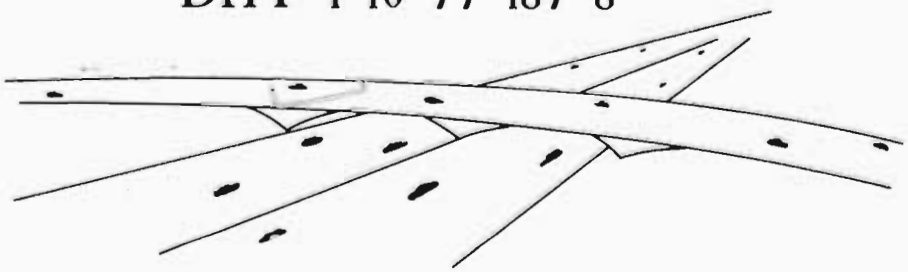
DHT-1-10-77-187-8



DEPARTMENTAL RESEARCH

Report Number 187-8

FOLLOW-UP REPORT ON SAS PAVEMENT IN KENEDY COUNTY-FOURTH-YEAR OBSERVATION

STATE DEPARTMENT OF HIGHWAYS
AND PUBLIC TRANSPORTATION

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA/TX-81/34+187-8		

4. Title and Subtitle	5. Report Date
"Follow up Report on SAS Pavement in Kenedy County - Fourth Year Observation"	June 1981
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7. Author(s)	8. Performing Organization Report No.
Kenneth D. Hankins	Report 187-8

9. Performing Organization Name and Address	10. Work Unit No.
Texas State Department of Highways and Public Transportation Box 5051 Austin, Tx 78763	11. Contract or Grant No. 1-10-77-187
	13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address Same as 9.	Interim
	14. Sponsoring Agency Code

15. Supplementary Notes

Study title: "Demonstrationand Field Test Support"
work done in cooperation with DOT, FHWA. Original State Study No. 1-9-76-519.
Original Study performed under agreement DOT-FH-11-8608, T.O. #6.

16. Abstract

This report describes the fourth year observation of an experimental project utilizing Sulphur-Asphalt-Sand (SAS) as the base material. The comparison material was an asphaltic concrete and a control of flexible base was also selected. Base depths of SAS and asphaltic concrete were 4,7 and 10 inches. Observations after four years indicated all sections were performing well with no trouble expected in the near future. The amount of longitudinal cracking appears to be increasing rapidly; however, a maximum of 206 feet (500 foot test sections) was observed. The cracks are extremely narrow.

17. Key Words	18. Distribution Statement
Sulfur Asphalt Sand	No restrictions Report available from the National Technical Information Service, Springfield, VA. 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	31	

Form DOT F 1700.7 (8-69)

FOLLOW UP REPORT ON SAS PAVEMENT IN KENEDY COUNTY (Original Project 1-9-76-519)

FOURTH YEAR OBSERVATION

by

Kenneth D. Hankins

Research Report 187-8

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

June, 1981

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 and the State Department of Highways and Public Transportation do not endorse products or manufacturers. Trade or manufacturer's names appear herein solely because they are considered essential to the object of this report.

Acknowledgements

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.

Acknowledgement is given to:

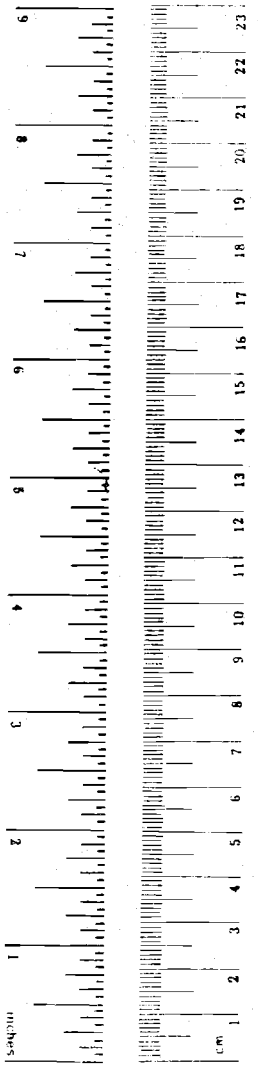
Mr. Brad Hubbard, Mr. Doug Chalman and Mr. James Wyatt for the technical support received during this study.

Mr. G. G. Garcia, District Engineer, and other District 21 personnel for the interest and aid received in the development of this project and report.

METRIC CONVERSION FACTORS

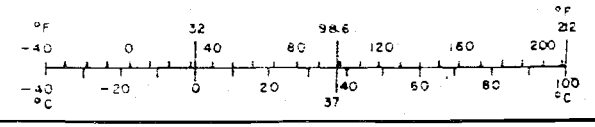
Approximate Conversions to Metric Measures

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



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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IMPLEMENTATION

Implementation of the use of Sulphur-Asphalt-Sand (SAS) will probably be delayed because of the high cost of the material. For example, as much as 15 percent of the total mix is sulphur. Actually, some of the aggregate is replaced by sulphur. Sulphur is approaching the cost of asphalt. However, the primary object of this project was to determine the performance of a SAS mix. In this particular project, at least, the material performed satisfactorily for four years and at this time several more years of service life are expected.

FOLLOW UP REPORT ON
SAS PAVEMENT
IN KENEDY COUNTY
(Original Project 1-9-76-519)

Fourth Year Observation

Background

The first (and only as of 1981) Sulphur-Asphalt-Sand (SAS) section in Texas was placed in Kenedy County on US-77 during the summer of 1977. The experimental sections compared materials and pavement depth. The control or comparison section consisted of one inch of HMAC surfacing on 10 inches of Caliche base. The SAS material was placed in three sections each with a different pavement depth of 4 inches, 7 inches and 10 inches. A one-inch HMAC surfacing was placed on each. A type D HMAC material using only asphalt as a binder was placed as the remaining part of the experiment in depths of 4, 7 and 10 inches. Again a one-inch (type D) HMAC surfacing was placed over these sections.

Objective

The object of this report is to discuss the series of tests obtained on this experiment on May 14, 1981. These tests were conducted in the 47th month after placement and could represent the 4-year test period.

Testing

The official testing and analysis ended after the 36th month. The only tests obtained during the 47th month were deflection and visual rating. Both types of data were collected in a manner similar to previous testing.

Reporting

Summary data from all test periods are included and shown in Tables I through IV. Appendix A shows Deflection Plots (after Little at TTI). Appendices B and C contain the data collected.

Analysis and Results

Basically all sections are still performing well after four years of service. Little visual difference can be noted between the SAS, HMAC or control sections. The roughness (SI) may be increasing slightly. There is little change in deflection values with time. The pavements are stiffer in winter (December) as compared to summer (June). Considering equal depth material and excepting the 7-inch material, the asphalt mix material could be slightly stronger than the SAS. The strengths seem about equal on the 7-inch material. The deflection plots indicate the thicker material is stronger and the more southerly subgrade (SAS) seems stronger than the more northerly (HMAC).

The cracking noted in the visual rating seems to reflect change more readily than other data items. As shown in Table IV, the longitudinal cracking has increased significantly between the third and fourth year. This cracking has extremely small crack width and one must kneel to see the cracks. Therefore, it is believed the pavement is still performing well and no undue concern should be placed on the cracking increase.

However, cracking is a (probably the best) forerunner of failure and it is interesting to note the trends. The following maybe noted:

1. Some of the tranverse cracks (caliche section) were noted during the first (winter) observation. These cracks closed during the summer and opened again during the next winter.

2. A fog seal was placed between the 18th and 24th month. This treatment appears to greatly aid in the sealing or reduction of cracking. Within one year after treatment, transverse cracks could not be found on several sections and a reduction in the longitudinal rate of cracking is evident.

3. Interestingly the 7-(actually 8-)inch depth material initially, and still, has the larger amount of longitudinal cracking.

4. The 10-inch sections are relatively crack-free.

5. The 4-inch sections are beginning to crack more rapidly than the other sections.

Summary and Conclusions

The SAS, HMAC and Control sections are performing well after four years of operation. All sections will probably perform well for several more years.

In Wheelpath -
Outside Lane

TABLE I

MRM VALUES

Date	Control 1980-1985 10" Caliche	1985-1990 10" SAS	1990-1995 7" SAS	1995-2000 4" SAS	2000-2005 4" HMAC	2005-2010 7" HMAC	2010-2015 10" HMAC
Dec. 13, 1977 Init or 6 mo.							
June 16, 1978 12 mo.		3.6	3.2	2.8	3.9	4.1	4.4
Dec. 4&5, 1978 18 mo.		3.3	3.4	2.9	4.4	4.2	4.4
June 6, 1979 24 mo.		2.7	3.5	3.4	4.2	3.9	4.2
June 25, 1980 36 mo.		2.5	3.0	2.7	3.8	3.8	3.5
May 14, 1981 47 mo.	NM	NM	NM	NM	NM	NM	NM

NM - Not Measured

TABLE II

DEFLECTION - STIFFNESS COEFFICIENTS

Date	Control 1980-1985 10" Caliche		1985-1990 10" SAS		1990-1995 7" SAS		1995-2000 4" SAS		2000-2005 4" HMAC		2005-2010 7" HMAC		2010-2015 10" HMAC	
	Subgr.	Pavem.	Subgr.	Pavem.	Subgr.	Pavem.	Subgr.	Pavem.	Subgr.	Pavem.	Subgr.	Pavem.	Subgr.	Pavem.
Dec. 13, 1977 Init or 6 mo.	.28	.88	.24	1.28	.25	1.34	.24	1.84	.23	2.05	.22	1.60	.21	1.53
June 16, 1978 12 mo.	.28	.84	.24	1.14	.27	1.07	.24	1.75	.24	1.85	.23	1.22	.21	1.26
Dec. 4&5, 1978 18 mo.	.29	.83	.24	1.41	.27	1.18	.25	1.81	.24	1.95	.22	1.58	.21	1.57
June 6, 1979 24 mo.	.31	.76	.26	1.12	.28	1.10	.27	1.57	.26	1.73	.25	1.15	.23	1.31
June 25, 1980 36 mo.	.31 (98°F)	.73	.26 (98°F)	1.02	.29 (98°F)	.95	.26 (98°F)	1.58	.25 (98°F)	1.73	.24 (98°F)	1.13	.24 (100°F)	1.14
May 14, 1981 47 mo.	.30 (85°F)	.69	.24 (87°F)	1.23	.27 (87°F)	1.14	.26 (86°F)	1.53	.25 (85°F)	1.83	.23 (86°F)	1.33	.21 (86°F)	1.55

TABLE III

DEFLECTION - SPREADABILITY AND MAXIMUM DEFLECTION

Date	Control 1980-1985 10" Caliche Spread	Max.Def.	1985-1990 10" SAS S.	M.D.	1990-1995 7" SAS S.	M.D.	1995-2000 4" SAS S.	M.D.	2000-2005 4" HMAC S.	M.D.	2005-2010 7" HMAC S.	M.D.	2010-2015 10" HMAC S.	M.D.
Dec. 13, 1977 Init or 6 mo.	65	.010	79	.010	68	.012	64	.019	68	.018	73	.017	83	.011
June 16, 1978 12 mo.	66	.010	75	.011	61	.014	60	.021	62	.021	64	.022	72	.017
Dec. 4&5, 1978 18 mo.	66	.009	82	.009	65	.011	63	.018	66	.018	72	.018	86	.011
June 6, 1979 24 mo.	61	.008	75	.008	62	.010	62	.015	65	.015	67	.016	80	.011
June 25, 1980 36 mo.	61	.009	75	.009	59	.012	58	.018	62	.017	61	.020	78	.012
May 14, 1981 47 mo.	59	.010	76	.009	60	.013	59	.019	66	.016	68	.018	82	.012

Outside Lane

TABLE IV

VISUAL RATING

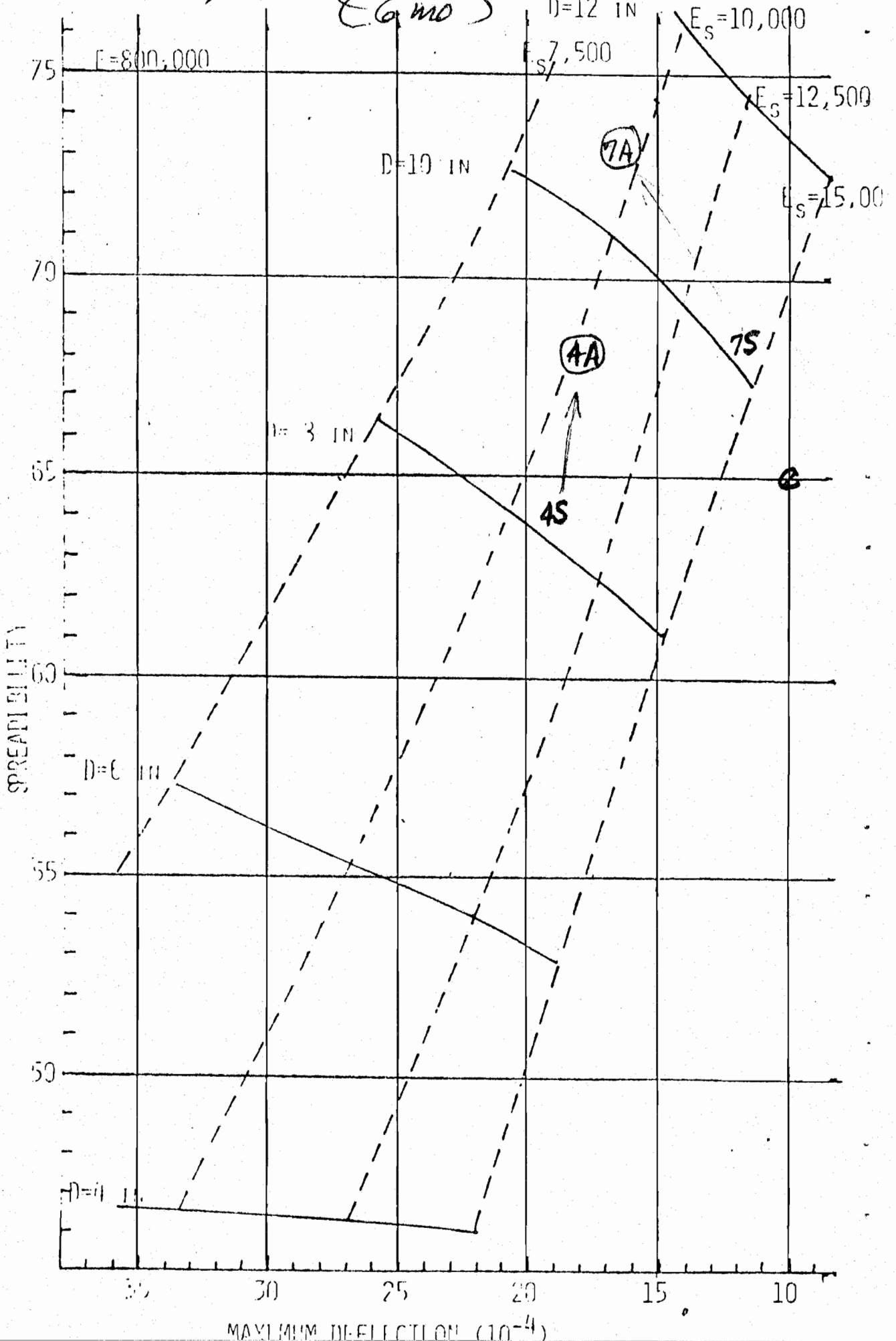
Date	Control 1980-1985 10" Caliche Long.	Trans.	1985-1990 10" SAS Long.	Trans.	1990-1995 7" SAS Long.	Trans.	1995-2000 4" SAS Long.	Trans.	2000-2005 4" HMAC Long.	Trans.	2005-2010 7" HMAC Long.	Trans.	2010-2015 10" HMAC Long.	Trans.
Dec. 13, 1977 Init or 6 mo.	0	12ea	0	0	0	0	0	0	0	0	0	0	0	0
June 16, 1978 12 mo.	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Dec. 4&5, 1978 18 mo.	15'	11ea	0	0	43'	0	15'	3ea	0	0	12'	0	3'	0
Fog Seal														
June 6, 1979 24 mo.	0	6ea	0	1ea	105'	0	20'	1ea	0	0	23'	1ea	3'	0
June 25, 1980 36 mo.	0	0	0	0	108'	0	27'	0	0	0	51'	1ea	6'	0
May 14, 1981 47 mo.	0	0	1'	0	202'	0	182'	3ea	155'	0	206'	2ea	31'	0

APPENDIX A

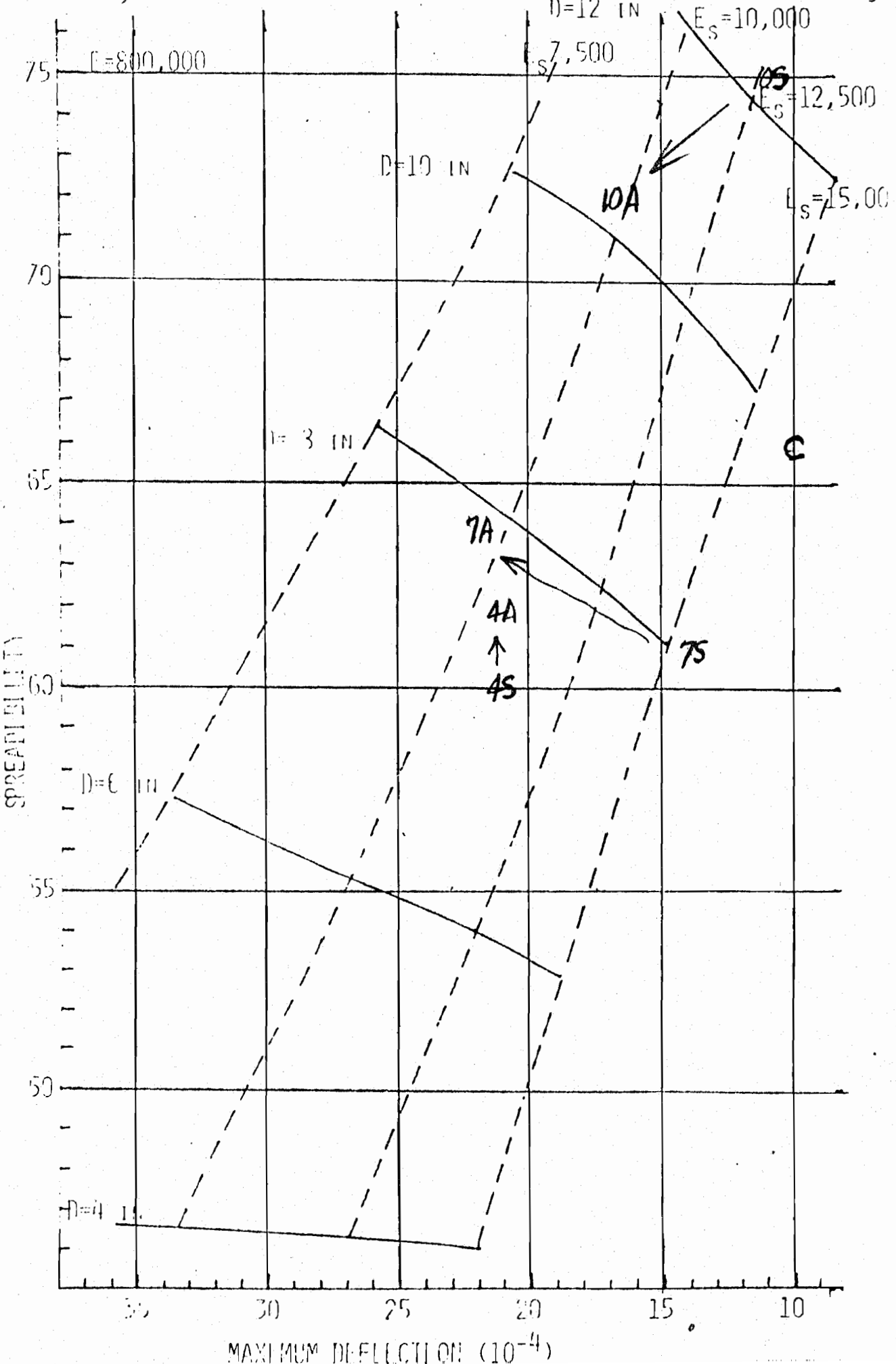
DEFLECTION PLOTS

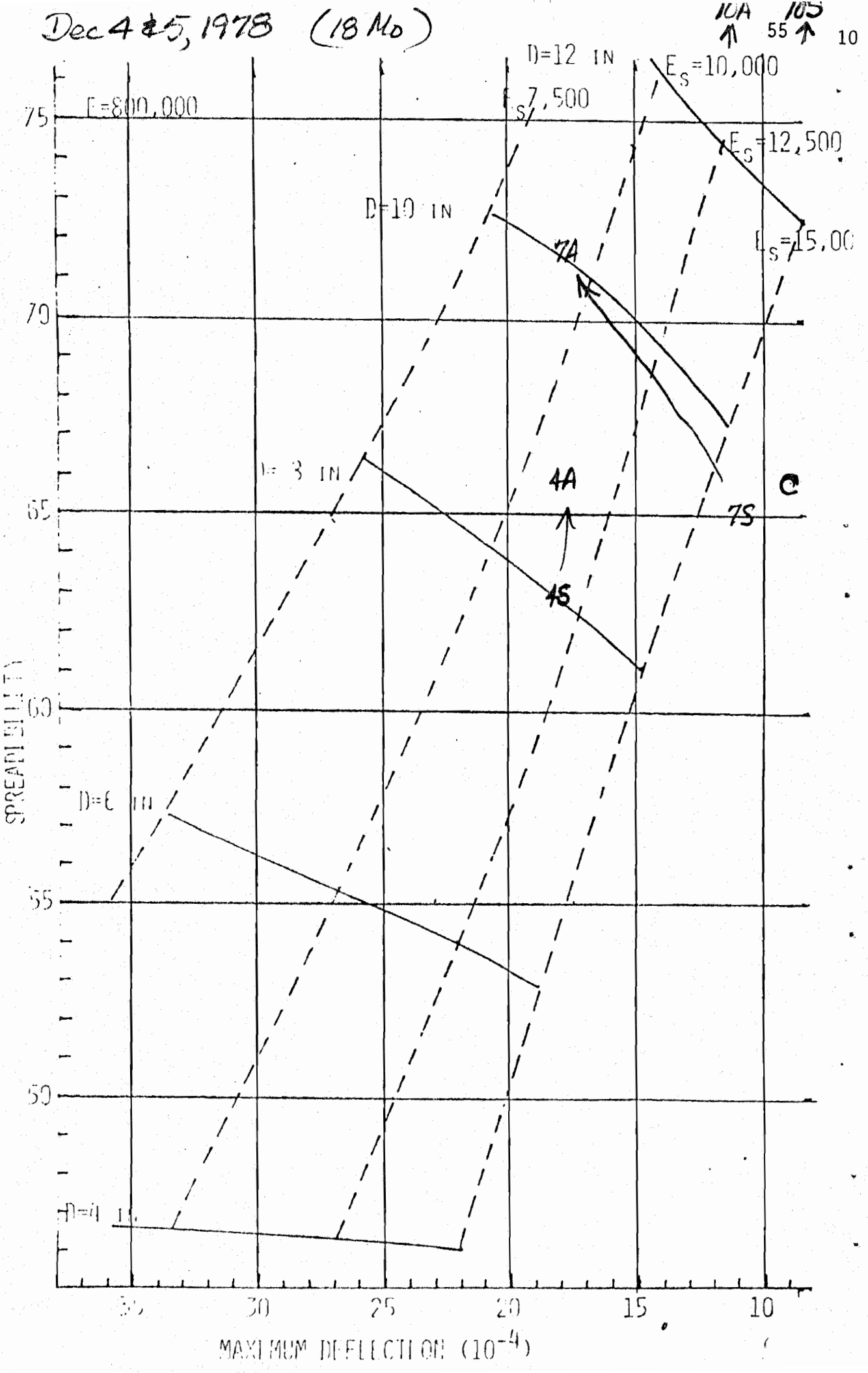
DEC. 13, 1977 (Initial 6 mo)

JOA↑ 10S 55

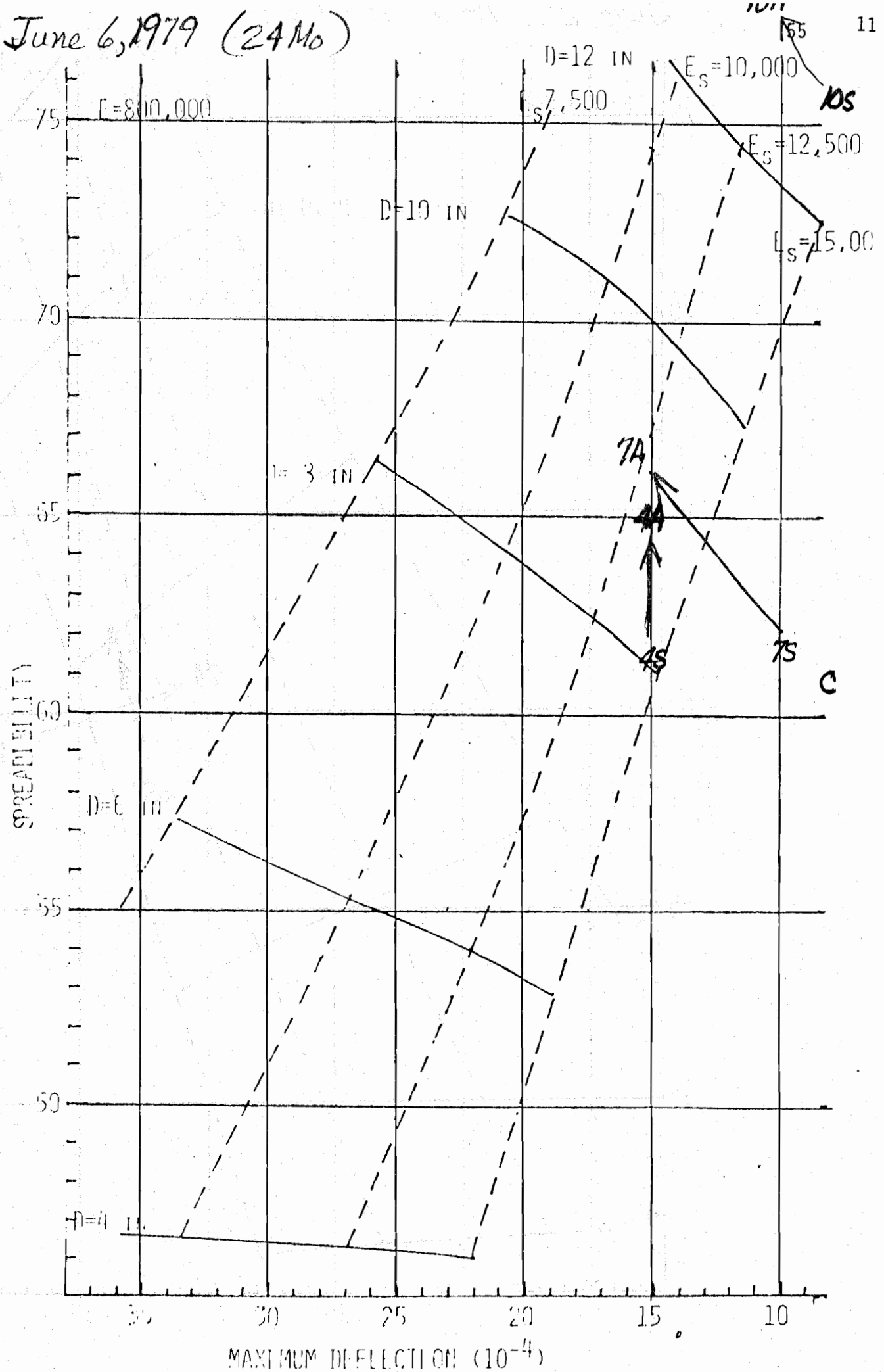


June 16, 1978 (12 Mo)

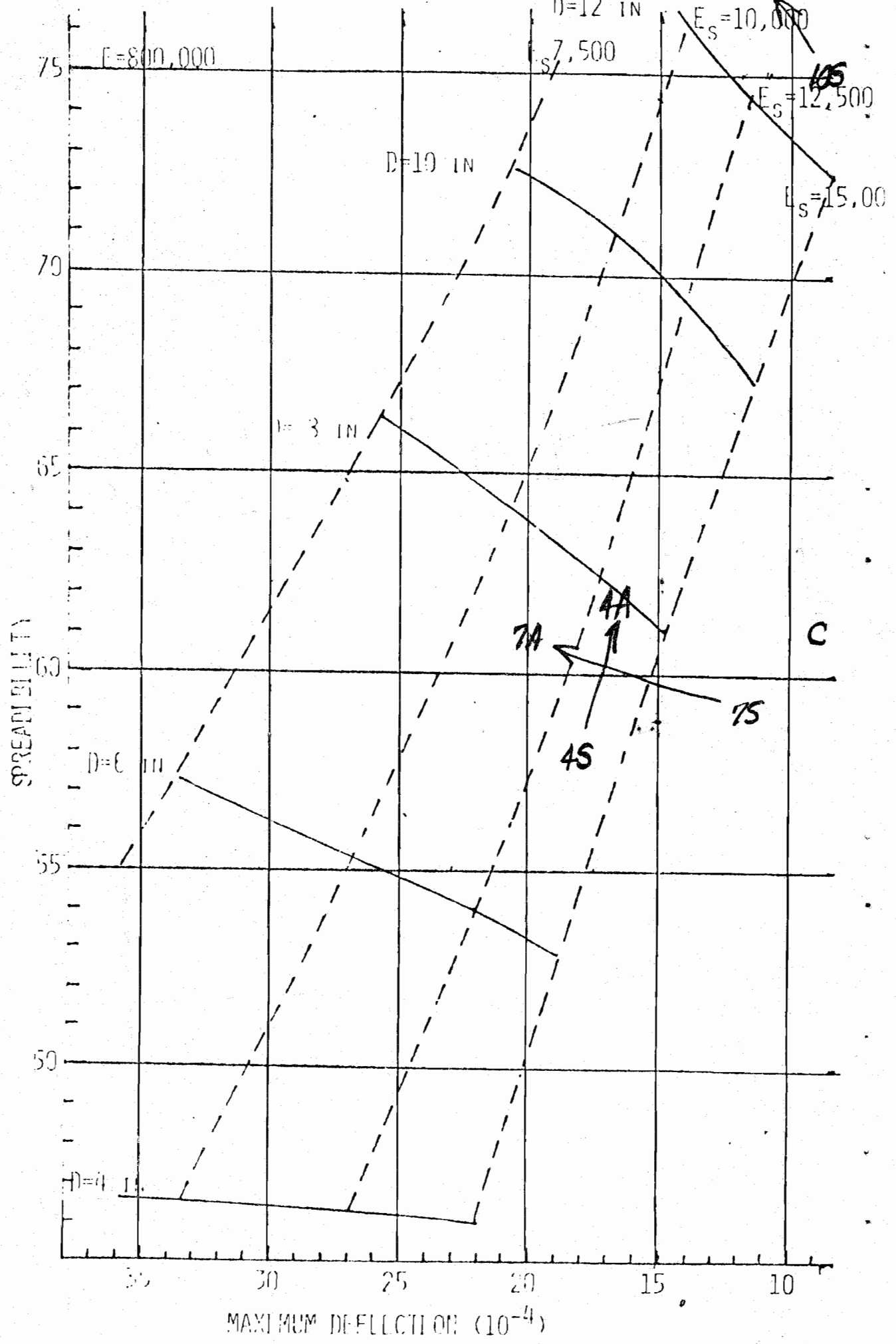



Dec 4 & 5, 1978 (18 Mo)
10A
55
10B
10
D=12 IN
E_s=10,000
E=800,000
E_s=7,500
E_s=12,500
E_s=15,00
D=10 IN
7A
D= 8 IN
4A
C
7S
4S
D=6 IN
D=4 IN
75
70
65
60
55
50
SPREAD (INCHES)
30
25
20
15
10
MAXIMUM DEFLECTION (10^{-4})

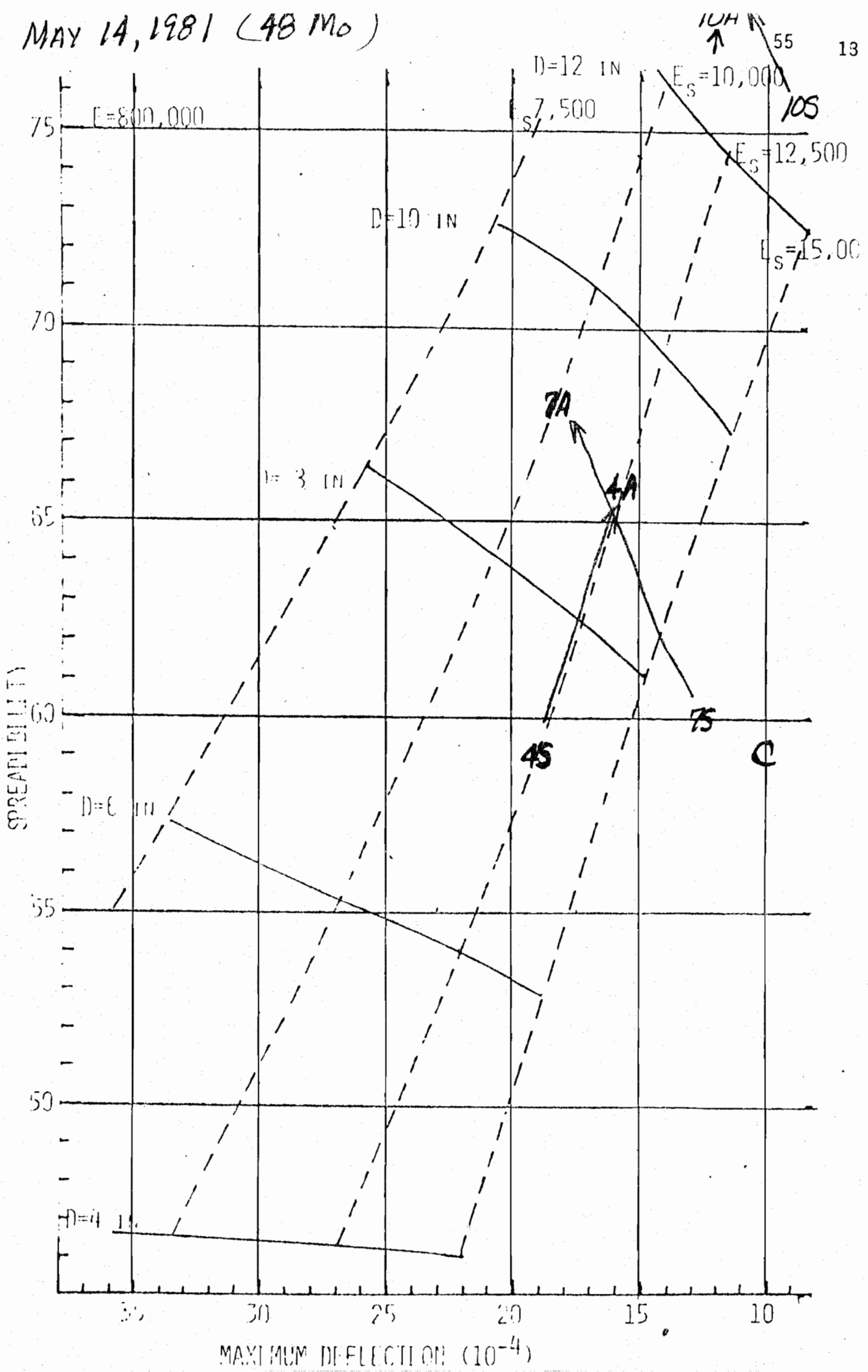
June 6, 1979 (24 Mo)



June 25, 1980 (36 Mo)



MAY 14, 1981 (48 Mo)



APPENDIX B

VISUAL DISTRESS DATA

SURFACE DISTRESS INVENTORY

ON SULFUR ASPHALT TEST SECTIONS
US-77 KENEDY CO.

May 14, 1981

	Station	Crack Type	Long. Crack Length	Remarks
Control	1980+00 to 1985+00	None		
10" SAS	1985+00 to 1990+00			
	1987+75 to 1987+76	Long.	1'	In Centerline
		total	1'	
7" SAS	1990+00 to 1995+00			
	1991+35 to 1991+70	Long.	35'	Outside lane right wheel path
	1992+46 to 1992+50	Long.	4'	Outside lane left wheel path at core
	1992+60 to 1993+09	Long.	49'	Outside lane right wheel path
	1993+28 to 1993+80	Long.	72'	Outside lane right wheel path with occasional short transverse leading off
	1994+03 to 1994+45		42'	Outside lane right wheel path
		total	202'	
7" SAS	1995+00 to 2000+00			
	1995+00 to 1995+30	Long.	30'	Outside lane right wheel path
	1995+20 to 1995+45	Long.	25'	Outside lane left wheel path
	1995+30	Trans.(1)		Between wheel path
	1995+43	Trans.(1)		From left wheel path about 2 feet
	1995+50	Trans.(1)		Outside lane from right wheel path to 3 feet left.
	1995+50 to 1995+70	Long.	20'	Outside lane right wheel path
	1995+85 to 1996+02	Long.	17'	Outside lane right wheel path
	1996+05 to 1996+30	Long.	25'	Outside lane left wheel path
	1996+05 to 1996+40	Long.	35'	Outside lane right wheel path

7" SAS (cont.)

	1997+74 to 1997+95	Long.	21'	Outside lane right wheel path
	1998+16 to 1998+20	Long.	4'	Outside lane right wheel path
	1999+00 to 1999+05	Long.	5'	Outside lane left wheel path
		Total	182'& 3 Trans.	
4" ACP	2000+00 to 2005+00			
	2000+18 to 2001+60	Long.	142'	Outside lane right wheel path very slight opening
	2003+05 to 2003+18	Long.	13'	Outside lane right wheel path
		Total	155'	
7" ACP	2005+00 to 2010+00			
	2005+69 to 2005+86	Long.	17'	Outside lane right wheel path
	2006+00 to 2006+81	Long.	81'	Outside lane left wheel path
	2006+95	Trans.(1)		Outside lane from centerline to left wheel path
	2008+03	Trans.(1)		From right wheel path to center of lane
	2008+10 to 2008+30	Long.	20'	Outside lane right wheel path - light
	2009+12 to 2010+00	Long.	88'	Outside lane right wheel path - light and intermittent
		Total	206'& 2 Trans.	
10" ACP	2010+00 to 2015+00			
	2010+05 to 2010+30	Long.	25'	Outside lane right wheel path - light
	2014+05 to 2014+11	Long.	6'	Outside lane right wheel path
		Total	31'	

Slight rutting in last two sections.

APPENDIX C

DEFLECTION DATA

TEXAS HIGHWAY DEPARTMENT

DISTRICT 21 -DESIGN SECTION

DYNAFLECT DEFLECTIONS AND CALCULATED STIFFNESS COEFFICIENTS

THIS PROGRAM WAS RUN - 05-21-81

****

PROJECT IDENTIFICATION

DIST.	COUNTY	CONT.	SECT.	PFSN	HIGHWAY	DATE	DYNAFLECT
21	KENEDY	0327	02		US-77	05-14-81	48

REASONS FOR MEASUREMENTS AND COMMENTS
SS - CONTROL SULF-ESPH

TOTAL PAV DEPTH
11.00 INCHES

****

EXISTING PAVEMENT

MATERIAL TYPE	LAYER THICK.(IN)
ASP TY D	1.00
FLEX BASE-CALICHE	10.00
LIME TR SUBGR	8.00

****

GENERAL LOCATION INFORMATION

DIRECTION OF TRAVEL IS NORTH OPPOSITE MILEPOINTS
MEASUREMENTS ARE 3 FEET FROM THE RIGHT SIDE OF LANE 1

DESCRIPTION OF LOCATION	STATION READING	MILEPOI
FROM-500 FT S OF SULF-ESPH SECT	1930+00	
TO-	1965+00	

****

DIST.	COUNTY	CONT.	SECT.	PROJ	HIGHWAY	DATE	DYNAFLECT
21	KENEDY	0327	02		US-77	05-14-81	49

DYNAFLECT DATA

STATION	W1	W2	W3	W4	W5	SCI	AS2	AP2	REMARKS
1960+25	0.380	0.300	0.230	0.160	0.130	0.080	0.30	0.81	CONTROL
1960+75	0.350	0.280	0.200	0.130	0.110	0.100	0.31	0.71	
1961+25	0.440	0.320	0.230	0.160	0.120	0.120	0.31	0.68	85 DEG F
1961+75	0.430	0.300	0.210	0.140	0.110	0.130	0.31	0.67	
1962+25	0.530	0.360	0.250	0.170	0.140	0.170	0.30	0.64	
1962+75	0.460	0.350	0.270	0.190	0.160	0.110	0.30	0.68	
1963+25	0.480	0.350	0.240	0.170	0.150	0.130	0.31	0.66	
1963+75	0.470	0.340	0.240	0.160	0.140	0.130	0.30	0.70	
1964+25	0.510	0.370	0.270	0.200	0.170	0.140	0.30	0.67	
1964+75	0.430	0.300	0.210	0.200	0.190	0.140	0.29	0.69	
AVERAGES	0.457	0.334	0.245	0.173	0.144	0.123	0.30	0.69	
STANDARD DEVIATION						0.021	0.01	0.05	

NUMBER OF POINTS IN AVERAGE = 10

W1-5 DEFLECTIONS AT GEOPHONES 1,2,3,4,&5
SCI SURFACE CURVATURE INDEX (W1 MINUS W2)
AS2 STIFFNESS COEFFICIENT OF THE SUBGRADE
AP2 STIFFNESS COEFFICIENT OF THE PAVEMENT

$\frac{1.356}{2.285} = 59$ .010

TEXAS HIGHWAY DEPARTMENT

DISTRICT 21 -DESIGN SECTION

DYNAFLECT DEFLECTIONS AND CALCULATED STIFFNESS COEFFICIENTS

THIS PROGRAM WAS RUN - 05-21-81

****

PROJECT IDENTIFICATION

DIST.	COUNTY	CONT.	SECT.	PRSN	HIGHWAY	DATE	DYNAFLECT
21	KENEDY	0327	02		US-77	05-14-81	49

REASONS FOR MEASUREMENTS AND COMMENTS
SS - 10 IN. SELF-ASPH

TOTAL PAV DEPTH
11.00 INCHES

****

EXISTING PAVEMENT

MATERIAL TYPE	LAYER THICK.(IN)
ACP TY C	1.00
SAND ASPH BASE	10.00
LIME TR SUBGR	8.00

****

GENERAL LOCATION INFORMATION

DIRECTION OF TRAVEL IS NORTH OPPOSITE MILEPOINTS
MEASUREMENTS ARE 3 FEET FROM THE RIGHT SIDE OF LANE 1

DESCRIPTION OF LOCATION	STATION READING	MILEPOINT
FROM- SECT 2 SB	1995+00	
TO-	1990+00	

****

DIST.	COUNTY	CONT.	SECT.	PRSN	HIGHWAY	DATE	DYNAFLECT
21	KENEDY	0327	02		US-77	05-14-81	48

DYNAFLECT DATA

STATION	W1	W2	W3	W4	W5	SCI	AS2	AP2	REMARKS
1986+15	0.430	0.380	0.320	0.250	0.220	0.050	0.25	1.13	10" SAS
1986+45	0.410	0.350	0.290	0.230	0.180	0.060	0.27	0.99	
1986+75	0.390	0.360	0.290	0.250	0.200	0.030	0.25	1.29	
1987+05	0.350	0.310	0.260	0.190	0.160	0.040	0.26	1.14	87 DEG F
1987+35	0.390	0.350	0.300	0.230	0.200	0.040	0.25	1.31	
1987+65	0.420	0.360	0.310	0.260	0.220	0.050	0.26	1.10	
1987+95	0.440	0.400	0.340	0.290	0.250	0.040	0.24	1.25	
1988+25	0.460	0.430	0.380	0.310	0.280	0.030	0.22	1.51	
1988+55	0.460	0.420	0.360	0.310	0.260	0.040	0.23	1.31	
1988+85	0.460	0.420	0.360	0.310	0.270	0.040	0.23	1.34	
AVERAGES	0.434	0.379	0.324	0.264	0.223	0.042	0.24	1.25	
STANDARD DEVIATION						0.009	0.02	0.15	

NUMBER OF POINTS IN AVERAGE = 10

W1-5 DEFLECTIONS AT GEOPHONES 1,2,3,4,&5
SCI SURFACE CURVATURE INDEX (W1 MINUS W2)
AS2 STIFFNESS COEFFICIENT OF THE SUBGRADE
AP2 STIFFNESS COEFFICIENT OF THE PAVEMENT

$\frac{1.59}{208} = 76$ .009

TEXAS HIGHWAY DEPARTMENT

DISTRICT 21 -DESIGN SECTION

DYNAFLECT DEFLECTIONS AND CALCULATED STIFFNESS COEFFICIENTS

THIS PROGRAM WAS RUN - 05-21-81

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PROJECT IDENTIFICATION

DIST.	COUNTY	CONT.	SECT.	PPSN	HIGHWAY	DATE	DYNAFLECT
21	KENEDY	0307	02		US-77	05-14-81	48

REASONS FOR MEASUREMENTS AND COMMENTS: SS - 7 IN. SULF-ASPH

TOTAL PAV DEPTH: 8.00 INCHES

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EXISTING PAVEMENT

MATERIAL TYPE	LAYER THICK.(IN.)
ACP TY D	1.00
SAND ASPH SULFUR	7.00
LIME TR SUBGR	8.00

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GENERAL LOCATION INFORMATION

DIRECTION OF TRAVEL IS NORTH OPPOSITE MILEPOINTS

MEASUREMENTS ARE 3 FEET FROM THE RIGHT SIDE OF LANE 1

	DESCRIPTION OF LOCATION	STATION READING MILEPOINT
FROM-	SECT B SA	1990+00
TO-		1995+00

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DIST.	COUNTY	CNTY.	SECT.	PRSN	HIGHWAY	DATE	DYNAFLECT
21	KENEDY	0327	02		US-77	05-14-81	48

DYNAFLECT DATA

STATION	W1	W2	W3	W4	W5	SCI	AS2	AP2	REMARKS
1991+15	0.530	0.420	0.310	0.210	0.160	0.110	0.28	1.05	7" SAS
1991+45	0.560	0.450	0.330	0.200	0.150	0.110	0.27	1.09	
1991+75	0.580	0.470	0.320	0.200	0.140	0.110	0.27	1.12	
1992+05	0.470	0.390	0.280	0.180	0.140	0.080	0.27	1.20	
1992+35	0.550	0.480	0.330	0.200	0.140	0.110	0.26	1.13	
1992+65	0.540	0.430	0.310	0.200	0.150	0.110	0.28	1.06	87 DEG F
1992+95	0.570	0.440	0.320	0.210	0.160	0.130	0.26	1.28	
1993+25	0.440	0.340	0.190	0.200	0.160	0.060	0.26	1.38	
1993+55	0.640	0.510	0.340	0.210	0.150	0.120	0.26	1.12	
1993+85	0.730	0.570	0.340	0.210	0.150	0.160	0.26	1.07	
AVERAGES	0.563	0.44	0.311	0.202	0.150	0.105	0.27	1.14	
STANDARD DEVIATION						0.027	0.01	0.11	
NUMBER OF UNITS IN AVERAGE = 10									

W1-5 DEFLECTIONS AT DISTANCES 1,2,3,4,5

SCI SURFACE CURVATURE INDEX (W1 MINUS W2)

AS2 STIFFNESS COEFFICIENT OF THE SUBGRADE

AP2 STIFFNESS COEFFICIENT OF THE PAVEMENT

.560 .455 .319 .202 .150

$\frac{1.686}{2.8} = 60$ .013

TEXAS HIGHWAY DEPARTMENT

DISTRICT 21 -DESIGN SECTION

DYNAFLECT DEFLECTIONS AND CALCULATED STIFFNESS COEFFICIENTS

THIS PROGRAM WAS RUN - 05-21-81

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PROJECT IDENTIFICATION

DIST.	COUNTY	CONT.	SECT.	PPSN	HIGHWAY	DATE	DYNAFLECT
21	KENEDY	[illegible]	12		US-77	05-14-81	48

REASONS FOR MEASUREMENTS AND COMMENTS — TOTAL PAV DEPTH
SS - 4 IN. SULF-ASPH — 5.00 INCHES

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EXISTING PAVEMENT

MATERIAL TYPE	LAYER THICK.(IN)
ACP TY C	1.00
SAND ASPH-SULFUR	4.00
LIME TR SURGE	8.00

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CONTROL LOCATION INFORMATION

DIRECTION OF TRAVEL IS NORTH OPPOSITE MILEPOINTS
MEASUREMENTS ARE 3 FEET FROM THE RIGHT SIDE OF LANE 1

DESCRIPTION OF LOCATION	STATION READING	MILEPOINT
FROM-SECT C SA	1995+00	
TO-	2005+00	

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DIST.	COUNTY	CONT.	SECT.	PPSN	HIGHWAY	DATE	DYNAFLECT
21	KENTON	0327	02		US-77	05-14-91	40

DYNAFLECT DATA

STATION	W1	W2	W3	W4	W5	SCI	AS2	AP2	REMARKS
1996+15	1.330	0.890	0.490	0.320	0.260	0.440	0.26	1.03	4" SAS
1996+45	0.920	0.630	0.450	0.320	0.270	0.190	0.26	1.51	
1996+75	0.870	0.580	0.430	0.320	0.270	0.190	0.25	1.53	
1997+05	0.840	0.590	0.430	0.310	0.270	0.090	0.24	2.15	86 DEG F
1997+35	0.820	0.640	0.450	0.320	0.270	0.190	0.26	1.54	
1997+65	0.780	0.610	0.450	0.330	0.280	0.170	0.26	1.59	
1997+95	0.730	0.590	0.450	0.340	0.280	0.140	0.25	1.75	
1998+25	0.690	0.580	0.440	0.310	0.270	0.220	0.26	1.45	
1998+55	0.650	0.580	0.440	0.290	0.240	0.300	0.28	1.22	
1998+85	0.700	0.560	0.370	0.260	0.210	0.230	0.28	1.24	
AVERAGES	0.841	0.633	0.445	0.314	0.262	0.209	0.26	1.53	
STANDARD DEVIATION						0.141	0.01	0.33	

NUMBER OF POINTS IN AVERAGE = 10

W1-5 DEFLECTIONS AT SENSORS 1,2,3,4,&5
SCI SURFACE CURVATURE INDEX (W1 MINUS W2)
AS2 STIFFNESS COEFFICIENT OF THE SUBGRADE
AP2 STIFFNESS COEFFICIENT OF THE PAVEMENT

$\frac{2.489}{4.205} = .59$ .019

TEXAS HIGHWAY DEPARTMENT

DISTRICT 21 -DESIGN SECTION

DYNAFLECT DEFLECTIONS AND CALCULATED STIFFNESS COEFFICIENTS

THIS PROGRAM WAS RUN - 05-21-81

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PROJECT IDENTIFICATION

DIST.	COUNTY	CONT.	SECT.	PRSN	HIGHWAY	DATE	DYNAFLECT
21	KENEDY	0327	02		US-77	05-14-81	48

REASONS FOR MEASUREMENTS AND COMMENTS
SS - 4 IN. ACP

TOTAL PAV DEPTH
5.00 INCHES

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EXISTING PAVEMENT

MATERIAL TYPE	LAYER THICK.(IN)
ACP TY C	1.00
ACP TY C	4.00
LIME TR SUBGR	0.0

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GENERAL LOCATION INFORMATION

DIRECTION OF TRAVEL IS NORTH OPPOSITE MILEPOINTS
MEASUREMENTS ARE 3 FEET FROM THE RIGHT SIDE OF LANE 1

	DESCRIPTION OF LOCATION	STATION READING	MILEPOINT
FROM-	SECT 01 ACP	2000+00	
TO-		2005+00	

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DIST.	COUNTY	CONT.	SECT.	PPSN	HIGHWAY	DATE	DYNAFLECT
21	KENEDY	0327	02		US-77	05-14-81	49

DYNAFLECT DATA

STATION	W1	W2	W3	W4	W5	SCI	AS2	AP2	REMARKS
2001+15	0.750	0.600	0.440	0.320	0.260	0.150	0.26	1.70	4" ACP
2001+45	0.640	0.480	0.440	0.330	0.280	0.160	0.26	1.54	
2001+75	0.780	0.630	0.450	0.320	0.270	0.150	0.25	1.74	
2002+05	0.690	0.580	0.450	0.330	0.280	0.110	0.25	1.98	85 DEG F
2002+35	0.750	0.600	0.460	0.340	0.290	0.150	0.26	1.70	
2002+65	0.730	0.590	0.440	0.330	0.280	0.140	0.25	1.75	
2003+55	0.730	0.590	0.440	0.340	0.290	0.130	0.25	1.84	
2003+25	0.720	0.600	0.440	0.350	0.290	0.120	0.25	1.92	
2003+55	0.740	0.610	0.460	0.370	0.300	0.120	0.24	1.96	
2003+85	0.690	0.540	0.450	0.340	0.290	0.090	0.24	2.17	
AVERAGES	0.733	0.583	0.455	0.335	0.283	0.135	0.25	1.83	
STANDARD DEVIATION						0.028	0.01	0.19	

NUMBER OF POINTS IN AVERAGE = 10

W1-5 DEFLECTIONS AT SENSORNES 1,2,3,4,&5
SCI SURFACE CURVATURE INDEX (W1 MINUS W2)
AS2 STIFFNESS COEFFICIENT OF THE SUBGRADE
AP2 STIFFNESS COEFFICIENT OF THE PAVEMENT

$\frac{2414}{3.64} = 66$ .016.

TEXAS HIGHWAY DEPARTMENT

DISTRICT 21 -DESIGN SECTION

DYNAFLECT DEFLECTIONS AND CALCULATED STIFFNESS COEFFICIENTS

THIS PROGRAM WAS RUN - 05-21-81

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PROJECT IDENTIFICATION

IST.	COUNTY	CONT.	SECT.	PPSN	HIGHWAY	DATE	DYNAFLECT
21	KENEDY	0327	02		US-77	05-14-81	4A

REASONS FOR MEASUREMENTS AND COMMENTS: SS - 7 IN. ACP

TOTAL PAV DEPTH: 8.00 INCHES

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EXISTING PAVEMENT

MATERIAL TYPE	LAYER THICK.(IN)
ACP TY D	1.00
ACP TY C	7.00
LIME TR SUBGR	0.0

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GENERAL LOCATION INFORMATION

DIRECTION OF TRAVEL IS NORTH OPPOSITE MILEPOINTS

MEASUREMENTS ARE 3 FEET FROM THE RIGHT SIDE OF LANE 1

	DESCRIPTION OF LOCATION	STATION READING	MILEPOINT
FROM-	SCT BY ACP	2005+00	
TO-		2010+00	

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DIST.	COUNTY	CONT.	SECT.	PPSR	HIGHWAY	DATE	DYNAFLECT
21	KENEDY	0327	02		US-77	05-14-81	49

DYNAFLECT DATA

STATION	W1	W2	W3	W4	W5	SCI	AS2	AP2	REMARKS
2[illegible]+15	[illegible]	[illegible]	[illegible]	[illegible]	0.290	0.110	0.23	1.33	7" ACP
2006+45	0.790	0.660	0.610	0.360	0.290	0.120	0.24	1.28	
2006+75	0.740	0.630	0.580	0.350	0.300	0.110	0.24	1.30	
2007+05	0.810	0.650	0.620	0.370	0.310	0.130	0.24	1.24	
2007+35	0.800	0.670	0.540	0.400	0.320	0.110	0.23	1.37	
2007+65	0.790	0.630	0.540	0.390	0.320	0.110	0.23	1.34	86 DEG F
2007+95	0.800	0.660	0.620	0.380	0.310	0.120	0.23	1.36	
2008+25	0.790	0.670	0.580	0.390	0.300	0.120	0.23	1.29	
2008+55	0.750	0.640	0.530	0.410	0.340	0.090	0.22	1.48	
2008+85	0.760	0.660	0.580	0.400	0.330	0.100	0.23	1.41	
AVERAGES	0.778	0.654	0.591	0.382	0.312	0.112	0.23	1.33	
STANDARD DEVIATION						0.011	0.00	0.07	

NUMBER OF POINTS IN AVERAGE = 10

W1-5 DEFLECTIONS AT GEOPHONES 1,2,3,4,&5
SCI SURFACE CURVATURE INDEX (W1 MINUS W2)
AS2 STIFFNESS COEFFICIENT OF THE SUBGRADE
AP2 STIFFNESS COEFFICIENT OF THE PAVEMENT

$\frac{2,659}{3.89} = 68$ .018

TEXAS HIGHWAY DEPARTMENT

DISTRICT 21 -DESIGN SECTION

DYNAFLECT DEFLECTIONS AND CALCULATED STIFFNESS COEFFICIENTS

THIS PROGRAM WAS RUN - 05-21-91

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PROJECT IDENTIFICATION

DIST.	COUNTY	CONT.	SECT.	PPSN	HIGHWAY	DATE	DYNAFLECT
21	KENEDY	4327	2		US-77	05-14-91	4?

REASONS FOR MEASUREMENTS AND COMMENTS: SS - 10 IN. ACP

TOTAL PAV DEPTH: 11.00 INCHES

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EXISTING PAVEMENT

MATERIAL TYPE	LAYER THICK.(IN)
ACP TY I	1.00
ACP TY C	10.00
LIME TR SUBGR	0.0

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GENERAL LOCATION INFORMATION

DIRECTION OF TRAVEL IS NORTH OPPOSITE MILEPOINTS

MEASUREMENTS ARE 5 FEET FROM THE RIGHT SIDE OF LANE 1

	DESCRIPTION OF LOCATION	STATION READING	MILEPOINT
FROM-	SECT A ACP	2010+00	
TO-		2015+00	

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DIST.	COUNTY	CONT.	SECT.	PPSN	HIGHWAY	DATE	DYNAFLECT
21	KENDY	0327	02		US-77	05-14-81	48

DYNAFLECT DATA

STATION	W1	W2	W3	W4	W5	SCI	AS2	AP2	REMARKS
2011+15	0.540	0.510	0.460	0.380	0.340	0.030	0.20	1.62	10" ACP
2011+45	0.510	0.480	0.450	0.380	0.330	0.020	0.20	1.73	
2011+75	0.530	0.490	0.440	0.380	0.330	0.040	0.21	1.58	
2012+05	0.520	0.480	0.430	0.360	0.320	0.040	0.22	1.39	86 DEG F
2012+35	0.540	0.500	0.440	0.370	0.320	0.040	0.22	1.43	
2012+65	0.510	0.480	0.430	0.360	0.320	0.030	0.21	1.58	
2012+95	0.540	0.510	0.450	0.370	0.330	0.030	0.20	1.62	
2013+25	0.550	0.520	0.500	0.410	0.360	0.030	0.20	1.67	
2013+55	0.510	0.500	0.500	0.410	0.360	0.010	0.22	1.35	
2013+85	0.600	0.560	0.510	0.420	0.370	0.040	0.21	1.49	
AVERAGES	0.547	0.513	0.471	0.392	0.338	0.034	0.21	1.55	
STANDARD DEVIATION						0.010	0.01	0.15	

NUMBER OF POINTS IN AVERAGE = 10

W1-5 DEFLECTIONS AT GEOPHONES 1,2,3,4,&5
SCI SURFACE CURVATURE INDEX (W1 MINUS W2)
AS2 STIFFNESS COEFFICIENT OF THE SUBGRADE
AP2 STIFFNESS COEFFICIENT OF THE PAVEMENT

$\frac{2.246}{2.735} = 82$ .012