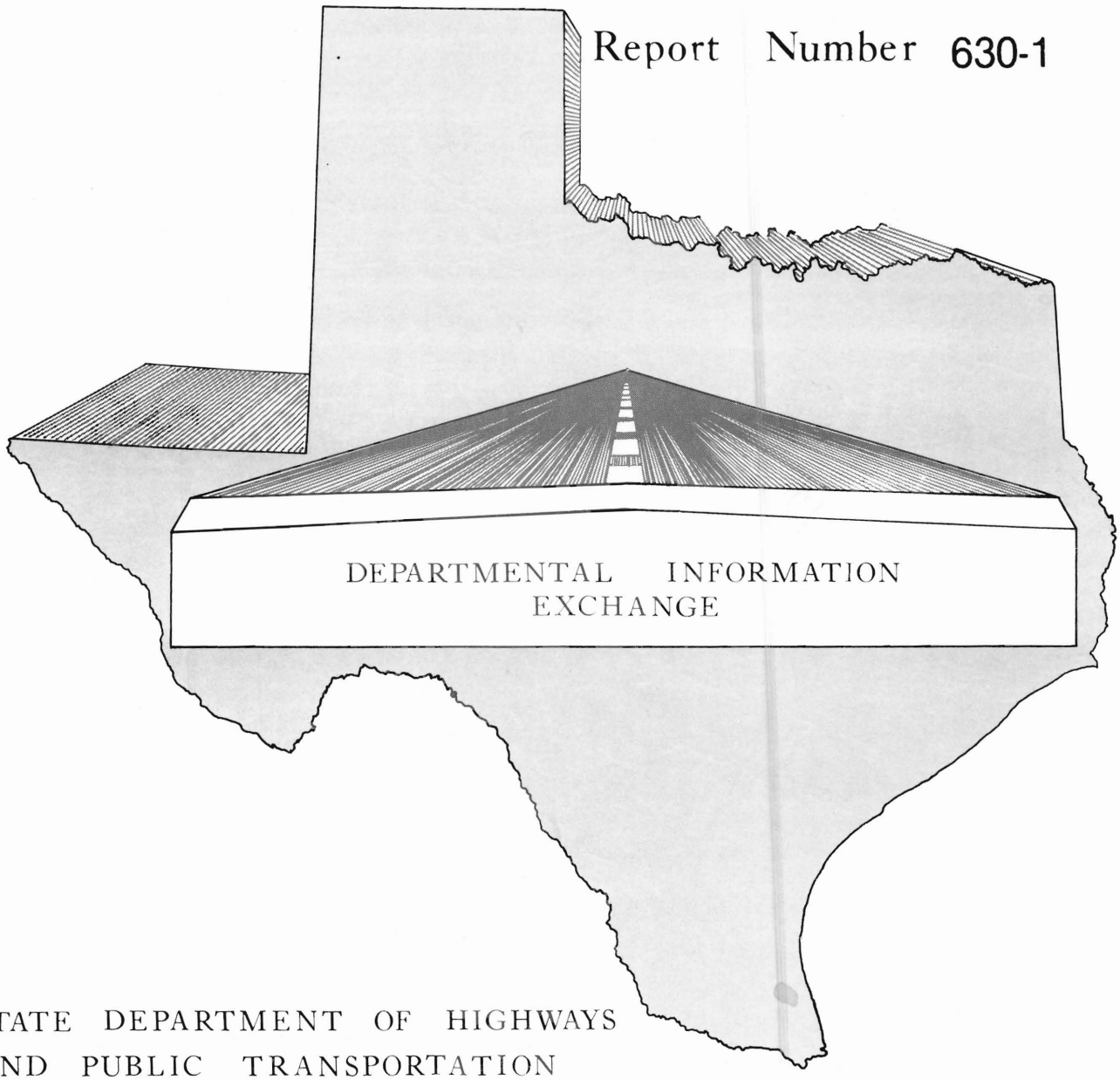
EXPERIMENTAL PROJECTS

SULPHUR EXTENDED ASPHALT (SEA) USING SOLID (PELLETIZED) SULPHUR

Report Number 630-1



STATE DEPARTMENT OF HIGHWAYS
AND PUBLIC TRANSPORTATION

TECHNICAL REPORT STANDARD TITLE PAGE

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Exp. Proj. Report 630-1		

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15. Supplementary Notes

16. Abstract

State Highway 94, in Lufkin, is the site of this SEA field trial. This report discusses the use of solid, pelletized sulphur melted and blended with asphalt (35/65 wt. ratio) within a drum dryer plant. A lightweight synthetic aggregate was used for what may be the first time with an SEA binder. The sulphur melting and blending method seemed successful and the synthetic aggregate posed no difficulties such as sulphur absorption. The converted ag-lime spreader feeder system for the sulphur and other special equipment used in this type of sulphur extended asphalt production are described. Construction methods are given. Data sheets and graphs of test results are included in the addenda, as are the project's Special Provisions to Items 292 and 340.

17. Key Words	18. Distribution Statement
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SULPHUR EXTENDED ASPHALT (SEA)
USING SOLID (PELLETIZED) SULPHUR

S.H. 94 WIDENING - LUFKIN, TEXAS

BY

STATE DEPARTMENT OF HIGHWAYS
AND PUBLIC TRANSPORTATION

DISTRICT 11

JUNE 1983

The material contained in this report is experimental in nature and is published for informational purposes only. Any discrepancies with official views or policies of the DHT should be discussed with the appropriate Austin Division prior to implementation of the procedures or results.

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Project Background

This is the third in a series of technical advances in the use of sulphur extended asphalt (SEA). The first project, completed in 1975 on U.S. 69 north of Lufkin (Research Report 512), preblended the sulphur/asphalt in a 35/65 (wt) ratio prior to introduction into the pug mill of a batch-type hot mix plant. The second project, completed in 1980 on Loop 495 at Nacogdoches (Demonstration Project 54), used liquid sulphur piped directly into the drum of a drum dryer plant and allowed the turbulent action of the drum to blend the sulphur and asphalt in a 35/65 (wt) ratio. This third field trial has taken the solid sulphur in a pelletized form and via a converted ag-lime spreader box (used as a bin and metering system) and a mineral aggregate feeder (Fig. 1) introduced the sulphur into the asphalt spray within the drum dryer plant allowing the drum temperature to melt the sulphur and the shearing action of the aggregate inside the drum to then blend the sulphur and asphalt in a 35/65 (wt), 22/78 (vol) ratio.

Project Location

State Highway 94 begins in Lufkin, Texas at its intersection with U.S. 59 and traverses westward to its terminus in Trinity, Texas at its intersection with S.H. 19. It carries predominantly regional traffic with a heavy influx of logging trucks. The existing facility was a two lane roadway with paved shoulders with a proposed widening to four lanes with paved shoulders and a continuous center left turn lane from Loop 287 in Lufkin to the Hudson Independent School facilities, a distance of over four miles. The annual average daily traffic (ADT) was 8,300 with 15 percent trucks.

Special Equipment

The system used to feed the sulphur into the drum was devised by the contractor and consisted primarily of two separate pieces of equipment. The material hopper and metering system used was an ag-lime spreader box with a steel drag chain. The motor used to pull the drag chain was variable speed; by using the number four cold feed bin, electronic connections could be regulated from the control room. This feature when coupled with the variable gate opening over the drag chain discharge allowed close calibration. This left the number four bin running at a preset calibration point; normally the plant was set to run at between 100 TPH and 120 TPH before disconnecting the number four bin.

The converted ag-lime feeder system fed directly into a constant speed vane feeder, which in turn, dumped the material into a four-inch diameter air duct. The air duct blower motor regulated the air flow at 520 cfm with a variable air pressure of from two psi to eight psi. The air flow pressure was regulated via a pressure relief valve. The material was blown into the lower end of the drum where it was then discharged directly into the asphalt stream. A bonnet shroud enclosed all sides of the asphalt and sulphur exit pipes, except the bottom and the rear. The bonnet was used to prevent the drum exhaust vacuum from catching the piped-in material and sweeping it out the exhaust. It also served to give the piped-in material first access to the raw asphalt for initial preblending. The original bonnet configuration, as shown in Figure 2, was used for three-fourths of the SEA project. The revised configuration shown in Figure 2 was made due to difficulty in feeding pelletized carbon black on a separate research test. The major modification involved bringing the material feed line closer to the asphalt discharge (from 12 in. to 4 in.) and providing a mixing cone to increase the effective surface area of the blending process. The four-inch distance resulted in unacceptable exhaust stack emissions, whereas the 12-inch distance provided a clean exhaust emission.

Preliminary Testing - Laboratory

The SEA binder was used in both the base and the surface courses. The base course was to be constructed of three inches of Item 292, Type A (see Special Provision 292-024). The control mix called for 6.0 percent asphalt binder. Using a 35/65 SEA binder ratio, this calculates to 7.2 percent SEA. From previous experience we were confident that this SEA binder content would be the equivalent design point as the control, but we ran a three point design curve for verification. (See Addenda).

The surface course was to be constructed of 1½ in. of Item 340, Type D Modified. (See Special Provision 340-148). The contractor elected to use synthetic (lightweight) aggregate in the surface course for polish value requirements (minimum of 35). As far as we could determine, this would be the first time a synthetic (lightweight) aggregate had been used with an SEA binder. There was some concern about the molten sulphur being absorbed into the lightweight aggregate before the sulphur and asphalt could be blended in the drum. Therefore, in the laboratory we tried to duplicate the chain of events that would allow this possibility. We preheated the aggregate portion of the mix design to approximately 300° Fahrenheit and dumped it into a 20-quart mixing bowl (Blanksee Dough Mixer), added the pelletized sulphur, began mixing and added the asphalt (preheated to 325° Fahrenheit). After mixing, we allowed the mix to remain in the 250° Fahrenheit oven for two and a half hours prior to the molding of the patties. We did not encounter the anticipated problem and continued our testing program. The theoretical maximum gravity for all mixes was determined using the Rice Method (ASTM D-2041). Marshall specimens were molded using the THD gyratory compactor. The Marshall specimens were molded to 2½ in. height using the same number of gyrations as the Hveem (2 in. height) specimens required. (We have found this procedure to produce patty densities reasonably equivalent to the Hveem specimens. (See Addenda).

Project Construction

It was decided to place a total of one lane mile of SEA mix for the total mat thickness of HMAC. We therefore decided to lay four one-quarter mile test sections in each driving lane for maximum evaluation. These test sites are located between Engineer's centerline Station 387+00 to 402+00 in the westbound lanes and 211+00 to 227+00 in the eastbound lanes (1500 and 1600 feet respectively). The four test sections using the Item 292, Type A mixture, were placed in late August and early September of 1982. The vapor plume from the exhaust stack was clean and the noxious odor of the SEA comparatively mild at the plant. The Texas Transportation Institute (TTI) investigators found the concentrations of H_2S and SO_2 to be well within acceptable standards. A representative from the Texas Air Control Board made a visual examination and, after consulting TTI tests results, commented favorably. The plant production was maintained at 100 TPH and mix temperature below 300° Fahrenheit (between 250° Fahrenheit and 285° Fahrenheit).

On the roadway the mix laid smoothly, but the odors were somewhat bothersome immediately behind the laydown machine. The fumes were especially noxious to the paver operator, as he could not easily leave the area for fresh air. We also noted the roller operator increased his roller speed until directed to slow down. A vibratory roller and a rubber tired pneumatic roller were used for compaction.

During the late Spring of 1983 the four test sections of surface course were placed using pelletized SEA HMAC containing lightweight coarse aggregate. The resulting mixture was satisfactory and placement operations were essentially the same as for the base course, as described above, with one exception. This exception was when the distance between the sulphur and asphalt pipe outlets within the drum was reduced from 12 in. to 4 in. This change resulted in an unacceptable emission from the exhaust stack. We thus learned that the 12 in. spacing was nearer the optimum.

Construction Testing

Samples were taken of the plant mix for testing and the test results are included in the addenda. Roadway densities were also determined via pavement coring operations. These results are included in the addenda also. The test results indicate that the sulphur was indeed melted in the plant and blended with the asphalt portion of the binder. This was evident by the fact that the mix had the same characteristics as the control mix and by the fact that the extracted binder percentage by weight was much higher than the percent asphalt alone (4.68 percent asphalt plus 2.52 percent sulphur = 7.2 percent SEA binder for Item 292, Type A, mix). Also the lightweight aggregate did not absorb the molten sulphur before it could blend with the asphalt to form an SEA binder.

Personal Comments

These field trials have verified the ability to use solid sulphur in a pelletized form to produce sulphur extended asphalt in a drum dryer plant. Also, synthetic lightweight aggregates appear to pose no unusual problems with SEA binders. Based on these results as well as prior construction tests and field performance it appears that SEA mixes are equally comparable to normal HMAC and should be considered as a suitable alternate based on pricing competitiveness.

ADDENDA

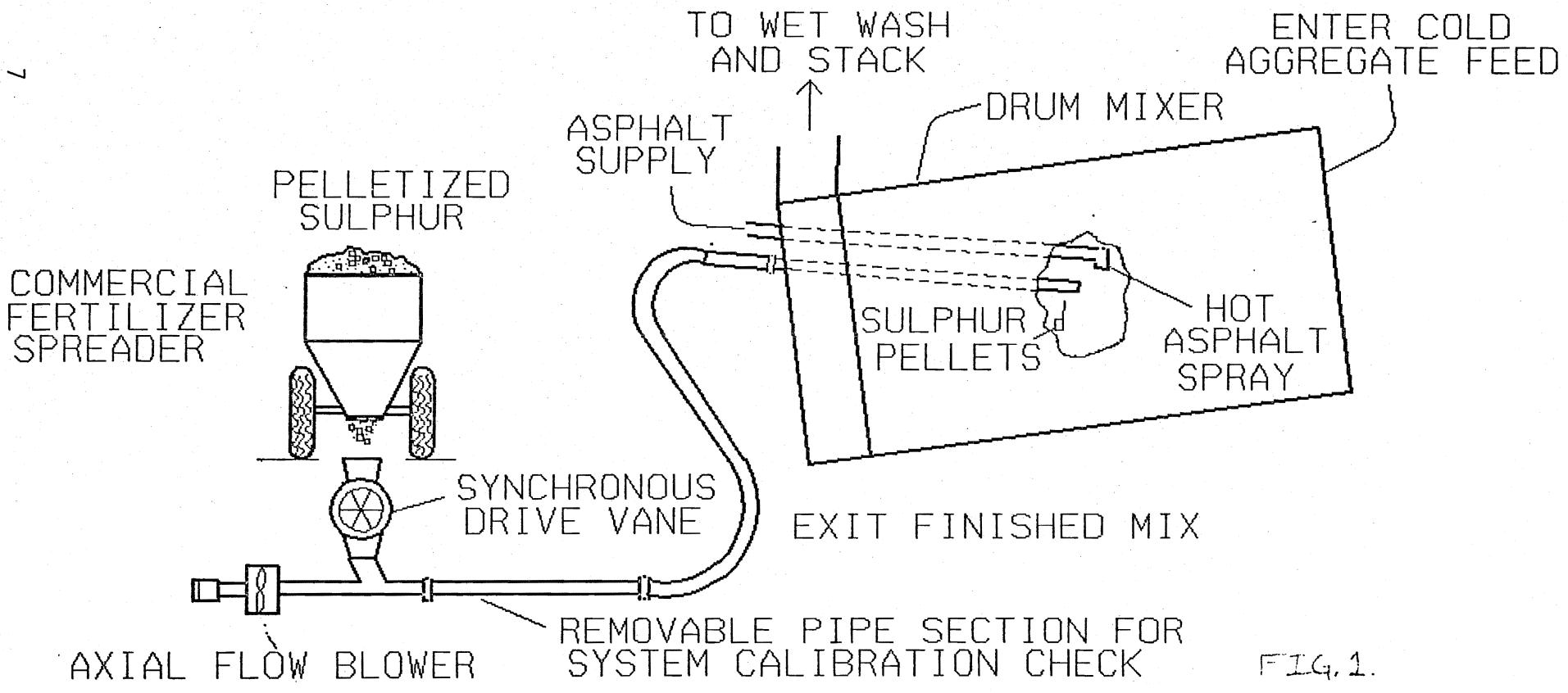
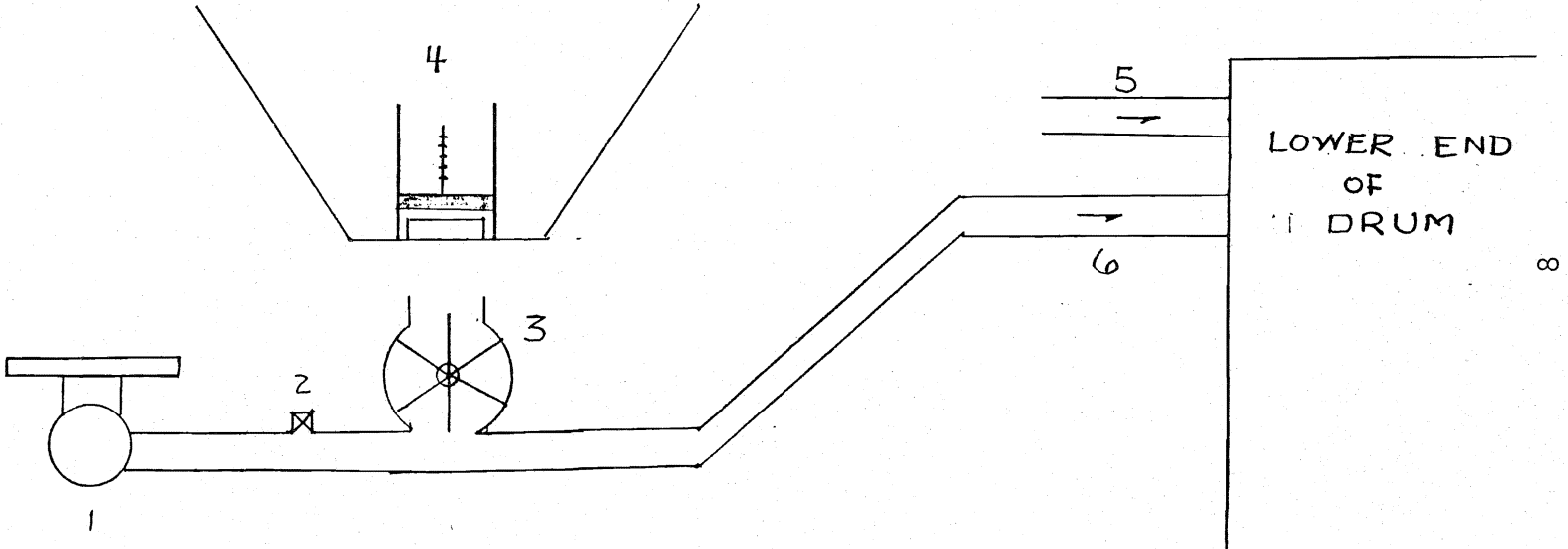

TO WET WASH
AND STACK
ENTER COLD
AGGREGATE FEED
DRUM MIXER
ASPHALT
SUPPLY
PELLETIZED
SULPHUR
COMMERCIAL
FERTILIZER
SPREADER
SULPHUR
PELLETS
HOT
ASPHALT
SPRAY
SYNCHRONOUS
DRIVE VANE
EXIT FINISHED MIX
REMOVABLE PIPE SECTION FOR
SYSTEM CALIBRATION CHECK
AXIAL FLOW BLOWER

FIG. 1.

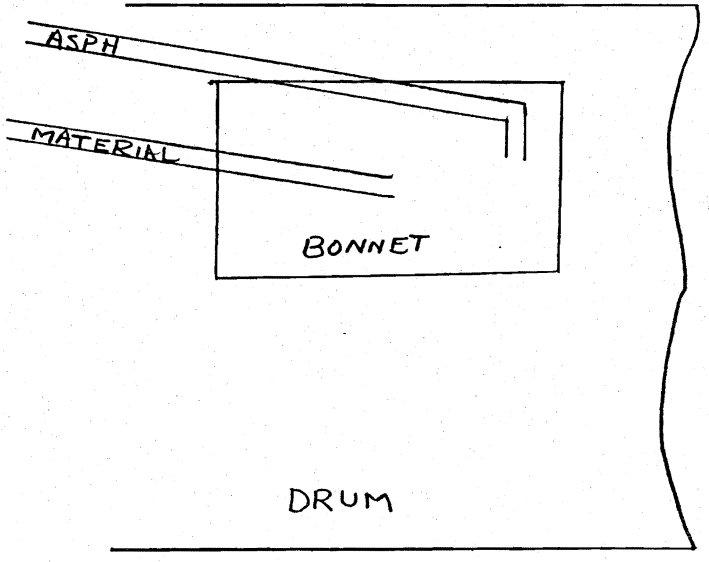
MATERIAL METERING AND FEEDING SYSTEM



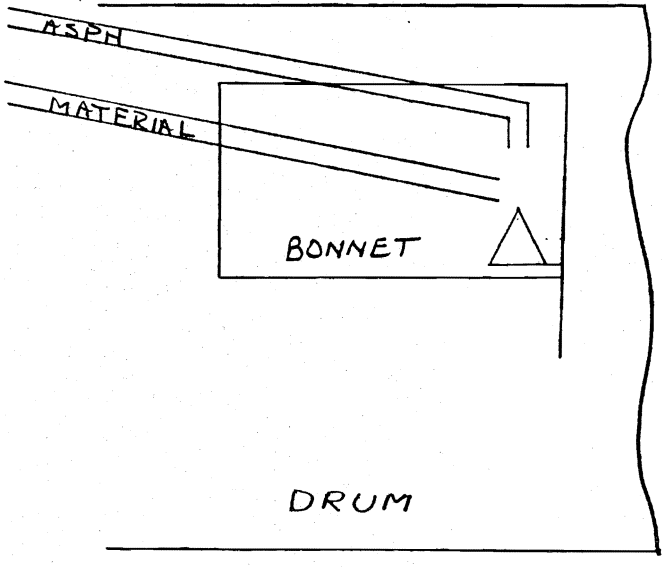
1. MINERAL AGG. BLOWER MOTOR
2. PRESSURE RELIEF VALVE
3. VANE FEEDER
4. AG LIME SPREADER HOPPER W/ DRAG BELT AND GATE
5. HOT ASPHALT LINE
6. 4" Air Duct

FIG 1
DETAIL

MIXING BONNET INSIDE DRUM

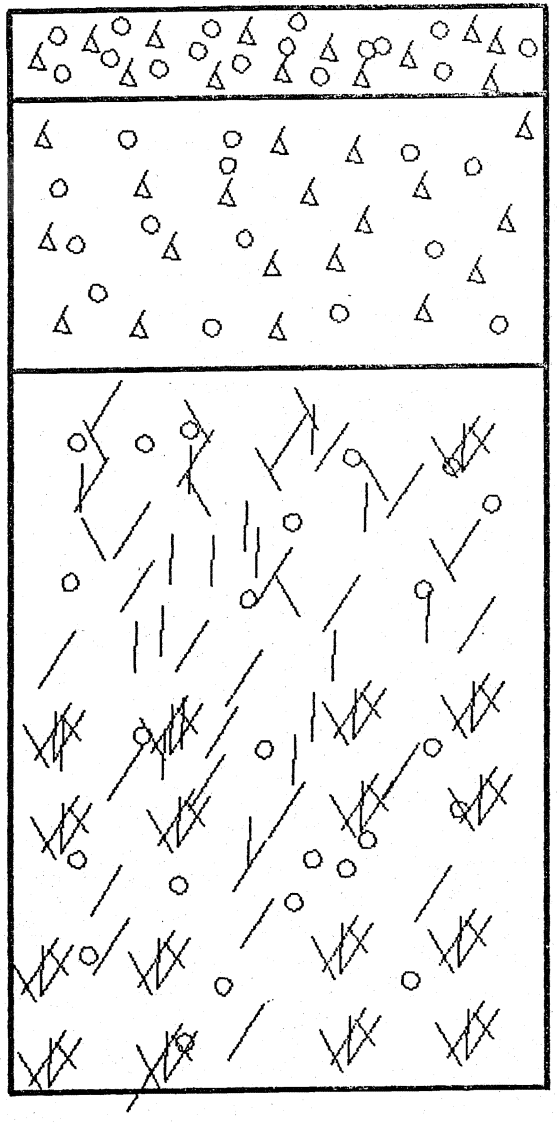


ORIGINAL
CUT AWAY
(used for sulphur and fiber feed)



REVISED
CUT AWAY
(Used for Carbon black trials)

Fig 2



1 1/2" ITEM 340 D ACP SURFACE

3" ITEM 292 A BASE COURSE

8" CEMENT STABILIZED
FOUNDATION COURSE

TYPICAL SECTION

TYPE "D" MODIFIED ACCORDING TO SPECIAL PROVISION TO ITEM 340

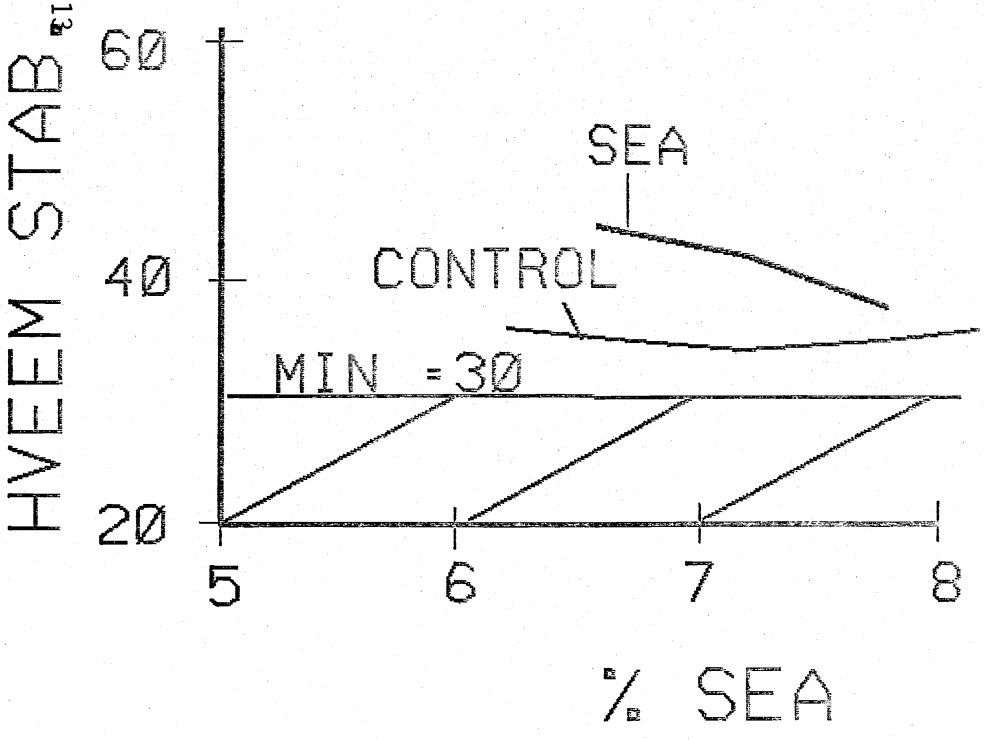
	Percent by Weight	Actual Percent
Passing 1/2" sieve	100	100
Passing 3/8" sieve	95 to 100	98.9
Passing 3/8" sieve, retained on No. 4 sieve	20 to 50	35.6
Passing No. 4 sieve, retained on No. 10 sieve	10 to 30	24.9
Total retained on No. 10	50 to 70	61.6
Passing No. 10 sieve, retained on No. 40	5 to 30	6.2
Passing No. 40 sieve, retained on No. 80	4 to 25	16.3
Passing No. 80 sieve, retained on No. 200 sieve	3 to 25	11.5
Passing No. 200 sieve	0 to 8	4.4

ITEM 340 D

MATERIALS

	VOLUME	WEIGHT
LTWT +4 =	23.0	17.0
LTWT -4 =	39.0	29.0
BUTLER SN =	24.0	34.3
TEMPLE SN =	14.0	19.7
	100.0	100.0

ITEM 292 A



MATERIALS

22% HOSLEY BROS. SILICEOUS
24% CR. LIMESTONE GIFFORD-HI
18% BUTLER SAND
36% TEMPLE SAND

BINDER

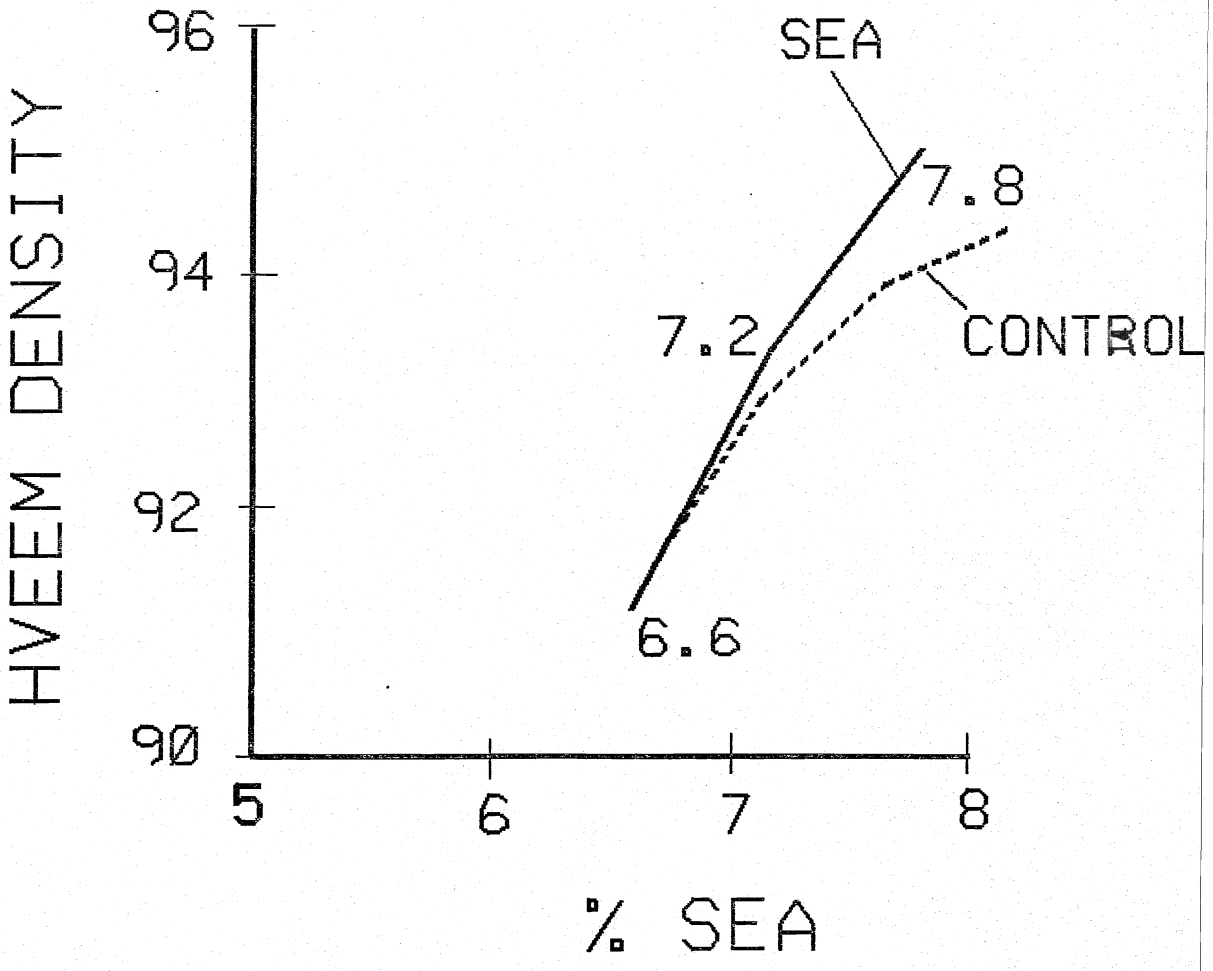
ASPH	SEA
5.5	- 6.6
6.0	- 7.2
6.5	- 7.8

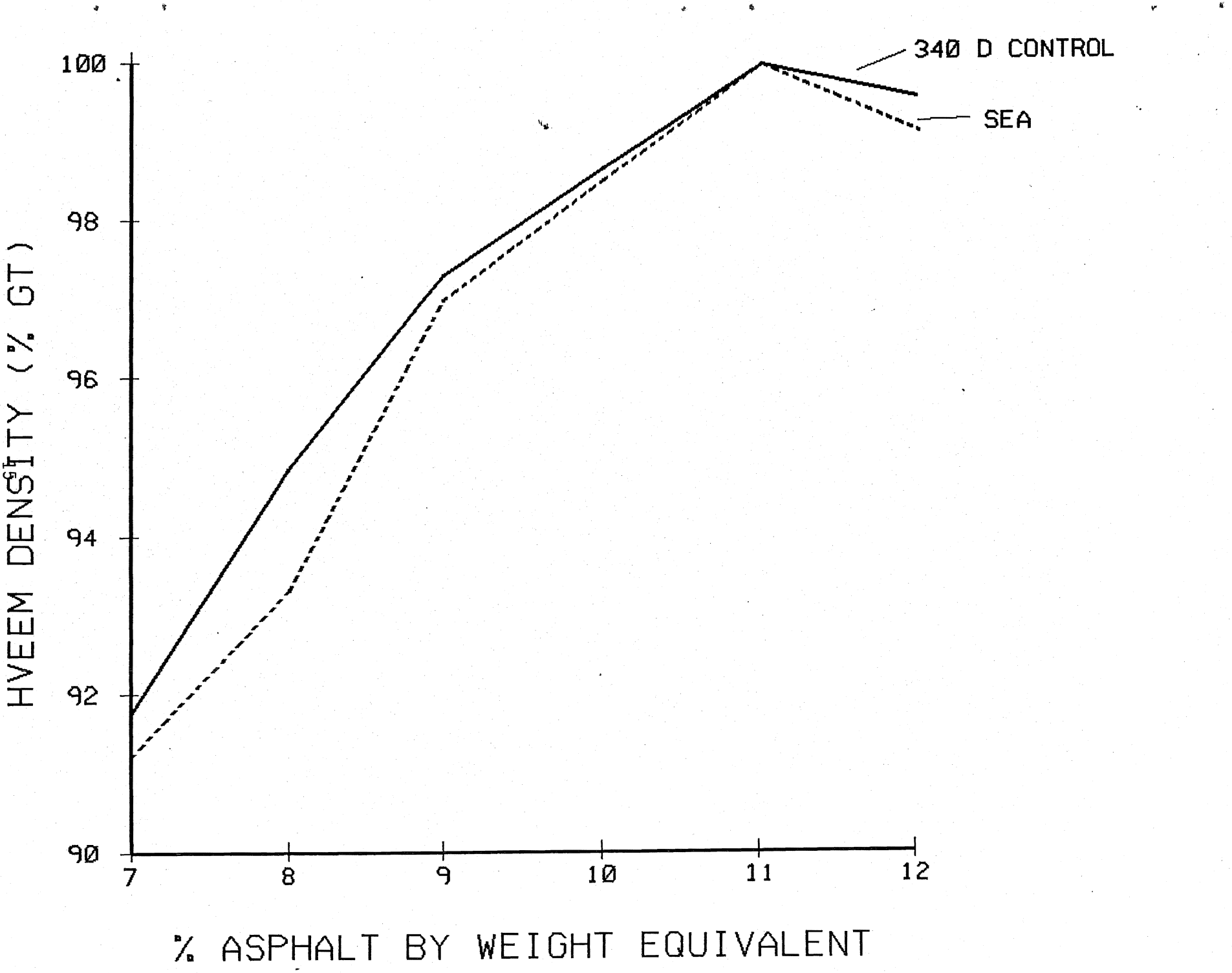
TEXACO AC-20
SULF PELLETS

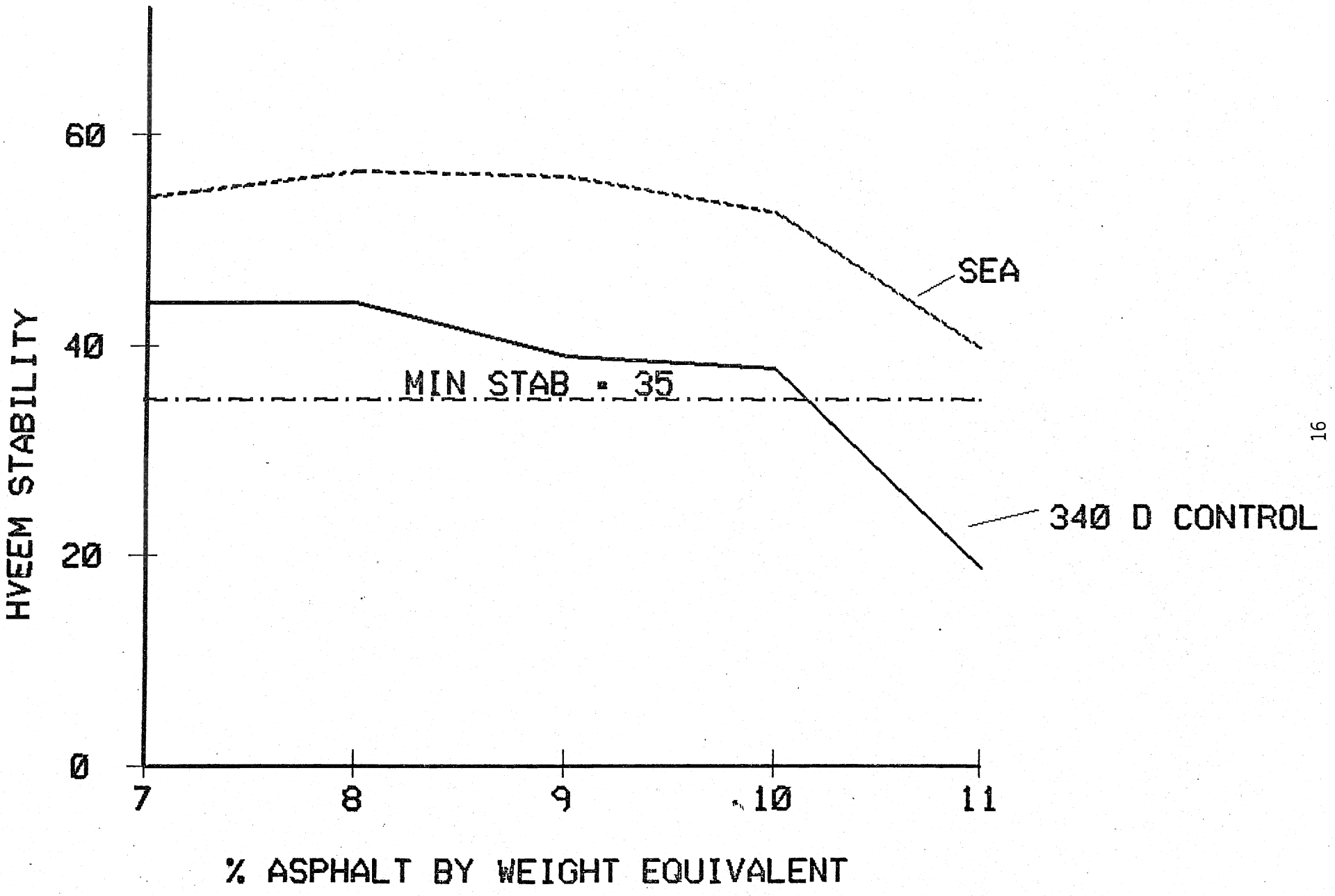
ITEM 292 A

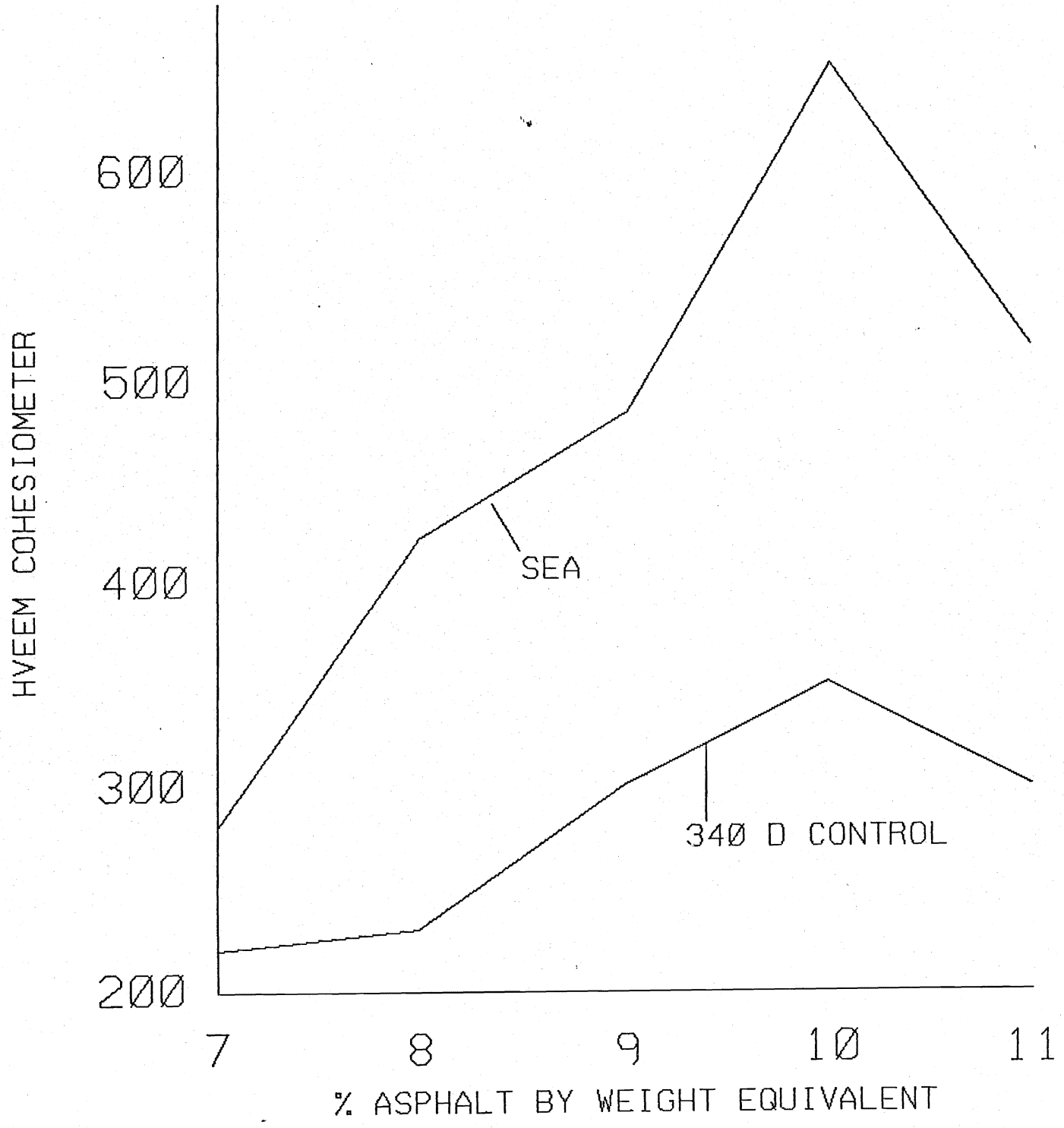
DESIGN ANALYSIS

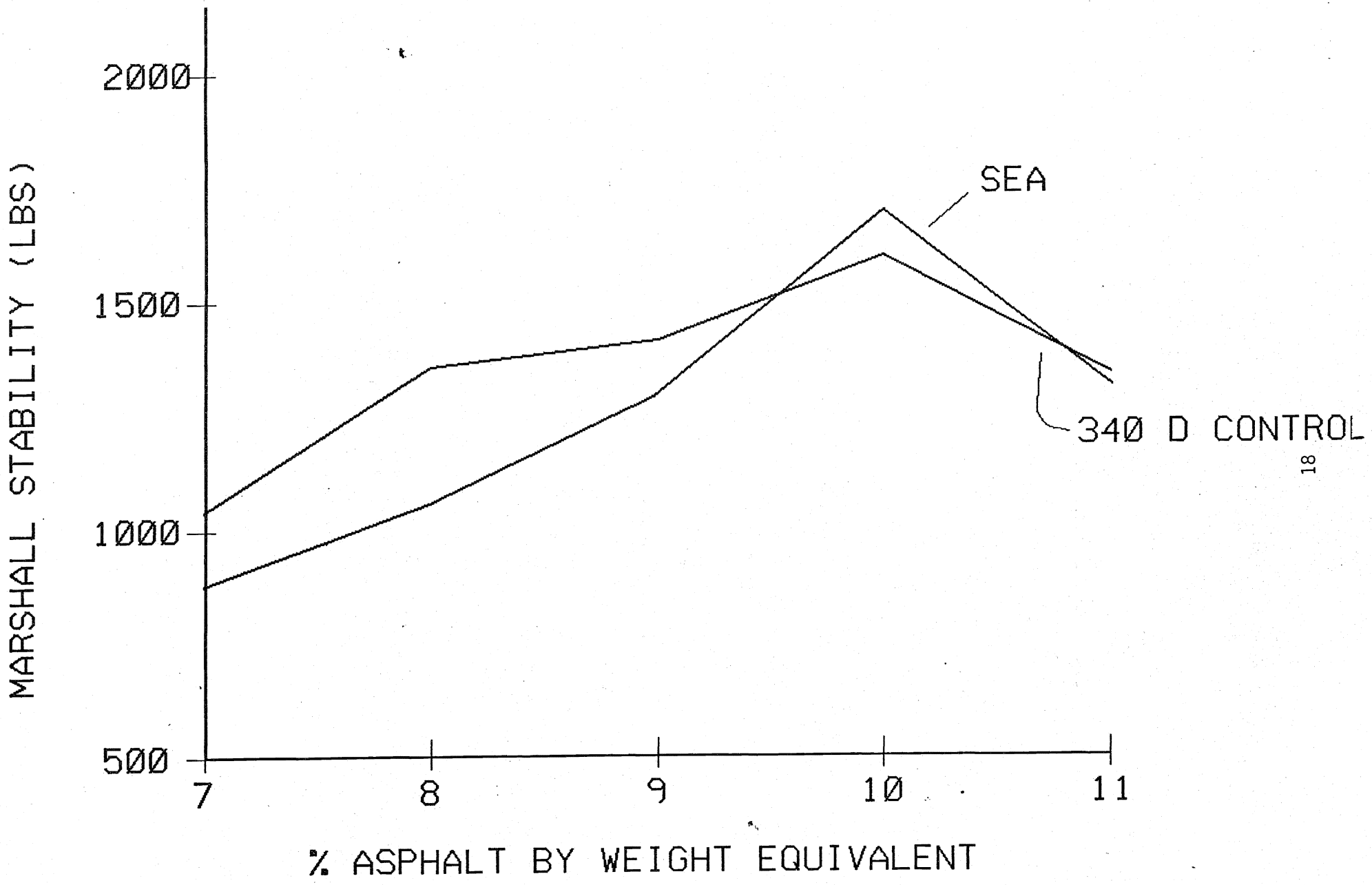
+1/2	0
1/2-3/8	0
3/8-4	19.6
4-10	22.2
+10	41.8
10-40	8.6
40-80	22.3
80-200	22.8
-200	4.5

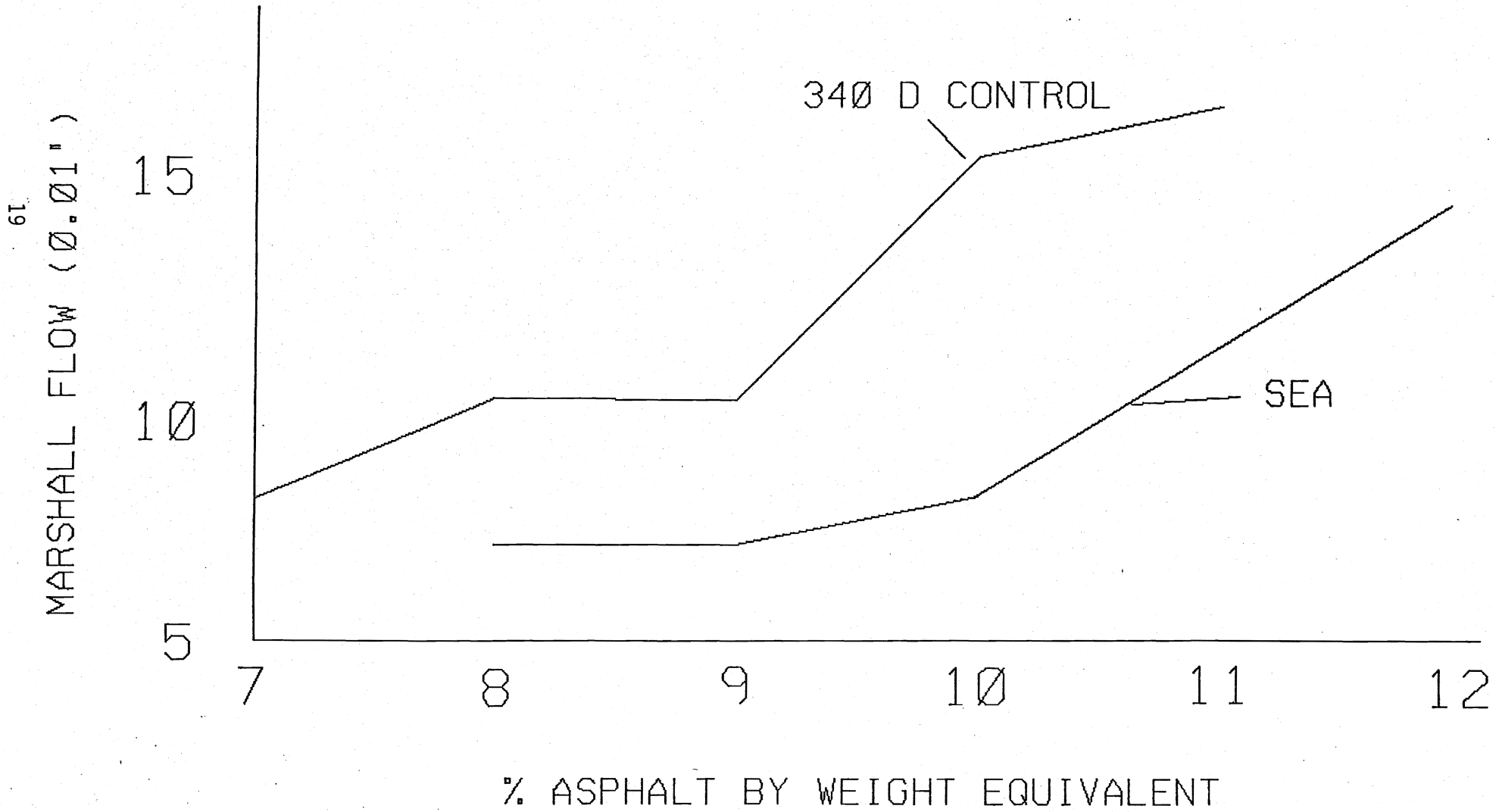



340 D CONTROL
SEA
100
98
96
94
92
90
7
8
9
10
11
12
HVEEM DENSITY (% GT)
% ASPHALT BY WEIGHT EQUIVALENT


HVEEM STABILITY
60
40
20
0
7
8
9
10
11
% ASPHALT BY WEIGHT EQUIVALENT
SEA
MIN STAB = 35
340 D CONTROL


HVEEM COHESIOMETER
600
500
400
300
200
SEA
340 D CONTROL
7
8
9
10
11
% ASPHALT BY WEIGHT EQUIVALENT


MARSHALL STABILITY (LBS)
2000
1500
1000
500
7
8
9
10
11
% ASPHALT BY WEIGHT EQUIVALENT
SEA
340 D CONTROL


MARSHALL FLOW (Ø.Ø1")
15
10
5
7
8
9
10
11
12
% ASPHALT BY WEIGHT EQUIVALENT
340 D CONTROL
SEA

Texas Highway Department
Construction Form No. 544 Rev. (2)

TEXAS HIGHWAY DEPARTMENT
ASPHALTIC CONCRETE SIEVE ANALYSIS WORK SHEET

County Angelina Highway SH 94 Project EACF 1151(1) Control 319-4-47
Date 8-26-82 Time Station Sampled By Frank Edge
Spec. Item 292 Type A Design No.

82-1880

Sieve Size	Bin No. 1 Temple Sand (a) Weight (grams)	Total % x 33.4 %	Bin No. 2 Butler Sand (b) Weight (grams)	Total % x 16.7%	Bin No. 3 Pea Gravel (c) Weight (grams)	Total % x 20.4 %	Bin No. 4 Cr. Limestone (d) Weight (grams)	Total % x 22.3%	Combined Analysis % (a+b+c+d)
		Temple Sand			82.2 lbs./c.f.			LL= = 15 PI= 2	
		Butler Sand			90.9 lbs./c.f.			LL= 15 PI= ;	
		Holsey Pea Gr.			97.7 lbs./c.f.			Decant. = 0.7	
		Cr. Limestone			94.8 lbs./c.f.			Sand Equiv. = 46	
1¾" — ⅞"									
⅞" — ⅜"									
⅝" — ⅜"									
½" — ⅜"									
⅜" — 4					284	28.3 5.8	528	52.6 11.7	17.5
¼" — 10									
4 — 10					618	61.6 12.6	426	42.5 9.5	22.1
+ 10									
10 — 40	8	1.6 0.5	137	27.3 4.5	77	7.7 1.6	39	3.9 0.9	7.5
40 — 80	77	15.3 5.1	261	52.0 8.7	12	1.2 0.2	1	0.1 0.0	14.0
80 — 200	334	66.4 22.2	84	16.7 2.8	5	0.5 0.1	2	0.2 0.0	25.1
Pass 200	84	16.7 5.6	20	4.0 0.7	7	0.7 0.1	7	0.7 0.2	6.6
Total	503 gm	100.0% 33.4%	502 gm	100.0% 16.7%	1003 gm	100.0% 20.4 %	1003 gm	100.0% 22.3%	92.8%

PER CENT MOISTURE IN AGGREGATES IN HOT BINS

Bin No.	(a) Tare Wt. (gms.)	(b) Gross Wet Wt. (gms.)	(c) Gross Dry Wt. (gms.)	(d) Wt. Moist (gms.) b-c	(e) Dry Wt. Aggr. (gms.) c-a	% Moist. $\frac{d}{e}$ x100%
1						
2						
3						
4						

20

Sulphur 2.4
Asphaltic Binder = 4.8 %
Total = 100.0%

Frank Edge
Inspector

Texas Highway Department
Form 231

692418-467-20M

GENERAL TEST REPORT

Laboratory No. 82-1878
Date Received 8-26-82 Date Reported 9-3-82
Dist. or Res. Engr. A. W. Cockrell
Address Lufkin, Texas
Sampler Frank Edge
Sampler's Title Engr. Tech. III
Contractor Moore Bros. Const. Co.
Sampled from Truck
(pit, quarry, car or stockpile)

Producer East Texas Asphalt
Quantity represented by sample
Has been used on
Proposed for use as SEA

Material Asph. Stab. Base (Plant Mix)

Control No.	Sect. No.	Job. No.
319-4-47		PD 8032
County	**Federal Project No.**	**Hwy. No.**
Angelina	EACF 1151(1)	SH 94
District No.	**Req. No.**	**Date Sampled**
11		8-26-82

Identification marks
Specification Item No. 292
Material from property of Holsey Pea Gr. 22%; Cr. Lmst. 24%; Butler Sand 18%; Temple Sand 36%

DETERMINATIONS

Sieve Analysis from Asphalt Stabilized Base Extraction Test

Sieve Size	Vacuum Ext. Sample % by Wt.	Design No. % by Wt.	Mineral Aggr. Gradation Spec. % by Wt.
+ 1/2"	0	0	0
1/2" - 3/8"	0	0	0-20
3/8" - 4	17.0	19.6	0-40
4 - 10	23.8	22.2	5-30
+ 10	(40.8)	(41.8)	35-70
10 - 40	6.9	8.6	5-35
40 - 200	40.7	45.1	20-50
Pass 200	5.9	4.5	2-15
SEA	5.7**	7.2*	4-7

The Specific Gravity of the mixture determined by the "Rice Method" = 2.494
Average Density (%) of Specimen LJG = 89.5 (Min. 88)
Average Hveem Stability (%) of Specimen LHG = 36 (Min. 27)
Average Cohesimeter Value = 152
Marshall Stab. = 400 Rate of Flow = 0.06
VMA = 20.8 VMAF/A = 50

Asph. Temp. @ Plant = 325°F
Mix Temp. @ Plant = 263°F

* 4.68% Asph. + 2.56% Sulphur
** 0.8% Sulphur burned from Ext. Aggr. = 6.5% SEA

Progress Record Test

Kenneth W Fults
Kenneth W. Fults
Sr. Lab Engineer

exas Highway Department
orm 231

493418-467-20M

GENERAL TEST REPORT

Laboratory No. 82-1888
Date Received 8-30-82 Date Reported 9-1-82
Dist. or Res. Engr. A. W. Cockrell
Address Lufkin, Texas
Sampler Frank Edge
Sampler's Title Engr. Tech. III
Contractor Moore Bros. Const. Co.
Sampled from Truck, Tk. # 15079342
(pit, quarry, car or stockpile)

Producer East Texas Asphalt
Quantity represented by sample
Has been used on
Proposed for use as Sulphur Extended Asphalt

Material SEA

319-4-47,etc. (Control No.) PD 8032,etc. (Job. No.)
Sect. No.

Angelina (County) EACF 1151(1) (Federal Project No.) SH 94 (Hwy. No.)

11 (District No.) Req. No. 8-30-82 (Date Sampled)

Identification marks
Specification Item No. 292 A
Material from property of

DETERMINATIONS

Sieve Analysis from Sulphur Extended Asphalt Extraction Test

Sieve Size	Vacuum Ext. Sample % by Wt.	Mineral Aggr. Gradation Spec. % by Wt.
1"		0
1" - 3/8"		0
3/8" - 4	16.8	18.4
4 - 10	24.3	20.9
+ 10	(40.1)	(39.3)
10 - 40	7.0	8.1
40 - 80	16.8	21.0
80 - 200	23.5	21.4
Pass 200	5.7	4.2
Asphalt	5.9	4.7 - 7.2

Texas Highway Department
Form 231

GENERAL TEST REPORT

Laboratory No. 82-1898
Date Received 8-30-82 Date Reported 9-3-82
Dist. or Res. Engr. A. W. Cockrell
Address Lufkin, Texas
Sampler Otis Clark
Sampler's Title Mat'l. Analysis III
Contractor Moore Bros. Const. Co.
Sampled from Truck, Tk. #15079369
(pit, quarry, car or stockpile)

Producer East Texas Asphalt
Quantity represented by sample
Has been used on
Proposed for use as

Material Asph. Stab. Base
(Plant Mix)

Control No.	Sect. No.	Job. No.
319-4-47		PD 8032

County	Federal Project No.	Hwy. No.
Angelina	EACF 1151(1)	SH 94

District No.	Req. No.	Date Sampled
11		8-30-82

Identification marks LHI
Specification Item No. 292
Material from property of Temple Sand 36%; Butler Sand 18%; Pea Gr. 22%; Cr. Lmst 24%

DETERMINATIONS

Sieve Analysis from Asphalt Stabilized Base Extraction Test

Sieve Size	Vacuum Ext. Sample % by Wt.	Design No. % by Wt.	Mineral Aggr. Gradation Spec. % by Wt.
+ 1/2"	0	0	0
1/2" - 3/8"	0	0	0-20
3/8" - 4	17.4	19.6	0-40
4 - 10	22.4	22.2	5-30
+ 10	(39.8)	(41.8)	35-70
10 - 40	8.6	8.6	5-35
40 - 200	40.4	45.1	20-50
Pass 200	5.4	4.5	2-15
SEA	5.8**	7.2*	4-7

The Specific Gravity of the mixture determined by the "Rice Method" = 2.488
Average Density (%) of Specimen LHI = 90.1 (Min. 88)
Average Hveem Stability (%) of Specimen LHI = 35 (Min. 27)
Average Cohesiometer Value =
Marshall Stab. = 534 Rate of Flow = 0.06
VMA = 19.7 VMAF/A = 54

Mix . Temp. @ Plant = 250°F

* 4.68% Asph. + 2.56% Sulphur
** 1.2% Additional Sulphur burned from Ext. Aggr. = 7.0% SEA

Progress Record Test

Kenneth W. Fults
Sr. Lab Engineer

Texas Highway Department
Form 231

GENERAL TEST REPORT

Laboratory No. 82-1913
Date Received 8-31-82 Date Reported 9-3-82
Dist. or Res. Engr. A. W. Cockrell
Address Lufkin, Texas
Sampler Frank Edge
Sampler's Title Engr. Tech. III
Contractor Moore Bros. Const. Co.
Sampled from Truck, Tk. #15079384
(pit, quarry, car or stockpile)
Producer East Texas Asphalt
Quantity represented by sample
Has been used on
Proposed for use as

Material: Asph. Stab. Base (Plant Mix)

Control No.	Sect. No.	Job. No.
319-4-47		PD 8032
County	**Federal Project No.**	**Hwy. No.**
Angelina	EACF 1151(1)	SH 94
District No.	**Req. No.**	**Date Sampled**
11		8-31-82

Identification marks LHJ
Specification Item No. 292
Material from property of Temple Sand 33.8%; Butler Sand 16.9%; Pea Gravel 20.7%; Cr. Lmst. = 22.6%

DETERMINATIONS

Sieve Analysis from Asphalt Stabilized Base Extraction Test

Sieve Size	Vacuum Ext. Sample % by Wt.	Design No. % by Wt.	Mineral Aggr. Gradation Spec. % by Wt.
+ 1/2"	0	0	0
1/2" - 3.8"	0	0	0-20
3/8" - 4	17.8	18.4	0-40
4 - 10	23.8	20.9	5-30
+ 10	(41.6)	(39.3)	35-70
10 - 40	7.4	8.1	5-35
40 - 200	38.8	42.4	20-50
Pass 200	6.3	4.2	2-15
SEA	5.9 **	7.2*	4-7

The Specific Gravity of the mixture determined by the "Rice Method" = 2.475
Average Density (%) of Specimen LHJ = 91.6 (Min. 88)
Average Hveem Stability (%) of Specimen LHJ = 42 (Min. 27)
Average Cohesiometer Value of Specimen = 266
Marshall Stab. = 301 Rate of Flow = 0.06
VMA = 19.3% VMAF/A = 56%

Asphalt Temp. @ Plant = 325°F
Mix Temp. @ Plant = 265°%

* 4.68% Asph. + 2.56% Sulphur

** 1.1% Sulphur burned from Ext. Agg = 7.1% SEA

Kenneth W. Fults
Sr. Lab Engineer

Texas Highway Department
Construction Form No. 544 Rev. (2)

TEXAS HIGHWAY DEPARTMENT
ASPHALTIC CONCRETE SIEVE ANALYSIS WORK SHEET

County Angelina Highway SH 94 Project EACF 1151(1) Control 319-4-49
Date 8-31-82 Time Station Sampled By Frank Edge
Spec. Item 292 Type A Design No.

82-1915

Sieve Size	Bin No. 1 Temple Sand (a) Weight (grams)	Total % x 33.8 %	Bin No. 2 Butler Sand (b) Weight (grams)	Total % x 16.9%	Bin No. 3 Pea Gravel (c) Weight (grams)	Total % x 20.7 %	Bin No. 4 Cr. Limestone (d) Weight (grams)	Total % x 22.6 %	Combined Analysis % (a+b+c+d)
		Temple Sand			82.2 lbs./c.f.			LL= 16 PI= 2	
		Butler Sand			90.6 lbs./c.f.			LL= 14 PI= 1	
		Holsey Pea Gr.			97.6 lbs./c.f.			Decant. = 1.3	
		Cr. Limestone			95.1 lbs./c.f.			Sand Equiv. = 46	
1¾" — ⅞"									
⅞" — ⅜"									
⅝" — ⅜"									
½" — ⅜"									
⅜" — 4					286	28.5 5.9	525	52.3 11.8	17.7
¼" — 10									
4 — 10					621	61.7 12.8	418	41.7 9.4	22.2
+ 10									
10 — 40	6	1.2 0.4	139	27.6 4.6	74	7.4 1.5	46	4.6 1.0	7.5
40 — 80	75	14.9 5.0	271	53.8 9.1	12	1.2 0.2	6	0.6 0.2	14.5
80 — 200	340	67.5 22.8	73	14.5 2.5	7	0.7 0.2	1	0.1 0.0	25.5
Pass 200	83	16.4 5.6	21	4.1 0.7	5	0.5 0.1	7	0.7 0.2	6.6
Total	504 gm	100.0% 33.8 %	504 gm	100.0% 16.9%	1005 gm	100.0% 20.7%	1003 gm	100.0% 22.6%	94.0 %

PER CENT MOISTURE IN AGGREGATES IN HOT BINS

Bin No.	(a) Tare Wt. (gms.)	(b) Gross Wet Wt. (gms.)	(c) Gross Dry Wt. (gms.)	(d) Wt. Moist (gms.) b-c	(e) Dry Wt. Aggr. (gms.) c-a	% Moist. $\frac{d}{e}$ x100%
1						
2						
3						
4						

Asphaltic Binder = 6.0 %
Total = 100.0%

Frank Edge
Inspector

Texas Highway Department
Form 231

GENERAL TEST REPORT

Laboratory No. 82-1952
Date Received 9-1-82 Date Reported 9-3-82
Dist. or Res. Engr. A. W. Cockrell
Address Lufkin, Texas
Sampler Frank Edge
Sampler's Title Engr. Tech. III
Contractor Moore Bros. Const. Co.
Sampled from Truck, Tk.# 15079449
(pit, quarry, car or stockpile)
Producer East Texas Asphalt
Quantity represented by sample
Has been used on
Proposed for use as

Material Asph. Stab. Base
(Plant Mix)

319-4-47 PD 8032
Control No. Sect. No. Job. No.

Angelina EACF 1151(1) SH 94
County Federal Project No. Hwy. No.

11 9-1-82
District No. Req. No. Date Sampled

Identification marks LHK 1,2,3
Specification Item No. 292
Material from property of Temple Sand 36%
Butler Sand 18%; Holsey Pea Gr. 22% ;
Cr. Limestone 24%

DETERMINATIONS

Sieve Analysis from Asphalt Stabilized Base Extraction Test

Sieve Size	Vacuum Ext. Sample % by Wt.	Design No. % by Wt.	Mineral Aggr. Gradation Spec. % by Wt.
+ 1/2"	0	0	0
1/2" = 3/8"	0	0	0-20
3/8" - 4	17.4	18.4	0-40
4 - 10	23.5	20.9	5-30
+ 10	(40.9)	(39.3)	35-70
10 - 40	7.1	8.1	5-35
40 - 200	39.2	42.4	20-50
Pass 200	6.8	4.2	2-15
SEA	6.0**	7.2*	4-7

The Specific Gravity of the mixture determined by the "Rice Method" = 2.475
Average Density (%) of Specimen LHK = 90.2 (Min. 88)
Average Hveem Stability (%) of Specimen LHK = 42 (Min. 27)
Average Cohesiometer Value of Specimen = 136
Marshall Stab. = 223 Rate of Flow - 0.06
VMA = 20.7 VMAF/A = 53

Asph. Temp. @ Plant = 300°F
Mix Temp. @ Plant = 175°F

* 4.68% Asph. + 2.56% Sulphur
** 0.9% Sulphur burned from Ext. Aggr. = 6.9% SEA

Progress Record Test

Kenneth W. Fults
Sr. Lab Engineer

Texas Highway Department
Form 231

692418 467-20M

GENERAL TEST REPORT

Laboratory No. 82-
Date Received 9-1-82 Date Reported 9-7-82
Dist. or Res. Engr. A W Cockrell
Address Hwy Rm
Sampler Clark
Sampler's Title
Contractor Moore Bros
Sampled from Rdwy (pit, quarry, car or stockpile)
Producer ETA Luftkin
Quantity represented by sample
Has been used on
Proposed for use as 292 A (SEA)

Material SEA

319-4-47 (Control No.) PD8032 (Sect. No., Job. No.)
Ang (County) SH 94 (Federal Project No., Hwy. No.)
11 (District No.) 8-30 thru 9-1-82 (Req. No., Date Sampled)
Identification marks
Specification Item No.
Material from property of

DETERMINATIONS

Rolling Patterns and Rdwy Dens - SEA

Date	Sta.	Lane	Depth	Roll Pattern	Ga	G_R	Dens	Remold Dens
8-30-82	396	B		1st Pass - Lead vib and Rear Static	2.199	2.457	89.5	
					2.168		88.2	
				2nd Pass-Lead and Rear Static	2.191		89.2	
8-31-82	393	B	1 3/16	1st & 2nd-Dual vib	2.146	2.480	86.5	
			1 3/16		2.155		86.9	
		Shld.	1 3/4	1st & 2nd- Dual vib	2.107	2.415	87.2	
			1 3/4		2.095		86.7	
	212	B	1 5/16	1st & 2nd- Dual vib	2.096	2.499	83.9	89.6
			1 5/16		2.100		84.0	
		Shld.	1 13/16	1st & 2nd- Dual vib	2.166	2.463	87.9	90.9
			1 13/16		2.149		87.3	
	216	B	1 1/2	1st & 2nd -Dual vib	2.102	2.445	86.0	91.6
			1 1/2		2.102		86.0	
	225	B	1 1/2	1st & 2nd -Dual vib	2.131	2.463	86.5	90.9
			1 1/2		2.137		86.8	

Texas Highway Department
Form 231

692418-467-20M

GENERAL TEST REPORT

Laboratory No. .....
Date Received 9-1-82 Date Reported 9-7-82
Dist. or Res. Engr. A W Cockrell
Address Lufkin
Sampler Clark
Sampler's Title .....
Contractor Moore Bros
Sampled from Rdwy
(pit, quarry, car or stockpile)
Producer ETA Lufkin
Quantity represented by sample .....
Has been used on .....
Proposed for use as 292 A (SEA)

Material SEA

319-4-47
Control No. Sect. No. Job. No.

Ang 5H 94
County Federal Project No. Hwy. No.

11
District No. Req. No. Date Sampled

Identification marks .....
Specification Item No. .....
Material from property of .....

DETERMINATIONS

Continued--

8-31-82	226	B	1 1/4	1st & 2nd Dual vib	2.105	2.484	84.7	88.6
			1 1/4		2.083		83.9	
9 82	224	B	2 3/16	2 lead vib & rear static	2.139	2.451	87.3	
		Top	1 3/16	plus Static & Pheu	2.133	2.468	86.4	
		Bottom	7/8	Cold	2.124		86.1	
	224	Shld	2 1/2	2 lead vib & 2 rear static	2.232	2.415	92.4	
		Top	1 1/4	plus Static & Pheu	2.208	2.414	91.5	
		Bottom	1 1/16	Cold	2.211		91.6	

Texas Highway Department
Form 231

492418-487-20M

GENERAL TEST REPORT

Laboratory No. 82-
Date Received 11-10-82 Date Reported 11-16-82
Dist. or Res. Engr. A. W. Cockrell
Address Lufkin, Texas
Sampler James Denum - Kip Smith
Sampler's Title Dist. Lab
Contractor Moore Bros. Const. Co.
Sampled from Roadway
(pit, quarry, car or stockpile)

Producer ETA, Lufkin
Quantity represented by sample
Has been used on
Proposed for use as Asph. Stab Base
292 Ty A

Material Rdwy. Cores

319-4-47
Control No. | Sect. No. | Job. No.

Angelina | | SH 94
County | Federal Project No. | Hwy. No.

11 | | 11-10-82
District No. | Req. No. | Date Sampled

Identification marks
Specification Item No.
Material from property of

DETERMINATIONS

Station	Location	Layer	Thickness	G_R*	Rdwy. Dens.	Remolded** Density
182+00	19' Lt. Curb	Top	1 5/8"	2.400	86.0	86.9
		Bottom	1 1/8"	2.385	80.0	86.6
189+00	18' Lt. Curb	Top	1 3/8"	2.401	88.2	88.0
		Bottom	1 3/16"	2.408	84.3	85.7
200+00	17' Lt. Curb	Top	1 3/4"	2.403	87.6	90.5
		Bottom	1 3/4"	2.433	87.8	86.5
200+00	17' Lt. Curb	Top	1 3/4"	2.382	88.1	92.7

* Rice Gravity

** Specimens were remolded at 250°F and to approximate roadway thickness. The bottom layers were shy of material due to cutting of specimens and removal of tack and seal coat.

Kenneth W. Fults
Sr. Lab Engineer

Texas Highway Department
Form 231

GENERAL TEST REPORT

Laboratory No. 85-485
Date Received 4-19-83 Date Reported 4-20-83
Dist. or Res. Engr. A. W. Cockrell
Address Lufkin, Texas
Sampler Frank Edge
Sampler's Title Engr. Tech. III
Contractor Moore Bros. Const. Co.
Sampled from Truck, Tk. #15377686 (pit, quarry, car or stockpile)
Producer East Texas Asphalt
Quantity represented by sample
Has been used on
Proposed for use as

Material HMAC - SEA

319-4-47 (Control No.) PD 8032 (Job. No.)
Angelina (County) EACF 1151(1) (Federal Project No.) SH 94 (Hwy. No.)
11 (District No.) 4-19-83 (Date Sampled)

Identification marks LCC 1,2,3
Specification Item No. 340-148
Material from property of Temple Sand 14%; Butler Sand 24%; Lt. Wt. +4-39%; Lt. Wt. Lt. Wt. -4 -23%; AC-20 Asphalt, Texaco 8.5%

DETERMINATIONS

Sieve Analysis from Asphaltic Concrete Extraction Test

Sieve Size	Vacuum Ext. Sample % by Wt.	Design No. 3 % by Wt.	Mineral Aggr. Gradation Spec. % by Wt.
+ 1/2"	0	0	0
1/2" - 3/8"	1.4	1.4	0-5
3/8" - 4	24.6	32.7	20-50
4 - 10	13.9	11.6	10-30
+ 10	(39.9)	(45.7)	50-70
10 - 40	7.9	8.8	0-30
40 - 80	24.7	23.3	4-25
80 - 200	14.3	16.3	3-25
Pass 200	4.7	5.9	0-6
Asphalt	* 8.5 (14.2 by Vol.)	8.5	9-19
	100.0	108.5	

The Specific Gravity of the mixture determined by the "Rice Method" = 1.747
The Theoretical Specific Gravity (G_t) being used = 1.722
Average Density (%) of Specimen LCC 1,2,3 = 95.3 (Opt. 97)
Average Hveem Stability (%) of Specimen LCC 1,2,3 = (Min. 35)
Average Cohesiometer Value of Specimen =
Potential for Asphalt Stripping = 15%
Sulfur Burn-off = 0.6%
Marshall Stability = 168 Flow= 0.08
VMA= 20.6 VMA F/A = 67.5

SEA 383+50 to 401+80

Asphalt Temp. @ Plant = 325°F
Mix Temp. @ Plant = 290°F

Progress Record Test

* Sulfer burn-off = 0.6%

Kenneth W. Fults
Kenneth W. Fults
Sr. Lab Engineer

Texas Highway Department
Form 221

GENERAL TEST REPORT

Laboratory No. 83-667
Date Received 5-3-83 Date Reported 5-6-83
Dist. or Res. Engr. A. W. Cockrell
Address Lufkin, Texas
Sampler Frank Edge
Sampler's Title Engr. Tech. III
Contractor Moore Bros. Const. Co.
Sampled from Truck, Tk. 15386435
(pit, quarry, car or stockpile)
Producer East Texas Asphalt
Quantity represented by sample
Has been used on
Proposed for use as

Material HMAC

Control No.	Sect. No.	Job. No.
319-4-47		PD 8032

County	Federal Project No.	Hwy No.
Angelina	EACF 1151(1)	SH 94

District No.	Req. No.	Date Sampled
11		5-3-83

Identification marks LCK 1,2,3
Specification Item No. 340-148
Material from property of Temple Sand, Butler Sand, -4 Lt. Wt., +4 Lt. Wt.; Sulphur, AC-20

DETERMINATIONS

Sieve Analysis from Asphaltic Concrete Extraction Test

Sieve Size	Vacuum Ext. Sample % by Vol.	Design No. % by Vol.	Mineral Aggr. Gradation Spec. % by Vol.
+ 1/2"	0	0	0
1/2" - 3/8"	3.8	1.1	0-5
3/8" - 4	42.3	35.6	20-50
4 - 10	18.3	24.9	10-30
+ 10	(64.4)	(61.6)	50-70
10 - 40	4.8	6.2	0-30
40 - 80	15.4	16.3	4-25
80 - 200	10.6	11.5	3-25
Pass 200	4.8	4.4	0-6
Asphalt	14.0 (8.3 by wt.)	~~11.1 (6.6 by wt.)~~ 14.4 (10.2 by wt.)	9-16

The Specific Gravity of the mixture determined by the "Rice Method" = 1.739
Average Density (%) of Specimen LCK 1,2,3 = 94.7 (Opt. 97)
Average Hveem Stability (%) of Specimen LCK 1,2,3 = (Min. 35)
Average Cohesiometer Value of Specimen =
Potential for Asphalt Stripping = 10%
Marshall Stability = 860 Flow = .07
VMA= 19.0 VMA F/A = 72.1

Asphalt Temp. @ Plant = 325°F
Mix Temp. @ Plant = 295°F

Progress Record Test

Kenneth W. Fults
Kenneth W. Fults
Sr. Lab Engineer

Texas Highway Department
Form 231

GENERAL TEST REPORT

Laboratory No. 83-753
Date Received 5-9-83 Date Reported 5-11-83
Dist. or Res. Engr. A. W. Cockrell
Address Lufkin, Texas
Sampler Frank Edge
Sampler's Title Engr. Tech. III
Contractor Moore Bros. Const. Co.
Sampled from Truck, Tk. #15386618
(pit, quarry, car or stockpile)

Producer East Texas Asphalt
Quantity represented by sample
Has been used on
Proposed for use as

Material HMAC (SEA)

Control No.	Sect. No.	Job. No.
319-4-47		PD 8032
County	**Federal Project No.**	**Hwy. No.**
Angelina	EACF1151(1)	SH 94
District No.	**Req. No.**	**Date Sampled**
11		5-9-83

Identification marks LCN 1,2,3
Specification Item No. 340
Material from property of Temple Sand, Butler Sand, -4 Lt. Wt., +4 Lt. Wt., Sulfur, AC-2-

DETERMINATIONS

Sieve Analysis from Asphaltic Concrete Extraction Test

Sieve Size	Vacuum Ext. Sample % by Vol.	Design No. 3 % by Vol.	Mineral Aggr. Gradation Spec. % by Vol.
+ 1/2"	0	0	0
1/2" - 3/8"	2.6	1.0	0-5
3/8" - 4	33.2	30.5	20-50
4 - 10	18.7	31.3	10-30
+ 10	(54.5)	(52.8)	50-70
10 - 40	3.4	5.3	0-30
40 - 80	15.3	14.0	4-25
80 - 200	8.5	9.8	3-25
Pass 200	3.4	3.7	0-6
Asphalt	14.9 (9.1)	14.4	9-19

The Specific Gravity of the mixture determined by the "Rice Method" = 1.781
The Theoretical Specific Gravity (G_t) being used = 1.684
Average Density (%) of Specimen LCN 1,2,3 = 100.0 (94.6) (Opt. 97)
Average Hveem Stability (%) of Specimen LCN 1,2,3 = (Min. 35)
Average Cohesiometer Value =
Potential for Asphalt Stripping = 10%
Marshall Stability= 1103 Flow = 9
VMA = 20.7 VMA F/A = 73.9

Asphalt Temp. @ Plant = 300°F
Mix Temp. @ Plant = 270°F

Progress Record Test

Kenneth W. Fults
Sr. Lab Engineer

SPECIAL PROVISION Districts 11 & 20

TO

ITEM 292

ASPHALT STABILIZED BASE

(PLANT MIX)

For this project, Item 292, "Asphalt Stabilized Base (Plant Mix)", is hereby amended with respect to the clauses cited below and no other clauses or requirements of this Item are waived or changed hereby.

Article 292.1. Description. The second sentence is voided and not replaced.

Article 292.2. Materials, Subarticle (2) Mineral Aggregates, Section (a) Description, and Section (b) Grades, are voided and replaced by the following:

(2) Mineral Aggregates. The mineral aggregate shall be composed of a coarse aggregate and a fine aggregate. Samples of coarse aggregate and fine aggregate shall be submitted in accordance with the methods prescribed in Item 6 of the Standard Specifications and approval of both material and source must be obtained from the Engineer prior to delivery. Sources of material specified on the plans as being available for use will not require prior approval. Unless otherwise on the plans, one or more mineral aggregates containing both coarse and fine aggregate may be used to produce the specified mixture.

(a) Coarse Aggregate. The coarse aggregate shall be that part of the aggregate retained on a No. 10 sieve; shall consist of clean, tough, durable fragments of stone, crushed gravel, gravel, iron ore, slag, or combinations thereof, as hereinafter specified, of uniform quality throughout.

The point of sampling for tests, Test Method Tex-217-F (Part I and Part II) will be at the cold bins, unless otherwise shown on the plans.

When the coarse aggregate is tested in accordance with Test Method Tex-217-F (Part I, Separation of Deleterious Material), the amount of organic matter, clay, loam or particles coated therewith or other undesirable materials shown in the plans shall not exceed three percent and when the remaining part of the sample is further tested in accordance with Test Method Tex-217-F(Part II, Decantation), the amount of material removed shall not be more than two percent.

The coarse aggregate, except iron-ore topsoil, (each coarse aggregate when a combination of materials is used) shall have an abrasion of not more than forty percent loss by weight when subjected to the Los Angeles Abrasion Test, Test Method Tex-410-A unless otherwise shown on the plans.

Unless otherwise indicated on the plans, the abrasion test requirements for iron-ore topsoil shall be omitted.

(b) Fine Aggregate. The fine aggregate shall be that part of the aggregate passing the No. 10 sieve and shall consist of sand or screenings or a combination of sand and screenings. Sand shall be composed of durable stone particles free from injurious foreign matter. Screenings shall be of the same or similar material as specified for coarse aggregate. The soil constants for that part of the fine aggregate passing the No. 40 sieve shall meet the following requirements, unless otherwise shown on the plans.

The liquid limit shall not be more than 30 when tested by Test Method Tex-104-E and the plasticity index shall not be more than 4 when tested by Test Method Tex-106-E.

The point of sampling of aggregates for tests speciried above will be at the cold bins, unless otherwise shown on the plans.

Article 292.2. Materials is supplemented by the following:

(3) Additives. Additives to facilitate mixing and/or improve the quality of the asphaltic mixture may be required by the Engineer.

Article 292.3. Asphalt Stabilized Mixture, is voided and replaced by the following:

292.3. Asphalt Stabilized Mixtures.

(1) Types. The mixtures shall consist of a uniform mixture of coarse aggregate, fine aggregate and asphaltic material. The grading of each constituent of the mineral aggregate shall be such as to produce, when properly proportioned, a mixture which will conform to the limitations for master grading given below for the specified type. Testing for gradation will be in accordance with Test Method Tex-200-F (Dry Sieve Analysis).

Type "A" (Black Base):

	Percent by Weight
Passing 1" sieve	100
Passing 1" sieve, retained on 3/8" sieve	0 to 20
Passing 3/8" sieve, retained on No. 4 sieve.....	0 to 40
Passing No. 4 sieve, retained on No. 10 sieve.....	5 to 30
Retained on No. 10 sieve	35 to 70
Passing No. 10 sieve, retained on No. 40 sieve	5 to 35
Psssing No. 40 sieve, retained on No. 200 sieve	20 to 50
Psssing No. 200 sieve.....	2 to 15

The asphaltic material shall form from 4.0 to 7.0 percent of the mixture by weight.

Type "B" (Hot Sand-Asphalt Base):

	Percent by Weight
Passing 1/2" sieve	100
Passing 1/2" sieve, retained on No. 10 sieve	0 to 50
Passing No. 10 sieve, retained on No. 200 sieve	40 to 95
Passing No. 200 sieve	2 to 20

The asphaltic material shall form from 4.0 to 7.0 percent of the mixture by weight.

Type "C":

Grading requirements and asphalt content shall be as shown on the plans.

(2) Tolerances. The Engineer will designate the grading of the aggregate and asphalt content to be used in the mixture. The mixture produced shall not vary from the designated grading for any sieve size plus or minus 5 percent by weight based on total mixture and shall be within the limits for master grading. The asphaltic material shall not vary by more than 0.5 percent by weight (based on total mixture) from the designated asphalt content, and shall be within limits specified by the plans.

(3) Extraction Test. Samples of the mixture when tested in accordance with Test Method Tex-210-F shall not vary from the grading proportions of the aggregate and asphalt content designated by the Engineer by more than the respective tolerances specified above.

(4) Sampling and Testing. It is the intent of this specification to produce a mixture which, when designated and tested in accordance with these specifications and methods outlined in THD Bulletin C-14, will have the following laboratory density and stability unless otherwise shown on plans:

Type	Density, Percent			Stability, Percent
A	Min 88	Max 96	Optimum 92	Not less than 27
B	Min 78	Max 95	Optimum 82	Not less than 20
C	As shown on the plans			Shown on plans

Stability and density tests are intended for control tests. If the laboratory stability of the mixture produced has a value lower than the specified and in the opinion of the Engineer is not due to a change in source or quality of materials, production may proceed with consequent changes in the mix until the laboratory stability equals or exceeds the specified values. If, in the opinion of the Engineer, there is a change in any material from that used in the design mixture, production will be discontinued until a new design mixture is determined by trial mixes.

Article 292.4. Equipment, Subarticle (1) Mixing Plants is supplemented by the following:

(c) Dryer-drum-mixing Plant. The Contractor may, at his option, elect to use the dryer-drum-mixing process in the mixing of asphalt-stabilized base. The plant shall be adequately designed and constructed for the process of mixing aggregates and asphalt in the dryer-drum without preheating the aggregates. The plant shall be equipped with satisfactory conveyors, power units, aggregate-handling equipment and feed controls, and shall consist of the following essential pieces of equipment.

Cold-aggregate Bin and Feed System. The number of compartments in the cold-aggregate bin shall be equal to or greater than the number of stockpiles of individual materials to be used.

The bin shall be of sufficient size to store the amount of aggregate required to keep the plant in continuous operation and of proper design to prevent over-flow of material of one bin to that of another bin. The feed system shall provide a uniform and continuous flow of aggregate in the desired proportion to the dryer. Each aggregate shall be proportioned in a separate compartment with total and proportional control.

The system shall provide positive weight measurement of the combined cold-aggregate feed by use of belt scales or other devices. A scalping screen will be required, unless otherwise shown on the plans.

Asphaltic-material-measuring System. An accurate asphaltic-material measuring device shall be placed in the asphalt line leading to the dryer-drum mixer so that the cumulative amount of asphalt used can be accurately determined. Provisions of a permanent nature shall be made for checking the accuracy of the measuring device output. The asphalt measuring device and line to the measuring device shall be protected with a jacket of hot oil or other approved means to maintain the temperature of the line and measuring device near that temperature specified for the asphaltic material.

Unless otherwise shown on the plans the temperature of the asphaltic material entering the measuring device shall be maintained at ± 10°F of the temperature at which the asphalt-measuring device was calibrated and set.

If a pressure-type flow meter is used to measure the asphaltic material, the requirements of the Item "Weighing and Measuring Equipment" shall apply.

Synchronization Equipment for Feed-control Systems. The asphaltic-material-feed control shall be coupled with the total-aggregate-weight-measurement device in such a manner as to automatically vary the asphalt feed rate as required to maintain the required proportion.

Dryer-drum-mixing System. The dryer-drum-mixing system shall be of the type that continually agitates the aggregate-and-asphalt mixture during heating and in which the temperature can be so controlled that aggregate and asphalt will not be injured in the necessary drying and heating operations required to obtain a mixture of the specified temperature. A continuously recording thermometer shall be provided which will indicate the temperature of the mixture as it leaves the dryer-drum mixer. The dryer-drum-mixing system shall be of sufficient size to keep the plant in continuous operation.

Surge-storage System. A surge-storage system will be required and it shall be adequate to minimize production interruptions during the normal day's operation.

Scales. Scales may be standard platform truck scales or other equipment such as weight hopper (suspended) scales approved by the Engineer. All scales shall conform to the Item, "Weighing and Measuring Equipment". If truck scales are used, they shall be placed at a location approved by the Engineer. If other weighing equipment is used, the Engineer may require weight checks by truck scales for the basis of approval of the equipment.

Article 292.4. Equipment is supplemented by the following.

(12) Inspection. It will be the Contractor's responsibility to provide safe and accurate means to enable inspection forces to take combined aggregate samples, and to provide permanent means for checking the output of any specified metering device and to perform these calibration checks as required by the Engineer.

Article 292.5. Stockpiling, Storage, Proportioning and Mixing is supplemented by the following:

When a dryer-drum-mixing plant is used the following requirments will apply.

(1) Stockpiling of Aggregates. Same as for other types of plants except for the following addition.

The gradation requirements for the individual stockpiles and proportioning from these stockpiles will be the Contractor's responsibility.

(2) Storage and Heating of Asphaltic Materials. Same as for other types of plants.

(3) Proportioning and Feeding Materials. The proportioning of the various materials entering into the asphaltic mixture shall be as directed by the Engineer and in accordance with these specifications. The feeding of various sizes of aggregate to the dryer-drum mixer shall be done through the cold-aggregate bin and feed system in such a manner that a uniform and constant flow of materials in the required proportions will be maintained. The asphaltic material shall be introduced into the dryer-drum mixer through the asphaltic-material measuring device. It will be the responsibility of the Contractor to demonstrate, prior to production, that the aggregates are being blended in the proper proportions to satisfy the specifications before entering the dryer-drum mixer.

(4) Mixing and Storage.

(a) The amount of aggregate and asphaltic material entering the dryer-drum mixer and the rate of travel through the mixing unit shall be so coordinated that a uniform mixture of the specified grading and asphalt content will be produced. The mixture when discharged from the plant shall have a moisture content not greater than 2 percent by weight unless otherwise shown on the plans and/or specified by the Engineer.

The moisture content shall be determined in accordance with Test Method Tex-212-F, Part II, or other methods of proven accuracy.

(b) Temporary storing or holding of the asphaltic mixture by the surge-storage system may be used during the normal day's operation. Overnight storage will not be permitted unless authorized in the plans or in writing by the Engineer. The mixture coming out of the surge-storage bin must be of equal quality to that coming out of the dryer-drum mixer.

(c) The asphaltic mixture shall be at a temperature between 175°F and 350°F when discharged from the plant. The Engineer will determine the temperature, within the above limitations, and the mixture when discharged from the plant shall not vary from this selected temperature more than 25°F.

Article 292.8. Measurement is supplemented by the following.

When dryer-drum mixing plants are used, measurement may be on truck scales, or other equipment approved by the Engineer.

SPECIAL PROVISION

TO

ITEM 340

HOT MIX ASPHALTIC CONCRETE PAVEMENT
(Class A)

For this project, Item 340, "Hot Mix Asphaltic Concrete Pavement (Class A)", is hereby amended with respect to the clauses cited below and no other clauses or requirements of this Item are waived or changed hereby.

Article 340.2. Materials, Subarticle (1) Mineral Aggregate, Section (a) Coarse Aggregate. The first, fourth and ninth paragraphs are voided and replaced by the following:

The coarse aggregate shall be that part of the aggregate retained on a No. 10 sieve; shall consist of clean, tough, durable fragments of stone, crushed blast-furnace slag, crushed gravel, gravel, iron-ore topsoil, oyster shell, cinder aggregate (produced from burning lignite or coal), crushed limestone rock-asphalt, synthetic aggregate (herein defined as aggregate produced by fusing raw shale or clay in a rotary kiln under intense heat into prodominately amorphous silicate), or combination thereof of uniform quality throughout. When specified on the plans, other coarse-aggregate material may be permitted or required, or specific combinations of materials may be required.

That portion of the coarse aggregate composed of synthetic aggregate shall meet the following requirements, unless otherwise specified on the plans. The dry loose unit weight shall be at least 35 pounds per cubic foot when tested in accordance with Test Method Tex-404-A. Synthetic material may be furnished from more than one source for this Item. Synthetic materials from each source, whose unit weights vary by more than 6 percent from that submitted for the acceptance test and used in the batch design, may be rejected. The "Pressure Slaking Value" shall not exceed 4 percent when tested in accordance with Test Method Tex-431-A. The "Aggregate Freeze-Thaw Loss" shall not exceed 7 percent when tested in accordance with Test Method Tex-432-A. Aggregates with a higher percentage of freeze-thaw loss may be used only when authorization is given in writing by the Engineer.

When it is specified that the coarse aggregate be sampled from the hot bins and tested in accordance with Test Method Tex-217-F(Part II, Decantation), the amount of material removed shall not exceed 1 percent except for Type "F" for which it shall not exceed 2 percent. Decantation shall not be required for Type "E".

The coarse aggregate, except iron-ore topsoil and synthetic aggregate, (each coarse aggregate when a combination of materials is used) shall have an abrasion of not more than 40 percent loss by weight when subjected to the Los Angeles Abrasion Test, Test Method Tex-410-A, unless otherwise shown on the plans.

Synthetic coarse aggregate shall have an abrasion of not more than 35 percent loss by weight when subjected to the Los Angeles Abrasion Test, Test Method Tex-410-A, unless otherwise shown on the plans. Coarse aggregate from each source shall meet the abrasion requirement specified.

Synthetic coarse aggregate shall have an absorption of not more than 12 percent in 24 hours when subjected to Test Mwthod Tex-433-A. The test method is hereby extended to include this 24-hour period.

When shown on the plans, the coarse aggregate used in the surface or finish course must meet one of the following conditions.

1. Have a "polish value" of not less than the value shown on the plans. Where the coarse aggregates are supplied from two or more sources, the aggregate from each source shall meet the "polish value" shown on the plans prior to being combined with other aggregates. Polish values shall be determined in accordance with Test Method Tex-438-A, Part I.

2. Have a "combined polish value" achieved by blending non-polishing aggregates with polishing aggregates in specific proportions as determined by Method "A" or Method "B" of Test Method Tex-438-A, Part II.

When the coarse aggregates are to be a blend of non-polishing with polishing aggregates to achieve a "combined polish value", the non-polishing aggregate portion shall comprise at least 20% by volume of the total coarse aggregate.

The non-polishing aggregate shall be so sized that it will constitute 50% by volume of the aggregate passing the 5/8 inch sieve and retained on the No. 4 sieve for a Type "C" mixture; 50% by volume of the aggregate passing the 3/8 inch sieve and retained on the No. 4 sieve for a Type "D" mixture; and 50% by volume of the aggregate passing the No. 4 sieve and retained on the No. 10 sieve for a Type "F" mixture. The amount of non-polishing aggregate required may be determined by either Method "A" or Method "B" of Test Method Tex-438-A, Part II. When Method "A" is used the percent by volume of the non-polishing aggregate in the blend shall be that amount required to provide the polish value shown on the plans, plus 2. When Method "B" is used the percent by volume of the non-polishing aggregate in the blend is determined by the formula based on the polish values of the aggregates to be blended and in addition, the non-polishing aggregate must be equal to or greater in differential wear resistance than the coarse aggregate to be improved by blending when tested in accordance with Test Method Tex-438-A, Part III.

When coarse aggregates from any source include appreciable quantitites of materials with substantially different mineralogy the more polish-resistant aggregates must equal or greater in differential wear resistance than other aggregates from the source. The Engineer may establish this on the basis of satisfactory experience with the source or tests may be required in accordance with Test Method Tex-438-A, Part III.

Specification compliance for proper proportioning of blended coarse aggregate will be determined from representative samples obtained from the hot bins on conventional plants or from the cold feed immediately prior to entering the dryer-drum on the dryer-drum plants. Percent by volume may be determined by making a visual separation of the materials as outlined in Test Method Tex-413-A and converting weights to volumes by appropriate methods or by testing in accordance with Test Method Tex-200-F, Part III.

Article 340.2. Materials is supplemented by the following:

(3) Additives. Additives to facilitate mixing and/or improve the quality of the asphaltic mixture may be required by the Engineer.

Article 340.3 Paving Mixture, Subarticle (1) Types is supplemented by the following:

Type "D" Modified:	Percent by Weight
Passing 1/2" sieve	100
Passing 3/8" sieve	95 to 100
Passing 3/8" sieve, retained on No. 4 sieve	20 to 50
Passing No. 4 sieve, retained on No. 10 sieve	10 to 30
Total retained on No. 10 sieve	50 to 70
Passing No. 10 sieve, retained on No. 40 sieve	5 to 30
Passing No. 40 sieve, retained on No. 80 sieve	4 to 25
Passing No. 80 sieve, retained on No. 200 sieve	3 to 25
Passing No. 200 sieve	0 to 8

The asphaltic material shall form from 4.0 to 8.0 percent of the mixture by weight unless specified otherwise on the plans.

For Surface Course Only:

(1) Types. The paving mixture shall consist of a uniform mixture of coarse aggregate, fine aggregate, asphaltic material and mineral filler, if required. Design of bituminous mixtures, compliance with specified aggregate gradation, the amount of aggregate in the mixture and tolerances will be in accordance with Department methods.

The grading of each constituent of the mineral aggregate shall be such as to produce, when properly proportioned, a mixture which, when tested in accordance with Test Method Tex-200-F (Part I or Part III, as applicable to Department methods of design) will conform to the limitation for master grading given below for the type specified unless otherwise shown on plans.

Type "B" (Fine-Graded Base or Leveling-Up Course):	Percent by Volume
Passing 1" sieve	100
Passing 7/8" sieve	95 to 100
Passing 7/8" sieve, retained on 3/8" sieve	20 to 50
Passing 3/8" sieve, retained on No. 4 sieve	10 to 40
Passing No. 4 sieve, retained on No. 10 sieve	5 to 25
Total retained on No. 10 sieve	55 to 70
Passing No. 10 sieve, retained on No. 40 sieve	0 to 30
Passing No. 40 sieve, retained on No. 80 sieve	4 to 20
Passing No. 80 sieve, retained on No. 200 sieve	3 to 20
Passing No. 200 seive	0 to 6

The asphaltic material shall form from 8 to 16 percent of the mixture by volume of 77°F, as applicable unless specified otherwise on the plans.

Type "C" (Coarse-Graded Surface Course):	
Passing 7/8" sieve	100
Passing 5/8" sieve	95 to 100
Passing 5/8" sieve, retained on 3/8" sieve	15 to 40
Passing 3/8" sieve, retained on No. 4 sieve	10 to 35
Passing No. 4 sieve, retained on No. 10 sieve	10 to 30
Total Retained on No. 10 sieve	50 to 70
Passing No. 10 sieve, retained on No. 40 sieve	0 to 30
Passing No. 40 sieve, retained on No. 80 sieve	4 to 25
Passing No. 80 sieve, retained on No. 200 sieve	3 to 25
Passing No. 200 sieve	0 to 6

The asphaltic material shall form from 8 to 16 percent of the mixture by volume at 77°F, as applicable unless specified otherwise on the plans.

Type "D" (Fine-Graded Surface Course):	
Passing 1/2" sieve	100
Passing 3/8" sieve	95 to 100
Passing 3/8" sieve, retained on No. 4 sieve	20 to 50
Passing No. 4 sieve, retained on No. 10 sieve	10 to 30
Total retained on No. 10 sieve	50 to 70
Passing No. 10 sieve, retained on No. 40 sieve	0 to 30
Passing No. 40 sieve, retained on No. 80 sieve	4 to 25

	Percent by Volume
Passing No. 80 sieve, retained on No. 200 sieve -------	3 to 25
Passing No. 200 sieve----------	0 to 6

The asphaltic material shall form from 9 to 19 percent of the mixture by volume at 77°F, as applicable unless specified otherwise on the plans.

Type "D" Modified (Fine-Graded Surface Course):

Passing 1/2" sieve----------	100
Passing 3/8" sieve----------	95 to 100
Passing 3/8" sieve, retained on No. 4 sieve----------	20 to 50
Passing No. 4 sieve, retained on No. 10 sieve----------	10 to 30
Total retained on No. 10 sieve----------	50 to 70
Passing No. 10 sieve, retained on No. 40 sieve---------	5 to 30
Passing No. 40 sieve, retained on No. 80 sieve---------	4 to 25
Passing No. 80 sieve, retained on No. 200 sieve--------	3 to 25
Passing No. 200 sieve----------	0 to 8

The asphaltic material shall form from 9 to 19 percent of the mixture by volume at 77°F, as applicable unless specified otherwise on the plans.

Type "E" (Sheet-Asphalt Surface Course):

Passing No. 4 sieve----------	100
Passing No. 4 sieve, retained on No. 10 sieve----------	0 to 5
Passing No. 10 sieve, retained on No. 40 sieve---------	15 to 40
Passing No. 40 sieve, retained on No. 80 sieve---------	20 to 45
Passing No. 80 sieve, retained on No. 200 sieve--------	12 to 32
Passing No. 200 sieve----------	7 to 20

The asphaltic material shall form from 17 to 28 percent of the mixture by volume at 77°F, as applicable unless specified otherwise on the plans.

Type "F" (Fine-Graded Surface Course):

Passing 3/8" sieve----------	100
Passing 1/4" sieve----------	95 to 100
Passing 1/4" sieve, retained on No. 10 sieve----------	55 to 70
Passing No. 10 sieve, retained on No. 40 sieve---------	0 to 25
Passing No. 40 sieve, retained on No. 80 sieve---------	3 to 12
Passing No. 80 sieve, retained on no. 200 sieve--------	2 to 10
Passing No. 200 sieve----------	0 to 6

The aspahltic material shall form from 8 to 15 percent of the mixture by volume at 77°F, as applicable unless specified otherwise on the plans.

Type "G":

Grading requirement by percent volume and asphalt content shall be as shown on the plans.

The Engineer will make laboratory mix designs from samples of material proposed for use by the Contractor. After an acceptance mixture meeting grading requirements is determined, the Engineer will furnish the Contractor with

Proportions of each material to be used, based on weight.

Article 340.3. Paving Mixtures, Subarticle (2) Tolerances is voided and replaced by the following:

(2) Tolerances. The Engineer will designate the exact grading of the aggregate and asphalt content, within the above limits, to be used in the mixture. The paving mixture produced should not vary from the designated grading and asphalt content by more than the tolerances allowed herein; however, the mixture produced shall conform to the limitations for master grading specified above.

	Percent by Volume or Weight, As Applicable
Passing 7/8" sieve, retained on 3/8" sieve	Plus or minus 5
Passing 5/8" sieve, retained on 3/8" sieve	Plus or minus 5
Passing 3/8" sieve, retained on No. 4 sieve	Plus or minus 5
Passing 1/4" sieve, retained on No. 10 sieve	Plus or minus 5
Passing No. 4 sieve, retained on No. 10 sieve	Plus or minus 5
Total retained on No. 10 sieve	Plus or minus 5
Passing No. 10 sieve, retained on No. 40 sieve	Plus or minus 3
Passing No. 40 sieve, retained on No. 80 sieve	Plus or minus 3
Passing No. 80 sieve, retained on No. 200 sieve	Plus or minus 3
Passing No. 200 sieve	Plus or minus 3
	Percent by Weight
Asphalt Material	Plus or minus 0.7

Should the paving mixture produced vary from the designated grading and asphalt content by more than the above tolerances, proper changes are to be made until it is within these tolerances.

Article 340.3. Paving Mixtures, Subarticle (4) Sampling and Testing. The first paragraph is voided and replaced by the following:

(4) Sampling and Testing.

It is the intent of this specification to produce a mixture which when designed and tested in accordance with these specifications and approved Department methods, will have the following laboratory density and stability unless otherwise shown on the plans.

DENSITY, PERCENT			STABILITY, PERCENT
Min	Max	Optimum	Not less than 35 unless otherwise shown on plans
95	99	97	

Article 340.4. Equipment, Subarticle (1) Mixing Plants, Section (a) Weight-batching Type, Subsection Screening and Proportioning is voided and replaced by the following.

Screening and Proportioning. The screening capacity and size of the bins shall be sufficient to screen and store the amount of aggregate required to properly operate the plant and keep the plant in continuous operation at full capacity. Provisions shall be made to enable inspection forces to have easy and safe access to the proper location on the mixing plant where representative samples may be taken from the hot bins for testing. The aggregate shall be separated into at least four bins when producing Type "B" and Type "C" mixtures, at least three bins when producing Type "D" and "D Modified" mixtures, and at least two bins when producing Type "E" and Type "F". If mineral filler is used, an additional bin shall be provided. These bins shall contain the following sizes of aggregates, in percentages by weight or by volume, as applicable.

Type "B":

Bin No. 1 - will contain aggregates of which 85 to 100 percent will pass the No. 10 sieve

Bin No. 2 - will contain aggregates of which at least 70 percent will be of such size as to pass the No. 4 sieve and be retained on the No. 10 sieve

Bin No. 3 - will contain aggregates of which at least 75 percent will be of such size as to pass the 3/8 inch sieve and be retained on the No. 4 sieve

Bin No. 4 - will contain aggregates of which at least 75 percent will be of such size as to pass the 1 inch sieve and be retained on the 3/8 inch sieve

Type "C":

Bin No. 1 - will contain aggregates of which 85 to 100 percent will pass the No. 10 sieve

Bin No. 2 - will contain aggregates of which at least 70 percent will be of such size as to pass the No. 4 sieve and be retained on the No. 10 sieve

Bin No. 3 - will contain aggregates of which at least 75 percent will be of such size as to pass the 3/8 inch sieve and be retained on the No. 4 sieve

Bin No. 4 - will contain aggregates of which at least 75 percent will be of such size as to pass the 7/8 inch sieve and be retained on the 3/8 inch sieve

Types "D" and "D Modified:"

Bin No. 1 - will contain aggregates of which 85 to 100 percent will pass the No. 10 sieve
Bin No. 2 - will contain aggregates of which at least 70 percent will be of such size as to pass the No. 4 sieve and be retained on the No. 10 sieve
Bin No. 3 - will contain aggregates of which at least 75 percent will be of such size as to pass the 1/2 inch sieve and be retained on the No. 4 sieve

Type "E":

Bin No. 1 - will contain aggregates of which 85 to 100 percent will pass the No. 10 sieve
Bin No. 2 - will contain aggregates of which at least 70 percent will be of such size as to pass the No. 4 sieve and be retained on the No. 10 sieve

Type "F":

Bin No. 1 - will contain aggregates of which 85 to 100 percent will pass the No. 10 sieve
Bin No. 2 - will contain aggregates of which at least 75 percent will be of such size as to pass the 3/8 inch sieve and be retained on the No. 10 sieve

Article 340.4. Equipment, Subarticle (1) Mixing Plants, Section (a) Weight-batching Type, Subsection Mixer. The first sentence is voided and replaced by the following:

The mixer shall be of the pug-mill type and shall have a capacity of not less than 3,000 pounds (of natural-aggregate mixture) in a single batch unless otherwise shown on the plans.

Article 340.4 Equipment, Subarticle (1) Mixing Plants is supplemented by the following:

(c) Dryer-drum-mixing Plant. Unless otherwise shown on the plans, the Contractor may, at his option, elect to use the dryer-drum-mixing process in the mixing of asphalt-concrete material. The plant shall be adequately designed and constructed for the process of mixing aggregates and asphalt in the dryer-drum without preheating the aggregates. The plant shall be equipped with satisfactory conveyors, power units, aggregate-handling equipment and feed controls and shall consist of the following essential pieces of equipment.

Cold-aggregate Bin and Feed System. The number of compartments in the cold-aggregate bins shall be equal to or greater than the number of stockpiles of individual materials to be used.

The bin shall be of sufficient size to store the amount of aggregate required to keep the plant in continuous operation and of proper design to prevent overflow of material of one bin to that of another bin. The feed system shall provide a uniform and continuous flow of aggregate in the desired proportion to the dryer. Each aggregate shall be proportioned in a separate compartment with total and proportional control.

The system shall provide positive weight measurement of the combined cold-aggregate feed by use of belt scales or other devices. A scalping screen will be required, unless otherwise shown on the plans.

Asphaltic-Material Measuring System. An accurate asphaltic-material measuring device shall be placed in the asphalt line leading to the dryer-drum mixer so that the cumulative amount of asphalt used can be accurately determined. Provisions of a permanent nature shall be made for checking the accuracy of the measuring-device output. The asphalt-measuring device and line to the measuring device shall be protected with a jacket of hot oil or other approved means to maintain the temperature of the line and measuring device near that temperature specified for the asphaltic material. Unless otherwise shown on the plans the temperature of the asphaltic material entering the measuring device shall be maintained at $\pm$ 10°F of the temperature at which the asphalt-measuring device was calibrated and set.

If a pressure-type flow meter is used to measure the asphaltic material, the requirements of the Item "Weighing and Measuring Equipment" shall apply.

Synchronization Equipment for Feed-Control Systems. The asphaltic-material-feed control shall be coupled with the total-aggregate weight-measurement device in such manner as to automatically vary the asphalt-feed rate as required to maintain the required proportion.

Dryer-Drum-Mixing System. The dryer-drum system shall be of the type that continually agitates the aggregate-and-asphalt mixture during heating and in which the temperature can be so controlled that aggregate and asphalt will not be injured in the necessary drying and heating operations required to obtain a mixture of the specified temperature. A continuously-recording thermometer shall be provided which will indicate the temperature of the mixture as it leaves the dryer-drum mixer. The dryer-drum-mixing system shall be of sufficient size to keep the plant in continuous operation.

Surge-Storage System. A surge-storage system will be required and it shall be adequate to minimize the production interruptions during the normal day's operations.

Scales. Scales may be standard platform truck scales or other equipment such as weight hopper (suspended) scales approved by the Engineer. All scales shall conform to the Item, "Weighing and Measuring Equipment". If truck scales are used, they shall be placed at a location approved by the Engineer. If other weighing equipment is used, the Engineer may require weight checks by truck scales for the basis of approval of the equipment.

Article 340.4. Equipment, Subarticle (3) Spreading and Finishing Machine. The second sentence of the second paragraph is voided and replaced by the following:

Vehicles of the semi-trailer type are specifically prohibited from dumping directly into the finishing machine unless otherwise permitted by the plans or unless authorization is given in writing by the Engineer approving use of such equipment.

Article 340.4. Equipment is supplemented by the following:

(13) Inspection. It will be the Contractor's responsibility to provide safe and accurate means to enable inspection forces to take combined aggregate samples, and to provide permanent means for checking the output of any specified metering device and to perform these calibration checks as required by the Engineer.

Article 340.5. Stockpiling, Storage, Proportioning and Mixing, Subarticle (1) Stockpiling of Aggregates is voided and replaced by the following:

(1) Stockpiling of Aggregates. Prior to stockpiling of aggregates, the area shall be cleaned of trash, weeds and grass and be relatively smooth. Aggregates shall be stockpiled in such a manner as to prevent mixing of one aggregate with another. Coarse aggregates for types "B" and "C" shall be separated into at least two stockpiles of different gradation, such as a large-coarse-aggregate and a small-coarse-aggregate stockpile and such that the grading requirements of the specified type will be met when the piles are combined in the asphaltic mixture. No coarse-aggregate stockpile, except for iron-ore topsoil, shall contain more than 15 percent of weight or by volume, as applicable, of material that will pass a No. 10 sieve except as noted on the plans. Fine-aggregate stockpiles, except for iron-ore topsoil, may contain coarse aggregate in the amount of up to 20 percent by weight or by volume, as applicable; however, the coarse aggregate shall meet the quality tests specified herein for "Coarse Aggregates". Iron-ore topsoil may be stockpiled without regard to percentages of coarse aggregate and fine aggregate in the stockpile.

Suitable equipment of acceptable size shall be furnished by the Contractor to work the stockpiles and prevent segregation of the aggregates.

(a) Minimum Stockpiling Requirement. When synthetic aggregates are used, the Contractor shall be required to have in approved stockpiles at the plant site a minimum quantity of each aggregate used in the composite paving mixture equal to the total amount required for 2 normal days of production as determined by the Engineer. The Contractor will not be allowed to begin production with a lesser amount unless authorized by the Engineer in writing. Aggregates shall be temporarily stockpiled and held in such temporary stockpiles until the unit weight has been checked to see if a variation of unit weight does not exceed the 6-percent unit-weight tolerance permitted for each stockpile that will go into the composite mixture.

Article 340.5. Stockpiling, Storage, Proportioning and Mixing is supplemented by the following:

When a dryer-drum-mixing plant is used, the following requirement will apply:

(1) Stockpiling of Aggregates. Prior to stockpiling aggregates the area shall be cleaned of trash, weeds and grass and shall be relatively smooth. Aggregates shall be stockpiled in such a manner as to prevent mixing of one aggregate with another. Suitable equipment of acceptable size shall be furnished by the Contractor to work the stockpiles and prevent segregation of the aggregates. The aggregates shall be separated into a minimum of two

stockpiles. one stockpile shall consist of primarily fine aggregates and the other stockpile shall consist of coarse aggregates. The coarse aggregates may be diveded into additional stockpiles as necessary to provide the necessary gradation. The gradation requirements for the individual stockpiles and proportioning from these stockpiles will be the Contractor's responsibility. The gradation of the aggregates in the stockpile shall be such that when the aggregates are combined in the proper proportion the combined gradation will meet the gradation requirements of the design-mix formulation without further manipulations.

(2) Storage and Heating of Asphaltic Materials. Same as for other types of plants.

(3) & (4) Proportioning and Feeding Materials. The proportioning of the various materials entering the asphaltic mixture shall be as directed by the Engineer and in accordance with these specifications. The feedings of various sizes of aggregate to the dryer-drum mixer shall be done through the cold-aggregate bin and feed system in such a manner that a uniform and constant flow of materials in the required proportions will be maintained. The asphaltic-material shall be introduced into the dryer-drum mixer through the asphaltic-material measuring device. It will be the responsibility of the Contractor to demonstrate, prior to production, that the aggregates are being blended in the proper proportions to satisy the specifications before entering the dryer-drum mixer.

(5) Mixing and Storage.

(a) The amount of aggregate and asphaltic material entering the dryer-drum mixer and the rate of travel through the mixing unit shall be so coordinated that a uniform mixture of specified grading and asphalt content will be produced.

(b) Temporary storing or holding of the asphaltic mixture by the surge-storage system may be used during the normal day's operation. Overnight storage will not be permitted unless authorized in the plans or in writing by the Engineer. The mixture coming out of the surge-storage bin must be of equal quality to that coming out of the dryer-drum mixer. The mixture when discharged from the plant shall have a moisture content not greater than 2 percent by weight unless otherwise shown on the plans and/or specified by the Engineer. The moisture content shall be determined in accordance with Test Method Tex-212-F, Part II, or other methods of proven accuracy.

(c) The asphaltic mixture shall be at a temperature between 175°F and 350°F when discharged from the plant. The Engineer will determine the temperature within the above limitations, and the mixture when discharged from the plant shall not vary from this selected temperature more than 25°F.

Article 340.6. Construction Methods. The second paragraph is voided and replaced by the following:

If the temperature of the asphaltic mixture of a load or any part of a load becomes 50°F or more less than the temperature selected by the Engineer under Article 340.5 of this specification after being dumped from the mixer and prior to placing while passing through the lay-down machine, all or any part of the load may be rejected and payment will not be made for the rejected material.

Article 340.7. Measurement is supplemented by the following:

When dryer-drum mixing plants are used, measurement may be on truck scales, or other equipment approved by the Engineer.

For Surface Course Only:

Asphaltic concrete will be measured separately by the ton of 2,000 pounds of "Asphalt" and by the cubic yard of laboratory-compacted "Aggregate" of the type actually used in the completed and accepted work in accordance with plans and specifications for the project. The volume of aggregate in the compacted mix will be calculated from the measured weights of the asphaltic concrete by the following formula:

$$V = \frac{W}{62.4\ (27)\ G_a}$$

V = Cubic yards of compacted aggregate
W = Total weight of asphaltic-concrete mixture in pounds
G_a = Average actual specific gravity of three molded specimens as prepared by Test Method Tex-206-F and determined in accordance with Test Method Tex-207-F.

The weight "W" if mixing is done by a continuous mixer or dryer-drum mixer, will be determined by truck scales, or other approved weighing equipment. Weight, if mixing is done by a batch mixer, will be determined by batch scales and records of the number of batches, batch designs and weight of asphalt and aggregate shall be kept. Where surge-storage is used measurment of material taken from the surge-storage bin will be made on truck scales, or other approved weighing equipment.

For the first day's production, the average actual specific gravity of specimens molded during laboratory design of the mix will be used in the volume-computation formula. For each subsequent day's production, the actual specific gravity of specimens molded from the previous day's production or the current day's production will be used.