORANDUM

TO: Date

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SUBJECT: Skid Resistance of Trap Mix, Continued Desk .....
Page 2

The friction data for Limestone Rock Asphalt is attached and consists of the following:

1. All skid information collected in 1971 for Cold Mix Limestone Rock Asphalt (Blade On as versus Machine Laid cannot be separated). Fig. 1

2. All skid information collected in 1971 for Limestone Rock Asphalt used in a Seal Course. Fig. 2

3. Friction versus Traffic plots for five sections in District 19. Fig. 3

Please note that many other LRA sections are in place but complete skid resistance information was not available.

In items 1 and 2 above, based on greater than an SN of 35 or less than an SN of 35, the following was found:

	Sites Equal to or Greater than 35	Sites Less Than 35
Cold Mix Limestone Rock Asphalt	20	11
Limestone Rock Asphalt in Seals	10	1

Or approximately 31 percent of the Limestone Rock Asphalt surfaces available to the public in 1971 were less than an SN of 35. The Hot Mix Asphaltic Concrete Section using LRA for the coarse aggregate was found to have an average SN of 47.

By studying the reduction in SN as traffic increases (or the polish) in Figures 1 and 2 it was found that only one section was above an SN of 35 after four million (Total) traffic applications. This was US 79 in Panola County which has an SN of 37 after 4.9 million (Total) traffic applications. Figure 3 indicates a four year skid resistance history of five highways in District 19 which have a Cold Mix Limestone Rock Asphalt Surface. Three of the sections were very low in skid resistance soon after placement. One has an SN of 31 after 9.9 million traffic applications and the fifth section is the US 79 section in Panola County mentioned above.

INTEROFFICE MEMORANDUM

TO: Date

FROM: Responsible

SUBJECT: Skid Resistance of Trap Mix, Continued
Page 3 Desk .....

B. Knippa Trap Rock

The Materials and Tests Division reports the following for Knippa Trap Rock:

Polish Value - 44
Percent Insoluble - Not Available
L. A. Abrasion - 14

Since the Trap Rock is a Basaltic Stone, the insoluble residue content would be very high or almost no loss in the acid leaching test. The Polish Value is mediocre. The material is very hard but it will polish. The friction life will depend largely on how long the aggregate can hold its small scale texture on the aggregate surface before polishing smooth and to some extent on how long the aggregate can hold its sharp angularity.

The Trap Rock materials is not used often in the field, however two experimental sections have been tested periodically and a blend of Trap Rock and Limestone coarse aggregate has been used in San Antonio which also has been tested periodically. Therefore, the field data is as follows:

1. Experimental Site near Buda, Texas on IH 35 Trap Rock was used in a seal. Figure 4

2. Hot Mix Asphaltic Concrete Experimental Site on IH 410 in San Antonio 35% of the Coarse Aggregate (+10) was Trap Rock. Figure 5

3. Three sections were placed in San Antonio. Each section was Hot Mix Asphaltic Concrete and contained approximately 35% Trap Rock in the Coarse Aggregate (+10).

   a. IH 35 - From IH 10 to Loop 13 - Fig. 6
   b. IH 10 - From Fredricksburg Road to Wonderland Dr. - Fig. 7
   c. IH 35 - From Broadway St. to Rittiman Road - Fig. 8

Figures 4 through 8 indicate Trap Rock polishes to an SN of 35 after around 2 to 4 million traffic applications.

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47407—1259—50m

INTEROFFICE MEMORANDUM

TO: Date

FROM: Responsible

SUBJECT: Skid Resistance of Trap Mix, Continued
Page 4

Desk .....

II. Trap Mix

In each occasion on our records, approximately 25% of the Trap Mix is composed of Knippa Trap Rock and 75% of the mix is Limestone Rock Asphalt. The field tests indicate the following:

A. US 90 near Hondo - Figure 9
B. IH 410 in San Antonio - Figure 10
C. IH 10 in Beaumont - Figure 11
D. US 69 in Port Arthur

Only one skid test was made on US 69 in Port Arthur and this test revealed an average SN of 38 after approximately 3 million traffic applications. The oldest of the sections is shown in Figure 11 and it appears to have polished to an SN of 35 after approximately 6 to 8 million traffic applications. Two of the sections are measuring 34 (IH 410 in San Antonio) and 38 (US 69 in Port Arthur) after approximately 3 million traffic applications and the fourth section (US 90 near Hondo) measured 42 after approximately one half million traffic applications. It should be noted that the skid number of the IH 410 section is the average of the inside and outside lanes. The outside lane presently has an average skid number of 31 with 37 on the inside.

It would appear from a study of the Trap Mix and of the two material components that the mix will polish to an SN of 35 at approximately 4 to 8 million traffic applications.

For your information the following table indicates the point at which Trap Mix would be expected to polish to an SN of 35 or lower considering a 4 to 8 million range.

No. of Years in Place	4 Million Single Lane Traffic Applications	8 Million Single Lane Traffic Applications
1 Year	10,990 veh. per lane per day	21,980 veh. per lane per day
2 Years	5,550 " " " " "	10,990 " " " " "
3 Years	3,660 " " " " "	7,330 " " " " "
4 Years	2,750 " " " " "	5,500 " " " " "
5 Years	2,200 " " " " "	4,400 " " " " "

We hope this will be of assistance to you. Thanks for your interest.

NOTE: The Total Traffic Figure Results from Multiplying ADT by the number of days the surface has been in place. All lanes are included.

COLD MIX LIMESTONE ROCK ASPHALT
ALL INFORMATION COLLECTED IN 1971.

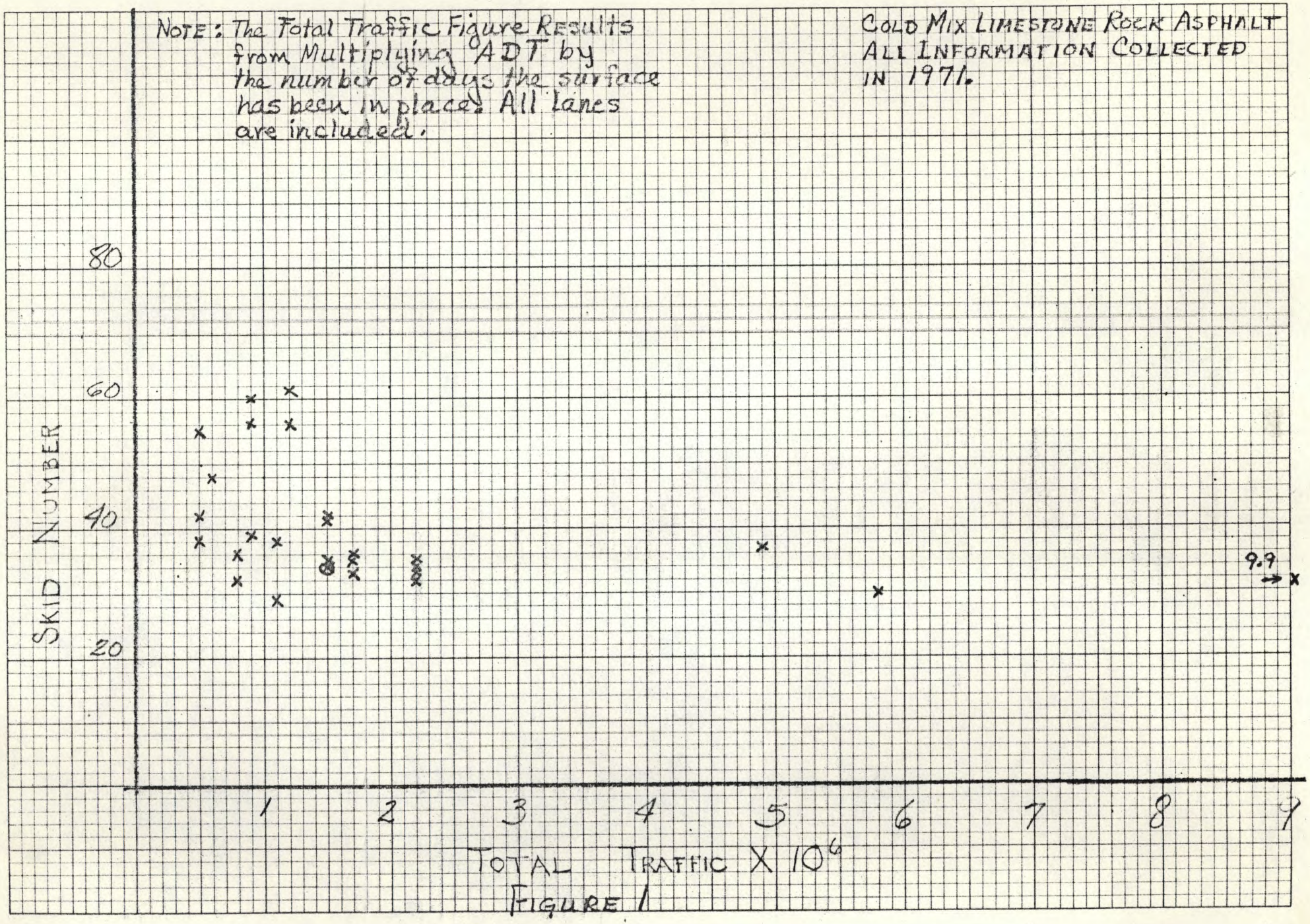

FIGURE 1

Note: The Total Traffic Figure Results from Multiplying ADT by the number of days the surface has been in place. All lanes are included.

LIMESTONE ROCK ASPHALT USED IN SEAL COURSES. ALL INFORMATION COLLECTED IN 1971.

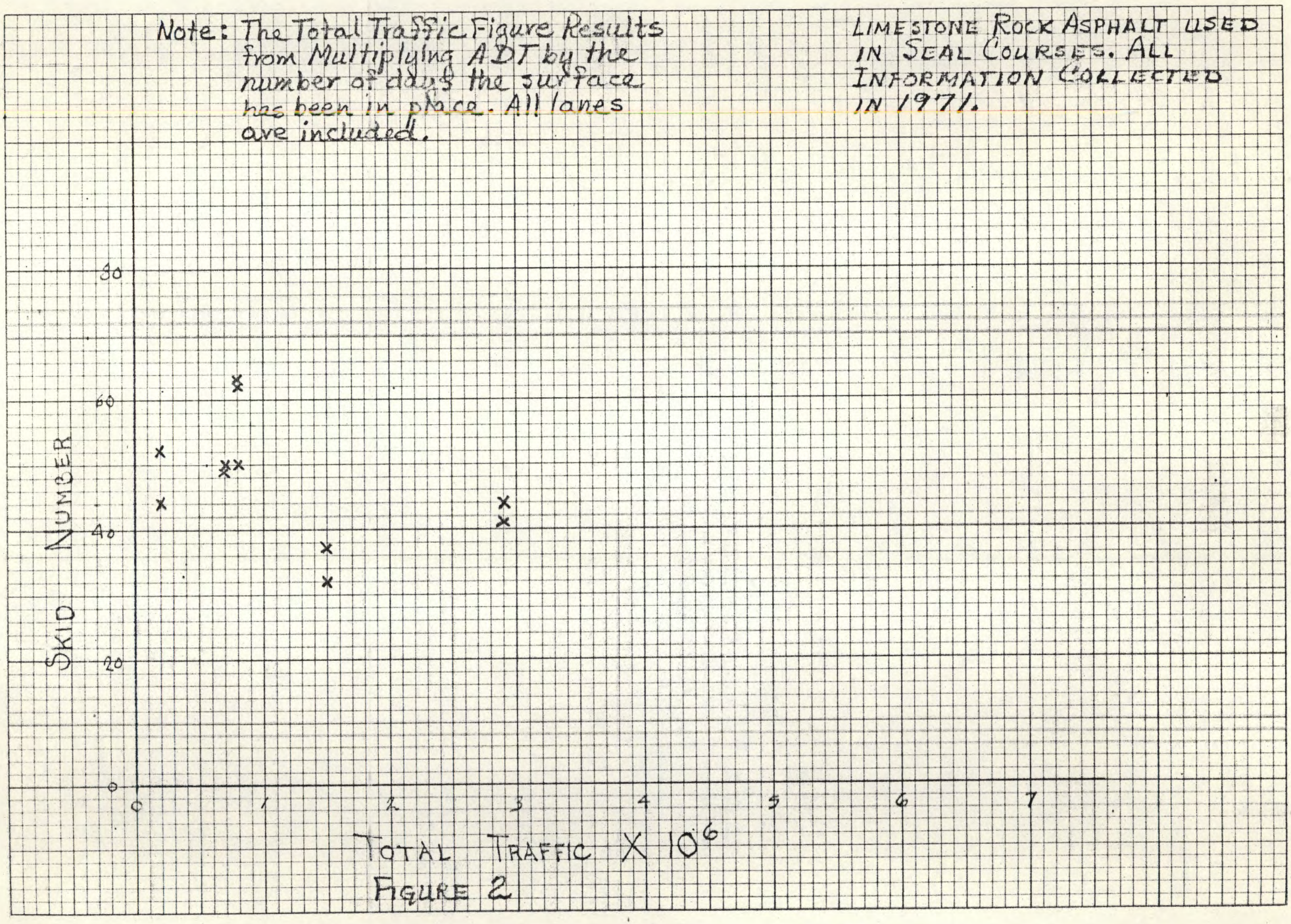

FIGURE 2

Note: The Total Traffic Figure Results from Multiplying ADT by the Number of days the surface has been in place. All Lanes are included.

FOUR YEAR HISTORY OF COLD MIX LIMESTONE ROCK ASPHALT FIVE HIGHWAYS IN DIST. 19

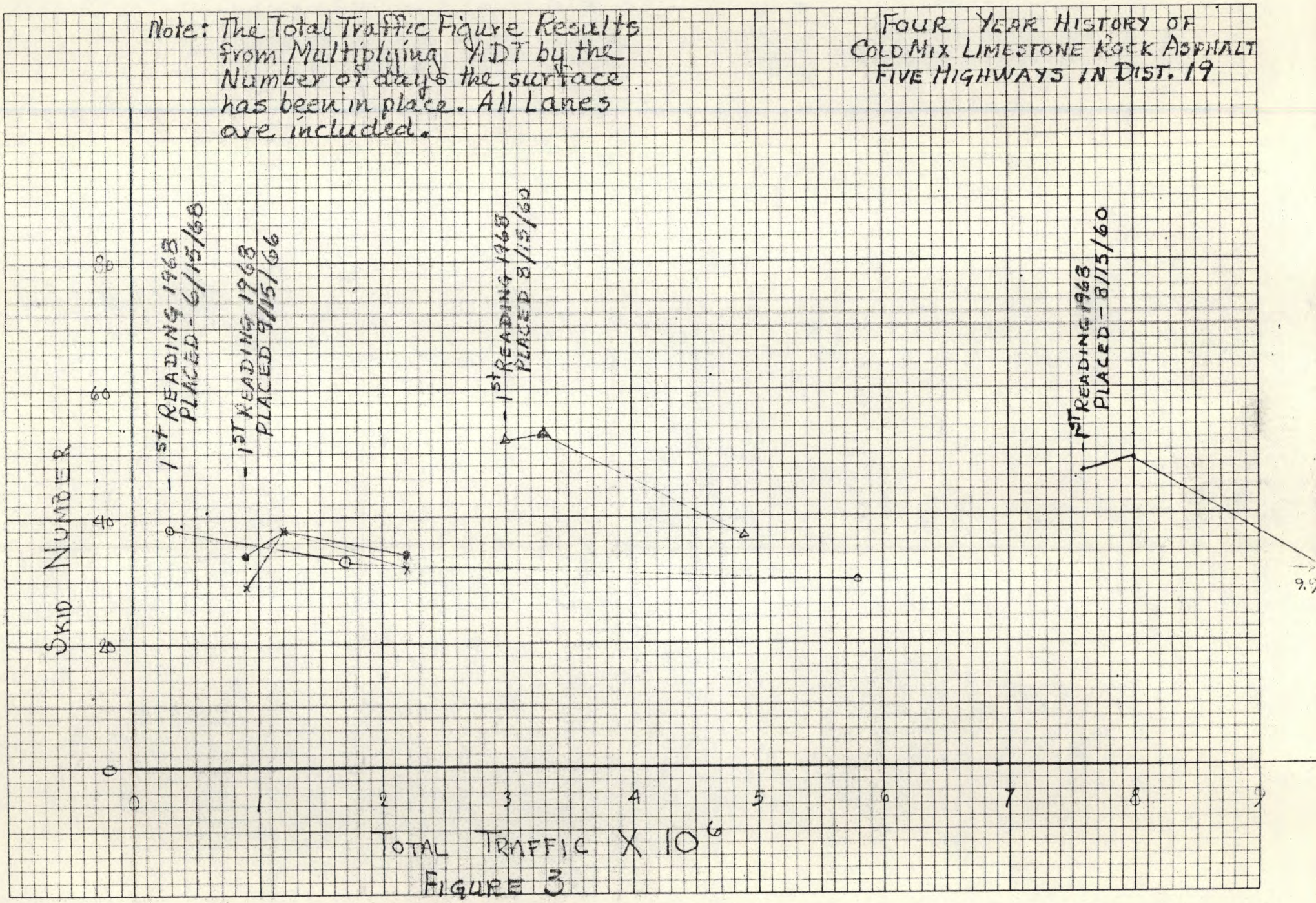

FIGURE 3

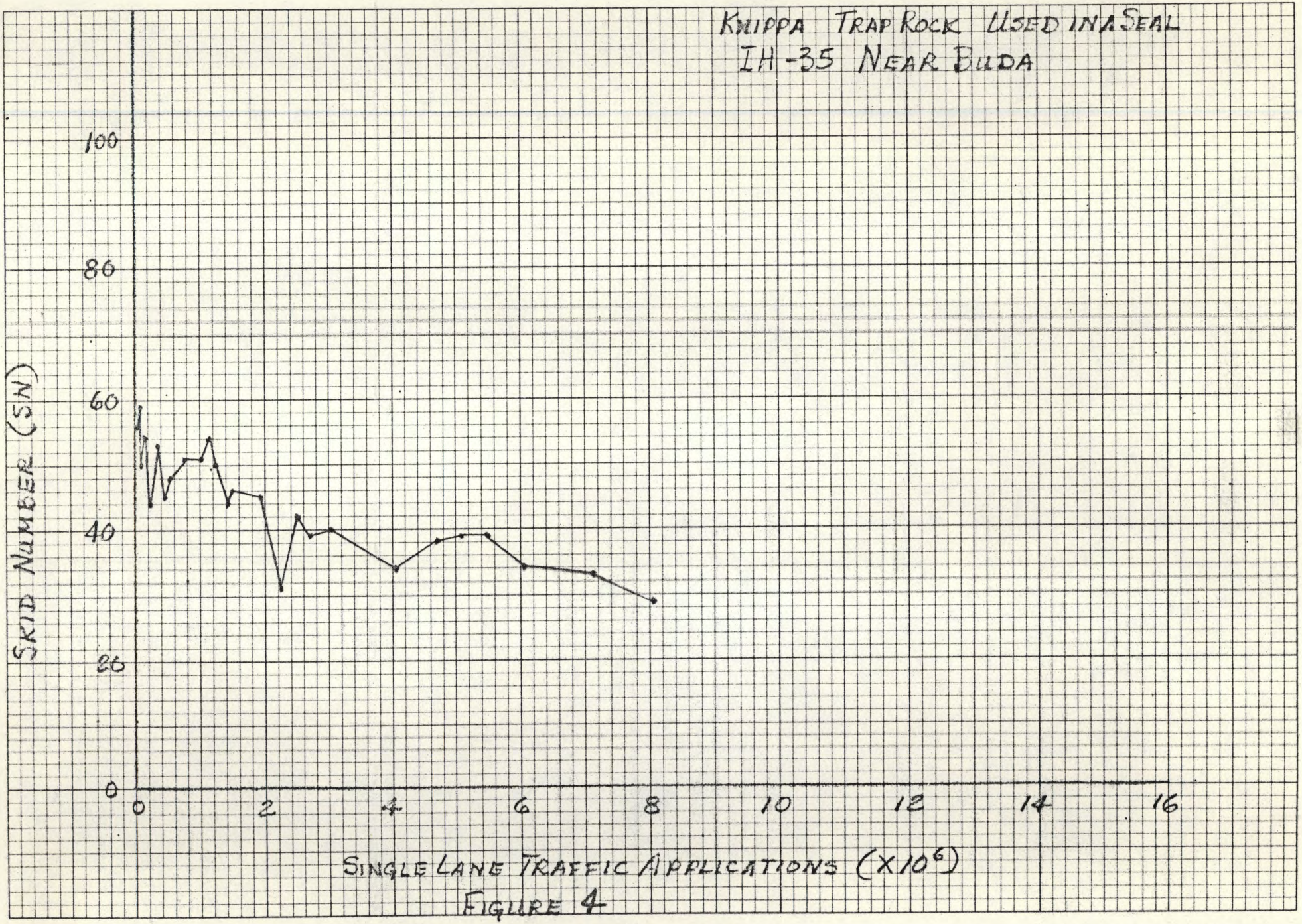
KNIPPA TRAP ROCK USED IN A SEAL
IH-35 NEAR BUDA
SKID NUMBER (SN)
100
80
60
40
20
0
0
2
4
6
8
10
12
14
16
SINGLE LANE TRAFFIC APPLICATIONS (X10⁶)

FIGURE 4

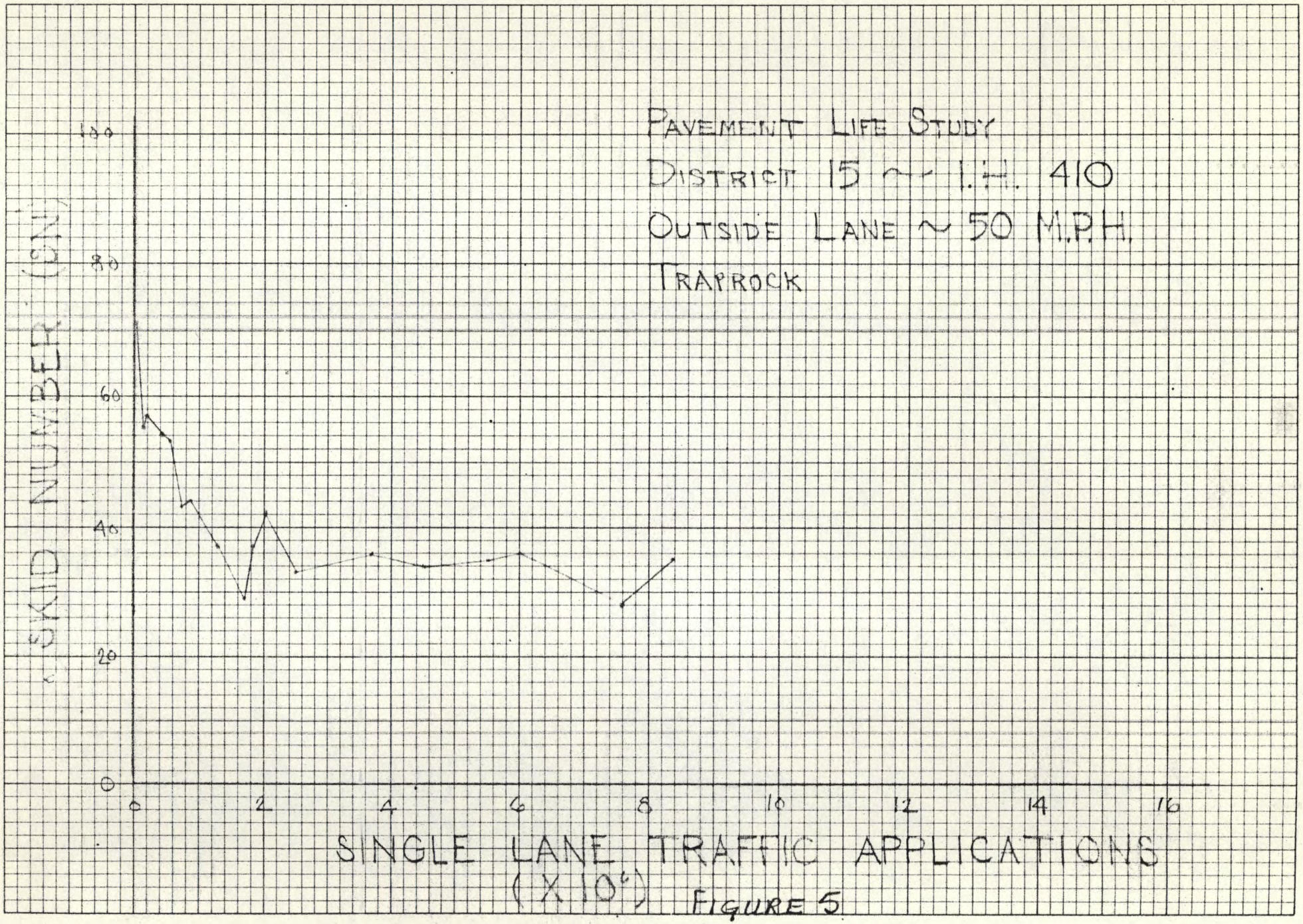
PAVEMENT LIFE STUDY
DISTRICT 15 ~ I.H. 410
OUTSIDE LANE ~ 50 M.P.H.
TRAPROCK
SKID NUMBER (SN)
100
80
60
40
20
0
0
2
4
6
8
10
12
14
16
SINGLE LANE TRAFFIC APPLICATIONS
(X 10⁴)

FIGURE 5

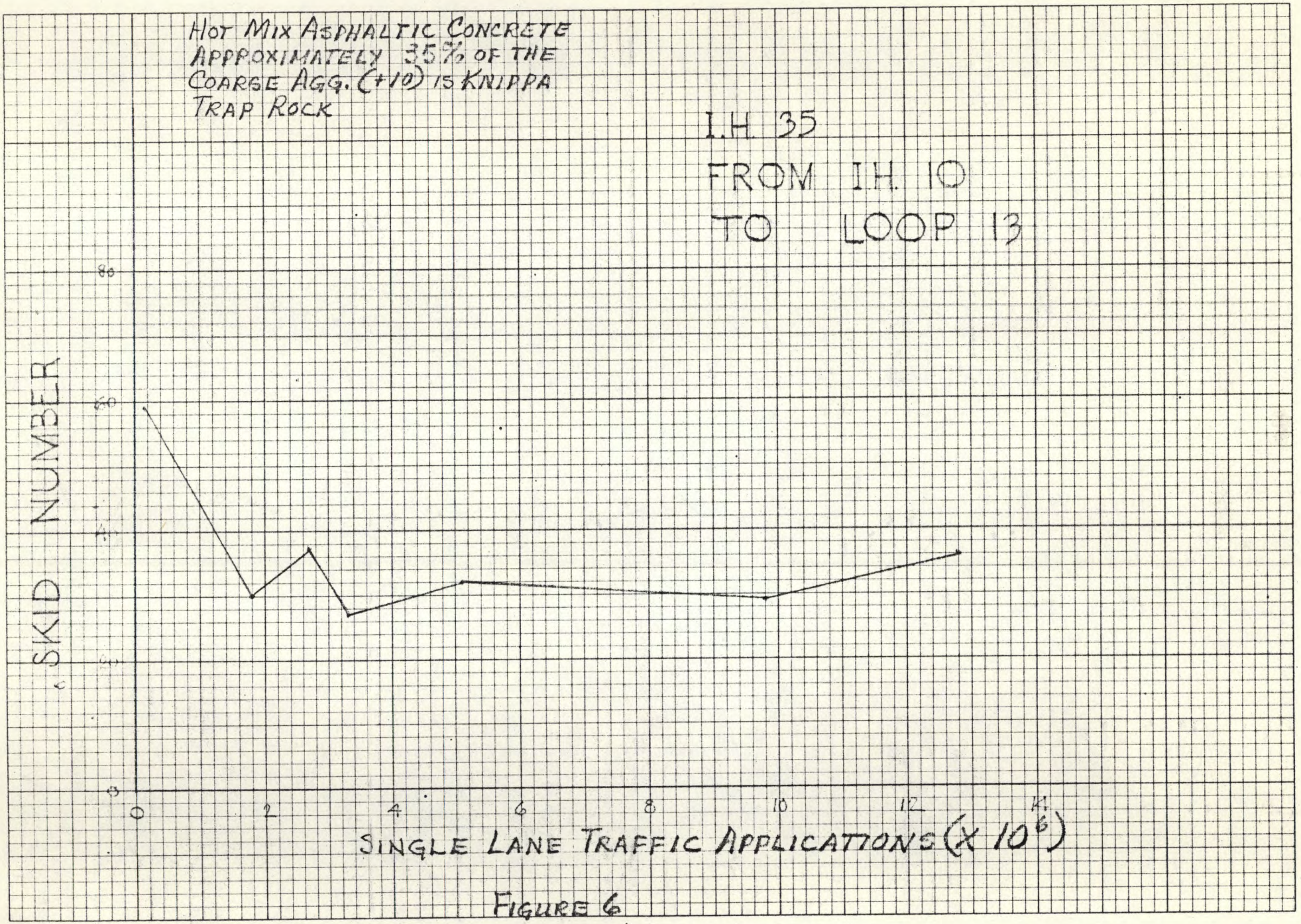
HOT MIX ASPHALTIC CONCRETE
APPROXIMATELY 35% OF THE
COARSE AGG. (+10) IS KNIPPA
TRAP ROCK
I.H. 35
FROM I.H. 10
TO LOOP 13
SKID NUMBER
80
60
40
0
2
4
6
8
10
12
14
SINGLE LANE TRAFFIC APPLICATIONS (X 10^6)

FIGURE 6

HOT MIX ASPHALTIC CONCRETE
APPROXIMATELY 35% OF THE
COARSE AGG. (+10) IS KNIPPA TRAP
ROCK

I.H. 10
FROM FREDRICKSBURG RD.
TO WONDERLAND DR.

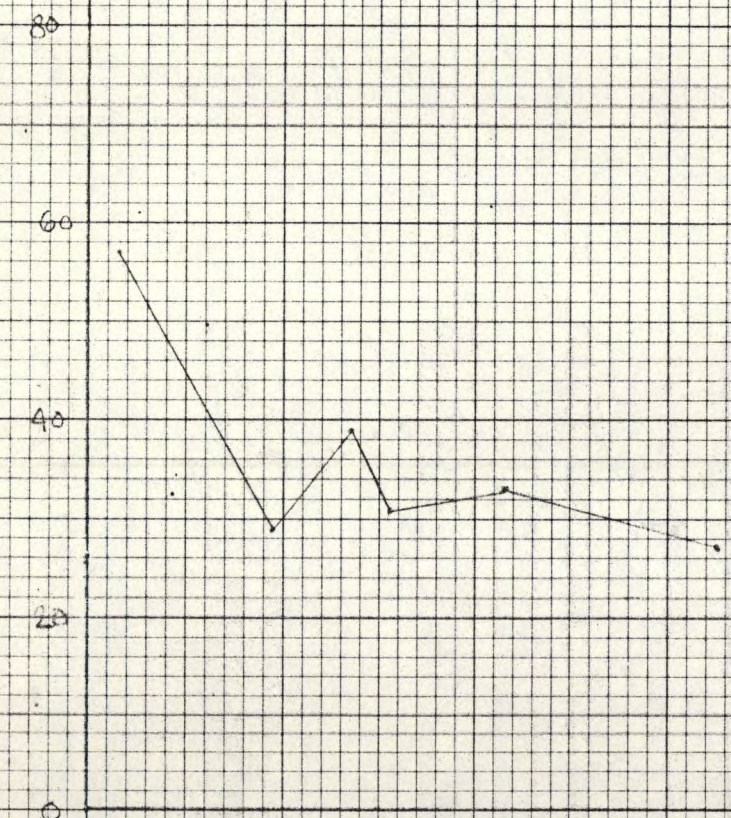

FIGURE 7

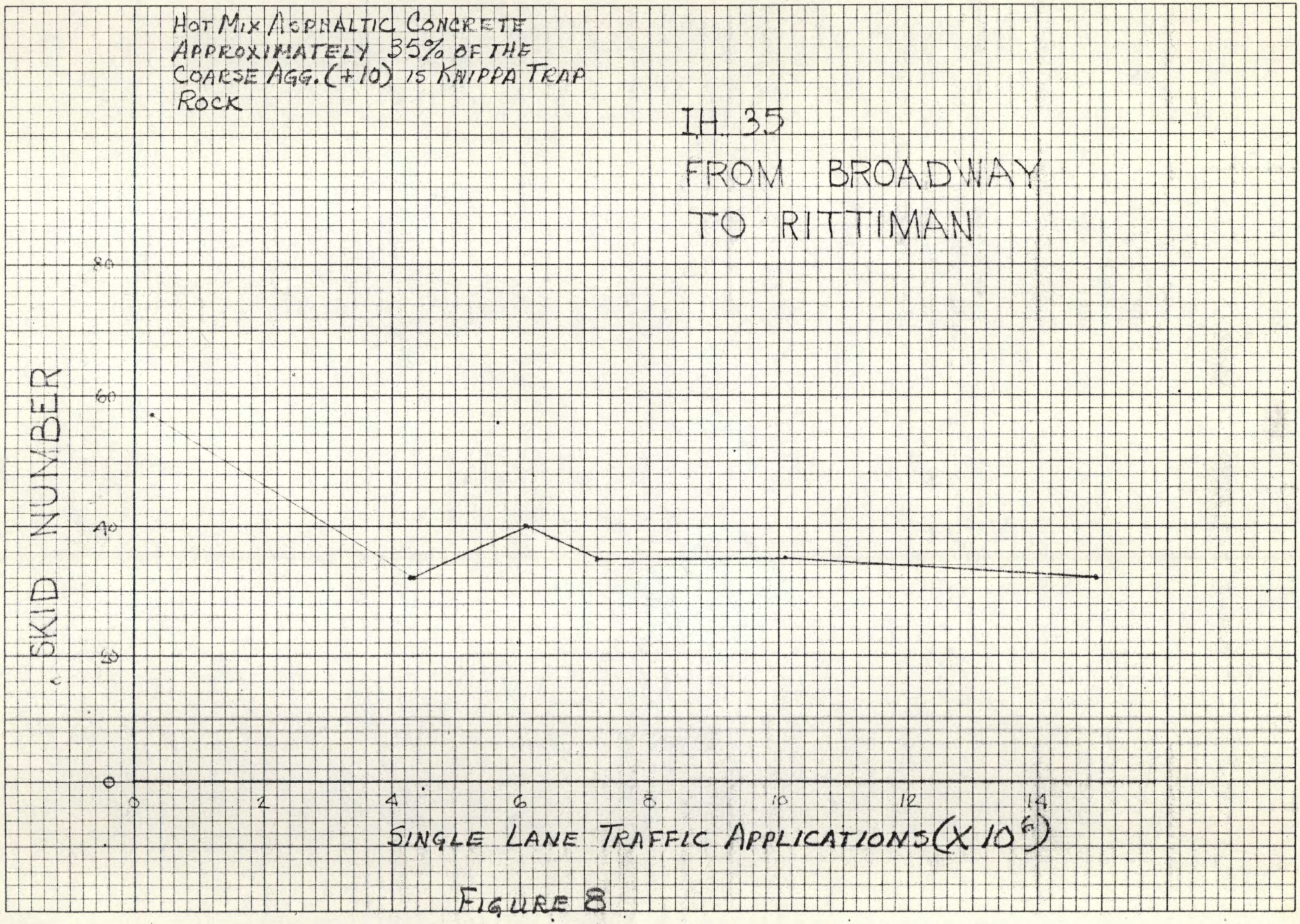
HOT MIX ASPHALTIC CONCRETE
APPROXIMATELY 35% OF THE
COARSE AGG. (+10) IS KNIPPA TRAP
ROCK
I.H. 35
FROM BROADWAY
TO RITTIMAN
SKID NUMBER
80
60
40
20
0
0
2
4
6
8
10
12
14
SINGLE LANE TRAFFIC APPLICATIONS (X 10⁶)

FIGURE 8

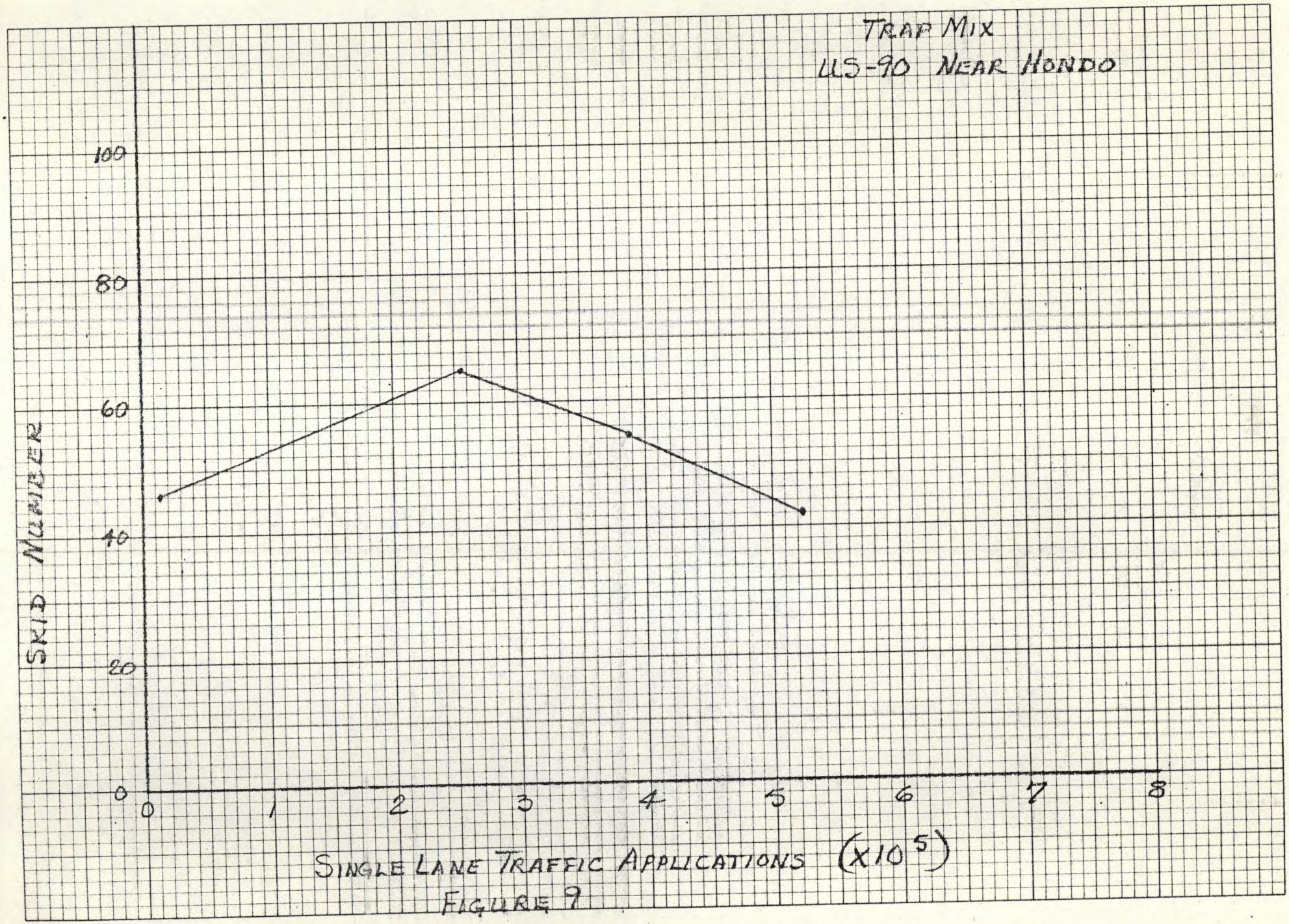
TRAP MIX
US-90 NEAR HONDO
SKID NUMBER
100
80
60
40
20
0
0
1
2
3
4
5
6
7
8
SINGLE LANE TRAFFIC APPLICATIONS (X10 5)

FIGURE 9

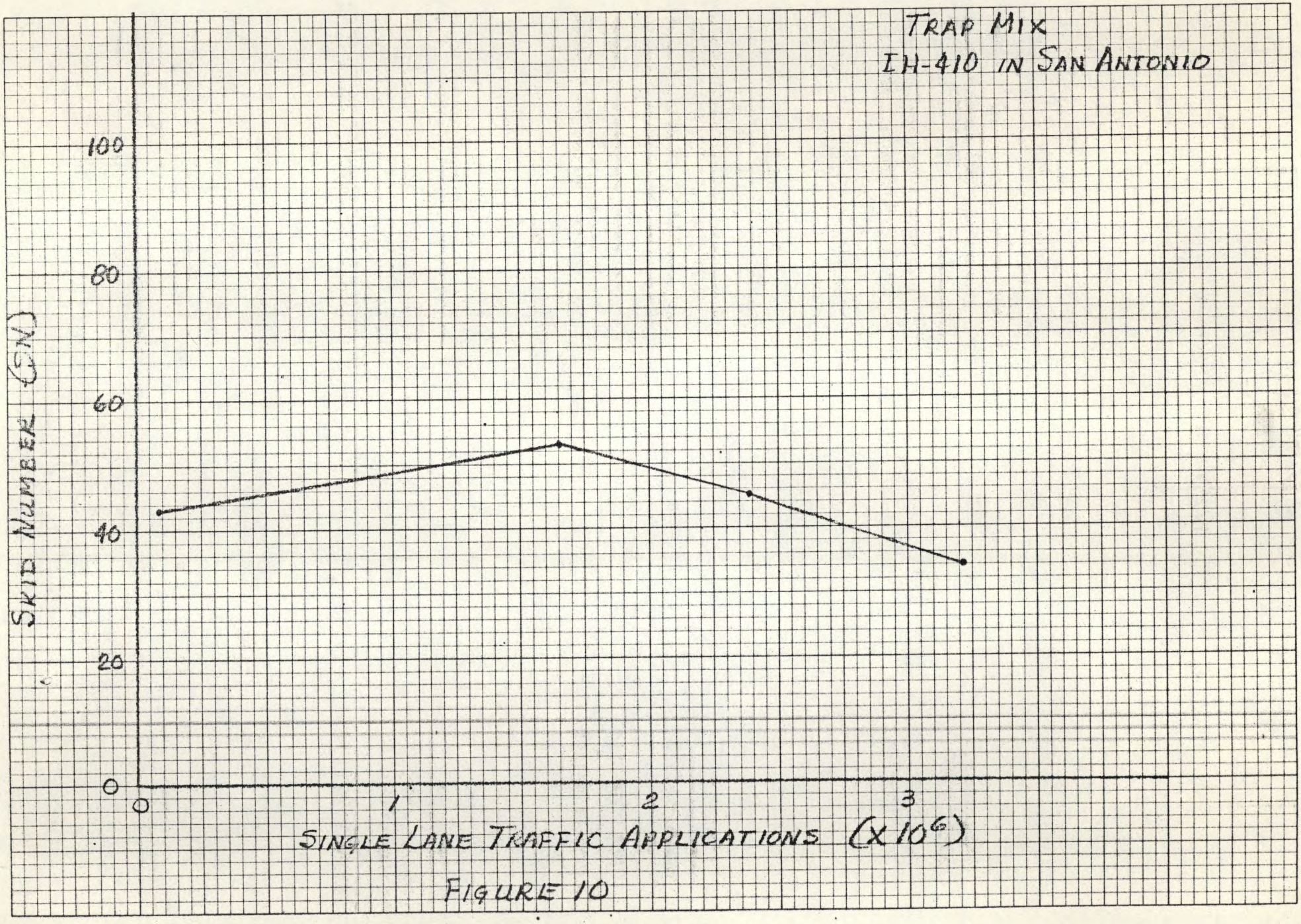
TRAP MIX
IH-410 IN SAN ANTONIO
SKID NUMBER (SN)
100
80
60
40
20
0
0
1
2
3
SINGLE LANE TRAFFIC APPLICATIONS (X 10⁶)

FIGURE 10

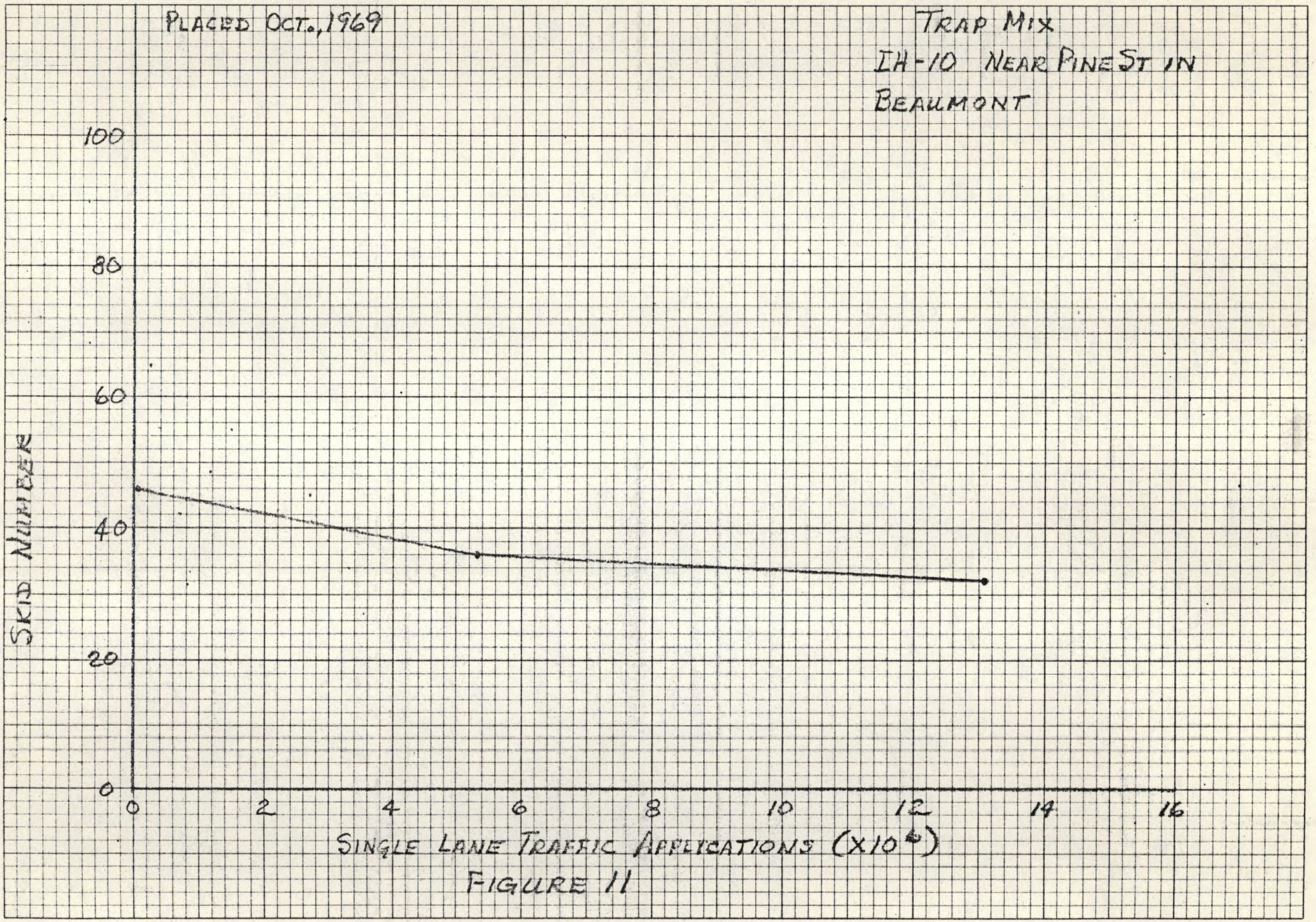
PLACED OCT., 1969
TRAP MIX
IH-10 NEAR PINE ST IN
BEAUMONT
100
80
60
40
20
0
SKID NUMBER
0
2
4
6
8
10
12
14
16
SINGLE LANE TRAFFIC APPLICATIONS (X10⁴)

FIGURE 11

APPENDIX A
All Limestone Rock Asph.
obtained in 1971

Skid Resistance Log

District ___

ADT # County	Highway No.	From **** To	DATE PLACED Date Tested	Skid Resist	Surface Type
2200 BROWN	SH 279	GANDYS CRLI NEEK 50 MPH SPEED LIMIT SIGN	11/5/70 6/17/71	45	HMAC
2200 BROWN	SH 279	BACK	11/5/70 6/17/71	49	HMAC
GREGG	FM 1845	SH 251 NEAR PINTS TREE SCHOOL	6/29/71	28	CMLRA
GREGG	FM 1845	BACK	6/29/71	28	CMLRA
2530 UPSHUR	U.S. 80	1.9 MI. EAST	5/15/60 5/3/71	31	CMLRA
1300 CAMP	U.S. 271	NORTH END LP. 233 SOUTH END LP. 233	9/5/66 5/6/71	32	CMLRA
1300 CAMP	U.S. 271	BACK	9/15/66 5/6/71	34	CMLRA
5540 MORRIS	U.S. 259	SOUTH SIDE DANGERFIELD NORTH SIDE DANGERFIED	6/15/68 5/5/71	30	CMLRA
770 MARION	S.H. 43	R.R. OVERPASS F.M. 805	3/15/69 5/13/71	48	CMLRA
2060 FRANKLIN	U.S. 79	F.M. 31 LOUISIANA ST. LINE	11/15/69 5/13/71	37	CMLRA
7100 BRAZORIA	SH 35	N. OF FM 523 1 MILE NORTH	6/22/71	47	CMLRA
3300 CALDWELL	US 183	S. C.L. OF LOCKHART FM 142 IN LOCKHART	6/29/70 9/14/71	34	CMLRA
3300 CALDWELL	U.S. 183	FM 142 IN LOCKHART N. C.L. OF LOCKHART	6/29/70 9/14/71	41	CMLRA
2770 LEE	U.S. 290	HILLS WEST C.L. OF GIDDINGS	7/15/70 9/16/71	56	CMLRA
3000 LEE	U.S. 290	WEST C.L. OF GIDDINGS EAST C.L. OF GIDDINGS	6/15/70 9/16/71	34	CMLRA
2200 LEE	U.S. 290	EAST C.L. OF GIDDINGS FAYETTE C/L	7/15/70 9/16/71	56	CMLRA
2200 LEE	U.S. 290	BACK	7/15/70 9/16/71	60	CMLRA

APPENDIX A

Skid Resistance Log

District ___

County	Highway No.	From **** To	PLACED Date Tested	Skid Resist	Surface Type
3300 LEE	U.S. 290	E. C.L. OF GIDDINGS U.S. 77	6/15/70 9/16/71	35	CMLRA
1750 LEE	U.S. 77	U.S. 290 IN GIDDINGS FM 448	6/11/70 9/16/71	32	CMLRA
2000 LEE	U.S. 77	FM 448 FM 2440	6/11/70 9/16/71	39	CMLRA
2330 LEE	U.S. 77	FM 2440 US 290 IN GIDDINGS	6/11/70 9/16/71	29	CMLRA
3300 LEE	U.S. 290	U.S. 77 W. C.L. OF GIDDINGS	6/15/70 9/16/71	42	CMLRA
LEE	U.S. 290	W. C.L. OF GIDDINGS HILLS	7/15/70 9/16/71	61	CMLRA
1800 BURNET	U.S. 281	.8 MI. SOUTH S.H. 71 9.5 MI. NORTH S.H. 71	7/26/71 9/23/71	63	SEAL
1800 BURNET	U.S. 281	BACK	7/26/71 9/23/71	62	SEAL
4900 BASTROP	S.H. 71	E. C.L. OF	6/18/70 9/15/71	33	CMLRA
4900 BASTROP	S.H. 71	BACK	6/18/70 9/15/71	35	CMLRA
3250 GILLESPE	U.S. 290	FREDRICKSBURG EAST C.L. FREDRICKSBURG WEST C.L.	4/15/70 9/29/71	35	CMLRA
2100 GILLESPE	US 290	FREDRICKSBURG WEST C.L. U.S. 87 IN FREDSRICKBURG	4/15/70 3/29/71	38	CMLRA
GILLESPE	U S 290	U.S. 87 IN. FREDERICKBURG FREDSRICKSBURG EAST C.L.	4/15/70 9/29/71	36	CMLRA
LANO - GILLESPE	SH 16	1.5 MI. NORTH LOCKHART 2 MI. SOUTH OXFORD	3/7/67 9/30/71	49	SEAL
1000 LLANO	SH 16	SOUTH C.L. OF LLANO NORTH C.L. OF LLANO	5/8/70 9/30/71	38	CMLRA
1000 LLANO	SH. 16	NORTH C.L. OF LLANO S.H. 28 IN LLANO	5/8/70 9/30/71	55	CMLRA
LLANO	S.H. 29	S.H. 16 IN LLANO S.H. 2241	6/20/64 9/30/71	32	SEAL

APPENDIX A

Skid Resistance Log

District ___

County	Highway No.	From **** To	Date Tested	Skid Resist	Surface Type
1006 LLANO	SH 29	R.M. 2241 SH 16 IN LLANO	6/20/69 9/30/71	37	SEAL
1000 LLANO	S.H. 16	S.H 29 IN LLANO SOUTH C.L. OF LLANO	5/8/70 9/30/71	42	CMLRA
GILLESPE	SH 16	2 MI. SOUTH OXFORD 1.5MI. NORTH EKART	9/7/67 9/30/71	50	SEAL
3350 LLANO	R.M. 1431	SH 29 BURNET C/L	5/17/69 6/11/71	41	SEAL
3350 LLANO	R.M 1431	BACK	5/17/69 10/11/71	44	SEAL
1740 LLANO	S.H. 29	S.H. 16 IN LLANO SH WEST OF LLANO	6/16/71 10/1/71	44	SEAL
1740 LLANO	S.H. 29	BACK	6/16/71 10/4/71	52	SEAL
1620 MASON	U.S. 87	S.H. 29 NORTH OF MASON SH 29 IN MASON	5/15/70 10/15/71	36	CMLRA
1600 MASON	S.H. 29	US 87 WEST OF MASON MASON EAST C.L.	5/15/70 10/15/71	50	SEAL
		WEST C/L 1.9 MI. EAST	3/15/60 10/21/68	47	CMLRA

APPENDIX-C
5 SECTION OF CMLRA
IN
DIST. 19

Skid Resistance Log

District ___

ADT County	Highway No.	From **** To	PLACED Date Tested	Skid Resist	Surface Type
2530 UPSHUR	US 80	WOOD C/L 1.9 Mi East	8/15/60 10/21/68	47	CMLRA
2530 UPSHUR	US80	WOOD C/L 1.9 Mi East	8/15/60 4/15/69	49	CMLRA
2060 PANOLA	US 79	FM 31 LOUISIANA ST. LINE	11/15/64 12/2/68	52	CMLRA
2060 PANOLA	US 79	FM 31 LOUISIANA ST. LINE	11/15/64 4/15/69	53	CMLRA
5540 MORRIS	US 259	SOUTH SIDE DANGERFIELD NORTH SIDE DANGERFIELD	6/15/68 8/12/68	38	CMLRA
5540 MORRIS	US 259	SOUTH SIDE DAINGERFIELD NORTH SIDE DAINGERFIELD	6/15/68 4/15/69	33	CMLRA
1300 CAMP	US 271	NORTH END LP 238 SOUTH END LP 238	9/15/66 8/6/68	27	CMLRA
1300 CAMP	US 271	NORTH END LP 238 SOUTH END LP 238	9/15/66 4/15/69	38	CMLRA
1300 CAMP	US 271	SOUTH END LP 238 NORTH END LP 238	9/15/66 8/6/68	34	CMLRA
1300 CAMP	US 271	SOUTH END LP 238 NORTH END LP 238	9/15/66 4/15/69	38	CMLRA

APPENDIX B
Data For Safety Overlays
on IH-35 & IH-10 in San Antonio
Skid Resistance Log

District ___

1.9
2.7
3.1
4.3
6.5

County	Highway No.	From **** To	Date Tested	Skid Resist	Surface Type
25,210 BEXAR	I.H. 10	FREDSRICKSBURG RD WONDERLAND DR.	7/15/67 11/12/68	28	TRAP ROCK LIMESTONE
"	"	"	11/12/68	29	"
"	ASBL "	"	11/12/68	32	"
"	CNBL "	"	11/12/68	28	"
"	BWBL "	"	11/12/68	27	"
"	AWBL "	"	11/12/68	32	"
30,000 "	CWBL	"	7/15/69	29	"
"	CEBL "	"	7/15/69	32	"
"	BEBL "	"	7/15/69	29	"
"	AEBL "	"	7/15/69	34	"
"	SWBL "	"	7/15/69	28	"
"	AWBL "	"	7/15/69	34	"
"	AEBL "	"	4/14/69	41	"
"	CEBL "	"	4/14/69	37	"
"	BWBL "	"	4/14/69	38	"
"	AWBL "	"	4/14/69	42	"
"	CEBL "	"	4/14/69	39	"

2

APPENDIX B

Skid Resistance Log

District ___

County	Highway No.	From **** To	Date Tested	Skid Resist	Surface Type
30,000 BEXAR	IH. 10	FREDRICKSBURG RD WONDERLAND DR	8/15/67 4/14/69	36	TRAP ROCK LIMESTONE
30,870 "	CWBL "	"	2/16/70	33	"
"	BWBL "	"	2/16/70	32	"
"	AWBL "	"	2/16/70	34	"
"	CEBL "	"	2/16/70	33	"
"	BEBL "	"	2/16/70	33	"
"	AEBL "	"	2/16/70	34	"
35,800 "	AEBL "	"	2/23/71	29	"
"	AWBL "	"	2/23/71	27	"
"	BEBL "	"	2/23/71	26	"
"	BWBL "	"	2/23/71	26	"
"	CEBL "	"	2/23/71	27	"
"	CWBL "	"	2/23/71	25	"

Appendix B
Skid Resistance Log

District ___

1.9
2.7
3.3
5.1
9.8
12.8

County	Highway No.	From **** To	Date Tested	Skid Resist	Surface Type
24,280 BEXAR	I.H. 35	IN.35 LOOP 13	3/15/67 11/12/68	30	TRAP ROCK LIMESTONE
"	ASBL "	"	11/13/68	33	"
"	BSBL "	"	11/13/68	31	"
"	CSBL "	"	11/13/68	29	"
"	BNBL "	"	11/13/68	28	"
"	CNBL "	"	11/13/68	26	"
35,600 "	CNBL "	"	7/16/69	29	"
"	CSBL "	"	7/16/69	26	"
"	ANBL "	"	4/14/69	38	"
"	BNBL "	"	4/15/69	33	"
"	ASBL "	"	4/14/69	44	"
"	BSBL "	"	4/15/69	37	"
"	CSBL "	"	4/15/69	35	"
"	CNBL "	"	4/15/69	35	"
52,440 "	ANBL "	"	2/26/70	35	"
"	BNBL "	"	2/26/70	30	"
"	CNBL "	"	2/26/70	34	"

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Appendix B

Skid Resistance Log

District ___

County	Highway No.	From **** To	Date Tested	Skid Resist	Surface Type
62,440	ASBL I.H. 35	I.H. 10 Loop 13	8/15/67 2/26/70	31	TRAP ROCK LIMESTONE
"	BSBL "	"	2/26/70	33	"
"	CSBL "	"	8/26/70	31	"
78,060	CSBL "	"	2/25/71	30	"
"	CNBL "	"	2/25/71	28	"
"	ASBL "	"	2/24/71	33	"
"	ANBL "	"	2/24/71	28	"
"	BSBL "	"	2/24/71	29	"
"	BNBL "	"	2/24/71	26	"
"	ASBL "	"	10/15/71	41	"
"	BSBL "	"	10/15/71	32	"
"	CSBL "	"	10/15/71	36	"

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Appendix B
Skid Resistance Log

District ___

4.3
6.1
7.2
10.1
14.9

County	Highway No.	From **** To	PLACED Date Tested	Skid Resist	Surface Type
57,250 BEXAR	ANBL IN. 35	BROADWAY RITTIMAN RD	8/15/67 11/12/68	32	TRAP ROCK LIMESTONE
"	ASBL "	"	11/13/68	32	"
"	BSBL "	"	11/13/68	31	"
"	CSBL "	"	11/13/68	32	"
"	BNBL "	"	11/13/68	32	"
"	CNBL "	"	11/13/68	34	"
69,710 "	CNBL "	"	7/16/69	35	"
"	CSBL "	"	7/16/69	35	"
"	BSBL "	"	7/16/69	32	"
"	ASBL "	"	7/15/69	38	"
"	BNBL "	"	7/16/69	30	"
"	ANBL "	"	7/15/69	38	"
"	BNBL "	"	4/14/69	42	"
"	BNBL "	"	4/15/69	38	"
"	ASBL "	"	4/14/69	43	"
"	BSBL "	"	4/15/69	38	"
"	CSBL	"	4/15/69	38	"

Appendix B

Skid Resistance Log

District ___

County	Highway No.	From **** To	Date Tested	Skid Resist	Surface Type
69, 710 BEXAR	CNBL IH 35	BROADWAY RITTIMAN RD.	8/15/67 4/15/69	40	TRAP ROCK LIMESTONE
78,570 "	ANBL "	"	2/26/70	36	"
"	BNBL "	"	2/26/70	34	"
"	CNBL "	"	2/26/70	35	"
"	ASBL "	"	2/26/70	34	"
"	BSBL "	"	2/26/70	32	"
"	CSBL "	"	2/26/70	36	"
70,060 "	CSBL "	"	2/25/71	32	"
"	CNBL "	"	2/25/71	33	"
"	ASBL "	"	2/24/71	33	"
"	ANBL "	"	2/24/71	33	"
"	BSBL "	"	2/24/71	31	"
"	BNBL "	"	2/24/71	31	"