EXPERIENCE OF DISTRICT 11

IN THE USE OF

LIGHTWEIGHT AGGREGATE ASPHALTIC CONCRETE

by

District 11

Special Study 15.1

TEXAS HIGHWAY DEPARTMENT

May 1970

Experience of District 11 in the use of Lightweight Aggregate Asphaltic Concrete

In July, 1969, construction of an experimental project was initiated utilizing lightweight aggregate asphaltic concrete. The project was located at Lufkin on Loop 266 and was 2.2 miles in length and approximately 48,000 square yards of surface area.

It is considered appropriate to provide background information on the project before discussing various phases of the construction and testing operations employed.

Early visual examination of the project indicated that the surface had deterioated to the point that an asphaltic concrete overlay was considered necessary. The project was included as an item on the 1969 State Highway Safety and Betterment Program, recommending an asphaltic concrete overlay.

Initially, it was planned for the overlay to be constructed with conventional Type "D" asphaltic concrete, however, several factors developed which altered the consensus of opinion and lightweight asphaltic concrete was employed.

One factor which influenced this change was the examination of several sections of pavement surfaces within the District, which indicated that it was desirable that texture (skid factor) and quality of the asphaltic concrete be upgraded. Previous laboratory testing in 1963 indicated that satisfactory asphaltic concrete mixtures could be designed using lightweight aggregate. At that time, however, economics

prevented the lightweight material from being competive with conventional aggregates being used. It was also understood that lightweight producers did not have sufficient capacity, at that time, to meet the needs for an expanded program, such as lightweight asphaltic concrete.

Another factor, which influenced this change, was the experience gained from the use of lightweight aggregates in seal coat operations. All projects which previously used the lightweight material had yielded satisfactory results and provided a high skid factor characteristic, which was considered desirable.

Correspondance with various lightweight producers indicated their interest in establishing an experimental section of asphaltic concrete employing lightweight aggregates.

After evaluating the various factors, it was decided to use lightweight aggregate asphaltic concrete on the proposed Loop 266 project. Since there would be an increased amount of testing and due to the uncertainties in producing and placing the lightweight asphaltic mixture, it was decided the work would be handled as a special maintenance project.

Bids were received from local producers to furnish 2,000 tons of lightweight aggregate asphaltic concrete to meet a modification to Item 340, "Hot Mix Asphaltic Concrete Pavement". Moore Brothers Construction Company was awarded the Purchase Order with a low bid of $9.35 a ton. A copy of the Purchase Order is included as page 1 of the Appendix. A lease agreement was executed with Moore Brothers Construction Company to provide the necessary equipment to place the asphaltic concrete at a rate of

$2.25 a ton. Hauling the material from the plant to the job site was with THD maintenance personnel. Control of traffic by flagging and signs was to be regulated by maintenance personnel.

The modification to the Type "D" Paving Mixture under Item 340, was in the following manner:

(1) Coarse aggregate to be composed of lightweight aggregate that shall meet the requirements of Special Specification Item 1862, "Aggregates for Surface Treatments (Lightweight)". (see page 2 and 3 of the Appendix.)

(2) The Type "D" Paving Mixture is to be altered to conform to the master grading as indicated below:

	Percent by Weight
Passing ½" Sieve	100
Passing 3/8" Sieve	95 - 100
Passing 3/8" Sieve, retained on No. 4 Sieve	10 - 35
Passing No. 4 Sieve, retained on No. 10 Sieve	5 - 20
Total retained on No. 10 Sieve	35 - 55
Passing No. 10 Sieve, retained on No. 40 Sieve	0 - 30
Passing No. 40 Sieve, retained on No. 80 Sieve	5 - 35
Passing No. 80 Sieve, retained on No. 200 Sieve	3 - 35
Passing No. 200 Sieve	0 - 10

The asphaltic material shall form from 5.0 to 9.0% of the mixture by weight.

(3) Requirements for Laboratory Density of the paving mixture to conform as follows:

Density, Percent

Minimum	Maximum	Optimum
93	97	95

Moore Brothers Construction Company procured the lightweight aggregate from Texas Industries at Dallas for the coarse aggregate. The fine aggregate, a local field sand, was located and secured. AC-20 asphalt cement was obtained from American Petrofina at Mt. Pleasant, Texas.

Test data for the asphalt cement is noted on page 4 of the Appendix.

Characteristics for the field sand are depicted on pages 5-7 of the Appendix. It is noted on page 7 that bulk gravity for the fine aggregate was determined by two procedures, namely, (1) Test Method Tex-201 and 202-F and (2) Test Method Tex-433-A Tentative. Test data for Test Method Tex 433-A was adjusted for readings covering the first eight minutes of the test due to air being entrapped by sand particles. Test Method Tex 433-A is not recommended for bulk gravity determinations for sand.

Material properties for the aggregate from Texas Industries are found on page 8 through 16 of the Appendix.

The results for the Los Angeles Abrasion and the Soundness Tests are found on page 8 of the Appendix. It is noted that the material meets the specification quality requirements.

Pages 9 and 10 reflect test data for the gradation of lightweight material sampled from railroad cars prior to being placed into the stockpile. Moisture tests were conducted on samples of material from railway cars and stockpile; and it was noted, that approximately 18% moisture, by weight, was present.

The lightweight material was subjected to a modified Wet Ball Mill Test. Soil binder after the test was found to be 5.7% as indicated on page 12 of the Appendix.

Slaking the aggregate with the pressure pycnometer indicated no harmful effects to the aggregate as shown by the test data found on page 12.

Bulk gravity values for the lightweight aggregate are shown on page 13. These values were determined by Test Method Tex-201-F. Results from determining the bulk gravity by Test Method Tex-433-A Tentative are found on page 14 through page 16. As stated on page 14, this procedure is not recommended due to the high initial rate of absorption in the aggregate. Laboratory personnel found it most difficult to obtain the first few readings accurately. Test Method Tex-433-A does offer a satisfactory procedure for determining the bulk gravity for other lightweight materials but not for materials which exhibit a high rate of absorption. The amount of absorption is not as critical as the rate of absorption.

Following preliminary testing of the aggregates, various combinations were used to determine the influence of the amount of lightweight aggregate on properties of asphaltic concrete mixtures. Basically, the percentage of lightweight aggregate varied from a minimum of 40% to a maximum of 67.5% by volume to the total volume of aggregates in the asphalt mixture. These percentages by volume of lightweight material correspond to a range from a minimum of 24.3% to a maximum of 50% by weight of the total aggregate combination. Pages 17 through 20 depict the various aggregate combinations.

Asphalt was added in increments to each of the aggregate combinations and specimen for Hveem Stability determinations were prepared as des-

cribed by Test Method Tex-204 through 206-F.

Stability and density values versus the asphalt content for each aggregate combination are depicted on pages 21 through 23. It is noted that stability values exceeded a minimum of 35% and ranged to a high of 50%.

Density values for the molded specimen were determined by procedures as outlined in Test Method Tex-207-F. Theoretical specific gravity of the mixtures was calculated from the specific gravity of asphalt and bulk gravity of the aggregates as determined by Test Method-Tex0201 and 202-F. There was much concern in using bulk gravity values determined by this method since the lightweight aggregate was highly absorptive. Another factor that caused some concern was the texture of the aggregate. The roughened texture presented a problem to laboratory personnel in that it was difficult to determine at what instant the lightweight aggregate was at a saturated-surface-dry condition.

Recognizing that there might be some asphalt absorption by the lightweight aggregate, aggregates for Design Series No. 5 were molded to an asphalt content of 13% which produced a density of 101.0%. Assuming this value to be the maximum density, the theoretical bulk gravity was adjusted by procedures as described in THD Bulletin C-14.

There were some thoughts that the problem of high absorptive aggregates might be circumvented by testing the asphaltic mixture by test procedure ASTM D 2041-64T, "Tentative Method of Test for Maximum Specific Gravity of Bituminous Mixtures". The test procedure is found on pages 24 through

26 of the Appendix. The procedure was modified in one respect, however. Under part 7.(b), rather than removing the surface moisture with an electric fan, two heating lamps were used. Page 27 through page 28 reflect test data on determining specific gravity of a lightweight asphaltic mixture method.

This procedure was evaluated by using several different asphaltic mixtures of various types of aggregates, both conventional and other lightweight material sources. It is the writer's personal opinion that this procedure may be used to an advantage on certain asphaltic mixtures, but for materials that have a high rate of absorption, its use is not recommended. When correcting for moisture absorption, it is somewhat difficult for the laboratory technician to determine exactly when the asphaltic mixture is no longer loosing surface moisture and beginning to loose internal or abosrbed moisture. This situation is similar to the technician's inability to determine the aggregate in a saturated-surface-dry condition.

For determining theoretical specific gravities of lightweight asphaltic mixture, use of both procedures, Test Method-Tex-201-202-F or ASTM D 2041-64T, might be utilized to compliment each other to reduce errors to a minimum for design purposes.

Pages 29 through 31 illustrate the absorptive characteristics of the lightweight asphaltic mixture as used for the project. Note that the specific gravity, as determined by ASTM D 2041-64T, was not corrected.

From data ascertained from preliminary testing, the asphaltic mixture selected to begin construction operations was 40% lightweight aggregate and 60% field sand by weight for the aggregate combination in the mixture. Asphalt content was set at 8.5% to begin operations.

To determine the effect of various percentages of lightweight aggregate on the workability and quality of the mixture and the skid factor of the finished surface, various rates of aggregate and asphalt were used during construction operations. Page 32 illustrates the various designs employed during the course of the project.

Construction operations began on July 22, 1969. Moore Brothers Construction Company's plant was a Standard weight batch plant with a 5,000 pound capacity pugmill. The aggregates were fed to the cold bins by a 1¼ cubic yard end loader. From the cold bins, the material was fed through the drier and thence to the screens and pugmill. Due to the bulked volume of the lightweight mixtures, batch weights were limited to a total weight of 2,667 pounds or 1 1/3 tons.

As stated earlier, THD Maintenance personnel hauled the material from the plant to the job site.

Pages 33 through 37 are copies of Form 404, "Daily Construction Report-Asphaltic Concrete Pavement". Additional tests were performed on the asphaltic mixtures but will be discussed later in the report.

The Contractor used a Barber-Green SA-41 Paving Machine with an electronic controlled 30-foot ski to place the asphaltic concrete mixture. Compaction was accomplished initially with a 10-ton Ingram 3-wheel roller. A 25-ton Ingram pneumatic roller was used as the intermediate roller and followed by an Ingram Tandem Roller of 8-10 ton capacity. RC-2 Asphalt for tack coat was applied by the Contractor at approximately 0.02 gallons per square yard.

No major construction difficulties were encountered during the mixing and placing operations of the project; however, several minor items may be of some interest.

At the beginning, there were several loads of material that were too cool and were difficult to place; however, once the temperature was raised to 300° F no further difficulties were encountered. Speed of the paving machine was reduced, while placing the cool material, in order to prevent the mat from tearing.

At the plant, it was thought some difficulties might be encountered by the lightweight material over-riding the screens, however, this was not the case. The material fed through the plant with little or no problems. As stated earlier in the report, moisture content of the aggregate was approximately 18%. Page 38 in the Appendix reflect the moisture content in each of the aggregates and asphaltic mixtures. The excessive moisture in the aggregates did not cause any difficulties to the mixture or production of the plant.

Due to the nature and location of the project, the contractor could not operate at maximum efficiency, however, the contractor felt that production could be increased for larger projects and provided operations were not hampered by local traffic.

The asphaltic mixture placed in the central business district was thought to be subjected to a rather severe test. Parallel parking in this area, while the mix was tender, was a source of concern. The use of power steering on automobiles caused some of the material to ravel, however, the material later blended with the mat. After the mat was cured, power steering produced no detrimental effects to the mat.

Referring to mix design No. 5 on page 32 of the Appendix, it is noted that the asphalt content is 6.5% by weight. This quantity of asphalt is equivalent to 4.5% when conventional aggregates are being used. It was observed that in some sections where this mixture was placed, local traffic produced some minor ravelling for a period of one to two days. It is felt the asphaltic mixture of 6.5% asphalt approached the minimum amount of asphalt for the type of aggregates used for this project.

Design mixture No. 9, as indicated on page 32, was composed of 30% lightweight aggregate and 70% field sand by weight of the aggregate combinations. This asphaltic mixture was placed to determine the effects of an overly-sanded mix. The only difficulty encountered was the mat appeared to be tender and rolling operations were delayed for a short time interval.

Design mixture No. 10, containing 55% lightweight aggregate and 45% field

sand by weight approached the upper limit of the amount of lightweight aggregate that the asphaltic mixture could tolerate. The texture of the mixture appeared to be harsh and the mat indicated a tendency to pull. The 55% by weight of lightweight aggregate was equivalent to 72% by volume of coarse aggregate in the mixture.

Depth of the asphaltic concrete mixture was normally one inch thick. This was achieved by placing the mixture at a rate of approximately 70 pounds per square yard. An attempt was made to determine the minimum mat thickness that could be placed for the asphaltic mixture. Only one section of pavement was relegated to this phase of the study. A mat thickness of 3/4" depth presented no problem, however, mat thickness of ½" depth appeared to pull somewhat. For the aggregates used, 3/4" mat thickness would be the minimum depth recommended.

Page 39 in the Appendix presents a Summary of Test Results for the various asphaltic concrete mixtures employed on the project. Please note that the numerals assigned to the various asphaltic concrete designs presented here do not correspond to the same numerals assigned to the asphaltic mixtures that were tested in the preliminary design as shown on page 17.

The data from this summary reflect that the laboratory density failed to meet the specified laboratory density of 93% to 97%. The lightweight aggregates that were used in the preliminary studies to establish the limits for the density requirements were coarser than that received for the project. It was also noted that the unit weight varied from 39 pounds per cubic foot for preliminary studies to 43 pounds per cubic foot for project materials. Contributing also to lower densities would be the

gap-grading of the aggregate combinations, as depicted on page 18.

It is felt that should laboratory density be a specification requirement for lightweight asphaltic concrete, a wider range of density values should be employed. The writer's personal opinion is that laboratory density should be limited to a tool of design, and be used only to evaluate various asphaltic mixtures in the laboratory.

Test data in the summary indicates a rate of approximately 70 pounds per square yard of asphaltic material to be required for a mat thickness of one-inch. This value corresponds to a rate of 105 pounds per square yard for mixtures composed of conventional aggregates. The conversion factor would be approximately 1.50.

Hveem stability values ranged from a minimum of 40% up to 49%. Cohesiometer values reported were from a minimum of 66 to a maximum 222 for the various asphaltic mixtures employed.

Please note also that a comparison was made to determine the specific gravity of the asphaltic mixtures. Column five reflects the calculated theoritical gravity based on Test Method-Tex-202 and 203-F. Column 14 depicts the gravity of the asphaltic mixture as determined from ASTM-D2041-64T. It may be observed that there was a difference in the reported values. Both test procedures have merit and shortcomings for certain asphaltic mixtures. It is the writer's opinion that both procedures might be employed to compliment each other and provide additional information to achieve a more thorough design.

Following construction of the project, in September, 1969, skid factor values were determined at random spots throughout the project. At least one skid value for each asphaltic mixture was determined. Results of the skid values are summarized on page 40 of the Appendix. The values reported are considered to be lower, than that expected following six to nine months of use by local traffic. From previous studies, it was observed that skid values for asphaltic concrete normally increased over those determined immediately following placement of an asphaltic mat. The project will be tested again in June, 1970 to determine the magnitude of any increase in skid values should there be an increase.

At several locations aluminum foil was placed prior to the placement of the asphaltic material. Samples will be taken later; and road densities will be determined. An attempt will be made to determine if there was any degradation of the aggregates from these road samples.

One of the primary objectives of the experimental project was that a specification for lightweight aggregate asphaltic concrete might be written for use in the District. Following the Appendix, there are three tentative specifications which utilize lightweight materials. Specification "A" utilizes only lightweight aggregate as the coarse aggregate, and measurement is by the ton. Specification "B" utilizes only lightweight material as the coarse aggregate but measurement is by the cubic yard or volume basis. Special Provision "C" to Item 340 provides for measurement of the aggregate by the cubic yard and permits the use of lightweight aggregate to supplement conventional materials for the coarse aggregates; however, the amount of lightweight material is restricted to a maximum of 25 percent by weight of the total mineral aggregate.

Specification "A" could be used when a high skid-factor pavement is desired and no other materials are to be considered; such as, surfacing only.

Specification "B" and Special Provision "C" for Item 340 could be employed as alternates to a specification using conventional aggregates when volume is being considered; such as satisfying the requirements for depth of the pavement structure.

Special Provision "D" to Item 340 provides for the use of conventional aggregates and measurement by the cubic yard. This permits asphaltic mixtures under Specification "B" and Special Provision "C" to Item 340 to be competitive with asphaltic concrete mixtures composed of conventional aggregates.

For the present, it is felt that the experimental project was successful. It was proven that a lightweight aggregate asphaltic mixture could be designed and placed without any great difficulties. During the course of the project from design or planning stage to the finished pavement overlay, a number of different test procedures were employed and evaluated. Some proved fruitful; whereas, others fell short of being to any great advantage.

The project will continue to remain under observation and further testing will be performed.

APPENDIX

Form 111 Rev. 11/67

PURCHASE ORDER

SHIP FOB TO
TEXAS HIGHWAY DEPARTMENT
F.O.B. See Below

THESE NOS. MUST APPEAR ON ALL PAPERS AND PACKAGES RELATING TO THIS ORDER

ORDER NO: 29073

REQ'N NO. HW: 11-00-Y

DATE April 23, 1969

SHIPPER
Moore Brothers Constr. Co.
Box 35
Lufkin, Texas 75901

MAIL INVOICE TO:
J. M. York, District Engineer
Box 260, Lufkin, Texas 75901

SHOW REQUISITION and ORDER NUMBERS AND INVOICE in 5 COPIES, sending all copies to the indicated agency.
INVOICE ON COMPTROLLER'S FORM 6-1.01.

All terms and conditions set forth in our bid invitation become a part of this order.
Vendor GUARANTEES Merchandise Delivered On This Order Will MEET OR EXCEED Specifications In The Bid Invitation.

Budget 11 Prefix 1 Auth. 300-600

Item No.	11-601-34 (Description)	Quantity	Unit	Unit Price	Extension
	Hot Mix Asphaltic Concrete to meet the following Specifications: Item 340 & Sp.	2,000	Tons	$9.35	$ 18,700.00
	1. Coarse Aggregate to be composed of lightweight aggregate that shall meet the requirements of Special Specification Item 1862, "Aggregate for Surface Treatments (Lightweight)". (Specification Attached)				
	2. The Type "D" Paving Mixture to be Modified to conform to the master grading as indicated below:				
		Percent by Wt.			
	Passing 1/2" Sieve		100		
	Passing 3/8" Sieve	95	100		
	Passing 3/8" Sieve, retained on No. 4 Sieve	10	35		
	Passing No. 4 Sieve, retained on No. 10 Sieve	5	20		
	Total retainedon No. 10 Sieve	35	55		
	Passing No. 10 Sieve, retained on No. 40 Sieve	0	30		
	Passing No. 40 Sieve, retained on No. 80 Sieve	5	35		
	Passing No. 80 Sieve, retained on No. 200 Sieve	3	35		
	Passing No. 200 Sieve	0	10		
	The Asphaltic Material shall form from 5.0 to 9.0% of the mixture by weight.				
	3. Requirements for Laboratory Density of the paving mixture to be modified to conform to the following:				
	Density Percent Min. Max. Optimum 93 97 95				
	F.O.B. Lufkin, Texas - Plant				

MC/ph

STATE SALES TAX EXEMPTION CERTIFICATE: The undersigned claims an exemption from taxes under Chapter 20, Title 122A, Revised Civil Statutes of Texas, for purchase of tangible personal property described in this numbered order, purchased from contractor and/or shipper listed above, as this property is being secured for the exclusive use of the State of Texas.

In accordance with your bid proposal, supplies MUST be placed in the department receiving room in _____ days from receipt of order. F.O.B. DESTINATION *Cash Discount _____ % 30 Days

*Normal payment of CASH DISCOUNTED INVOICES is approximately 30 calendar days, after the correct supplies and invoices are received by the proper agency. Bidder must state the MAXIMUM discount period he will allow. In the event his bid is low ONLY because of cash discount, he must have allowed at least 30 calendar days OR award will be made to next low bidder.

IMPORTANT—CONDITIONS OF ORDER—
If the contractor fails to deliver these supplies by the promised delivery date or a reasonable time thereafter, giving acceptable reasons for delay, or if supplies are rejected for failure to meet specifications, the State reserves the right to purchase specified supplies elsewhere, and charge the increase in price and cost handling, if any, to the contractor. No substitutions nor cancellations permitted without prior approval of the Board of Control.
The State of Texas is exempt from all Federal Excise Taxes and Federal Transportation Tax.

BC FORM NO. 888.3 - REVISED 11/67

By _____ Purchasing Division

STATE BOARD OF CONTROL
CAPITOL STATION—P.O. DRAWER CC
AUSTIN, TEXAS 78711

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TEXAS HIGHWAY DEPARTMENT

SPECIAL SPECIFICATION

ITEM 1862

AGGREGATE FOR SURFACE TREATMENTS

(LIGHTWEIGHT)

1. DESCRIPTION. This item establishes the requirements for lightweight aggregates to be used in the construction of surface treatments.

2. MATERIALS. Aggregates shall be composed predominantly of lightweight cellular and granular inorganic material prepared by expanding, calcining, or sintering products such as clay or shale.

The aggregate shall contain not more than 1 percent of organic matter, impurities or objectionable matter when tested in accordance with Test Method Tex-217-F.

The dry loose unit weight of coarse lightweight aggregates shall not be less than 35 and shall not exceed 60 pounds per cubic foot. If the unit weight of any shipment of lightweight aggregate differs by more than 6 percent from that of the sample submitted for acceptance tests, the aggregates in the shipment may be rejected. Tests shall be in accordance with Test Method Tex-404-A, except that the aggregate shall be tested in an oven-dry condition. The percent of wear, as determined by Test Method Tex-410-A (Part II), shall not exceed 35 percent.

The aggregate, when tested in accordance with Test Method Tex-411-A, shall show a loss of not more than 12 percent after five cycles of the sodium sulfate soundness test or 18 percent after five cycles of the magnesium sulfate soundness test.

3. GRADES. When tested by Test Method Tex-200-F, the gradation requirements for the several grades of aggregate shall be as follows:

		Percent by Weight
Grade 1:	Deleted	
Grade 2:	Retained on 7/8" sieve	0
	Retained on 3/4" sieve	0-2
	Retained on 1/2" sieve	20-35
	Retained on No. 4 sieve	85-100
	Retained on No. 10 sieve	98-100
Grade 3:	Retained on 3/4" sieve	0
	Retained on 5/8" sieve	0-2
	Retained on 1/2" sieve	5-20
	Retained on No. 4 sieve	95-100
	Retained on No. 10 sieve	99-100
Grade 4:	Retained on 5/8 " sieve	0
	Retained on 1/2" sieve	0-2
	Retained on 3/8" sieve	15-45
	Retained on No. 4 sieve	90-100
	Retained on No. 10 sieve	99-100

Grade 5:	Retained on 1/2" sieve	0
	Retained on 3/8" sieve	0-2
	Retained on No. 4 sieve	60-90
	Retained on No. 10 sieve	99-100
Grade 6:	Retained on 1/2" sieve	0
	Retained on 3/8" sieve	0-2
	Retained on No. 4 sieve	35-70
	Retained on No. 10 sieve	90-100
	Retained on No. 20 sieve	99-100
Grade 7:	Retained on 1/4" sieve	0
	Retained on No. 4 sieve	0-10
	Retained on No. 20 sieve	25-55
Grade 8:	Retained on No. 4 sieve	0
	Retained on No. 10 sieve	0-10
	Retained on No. 20 sieve	10-55

4. MEASUREMENT AND PAYMENT. Aggregates will be measured and paid for in accordance with the governing specifications for the items of construction in which these materials are used.

Texas Highway Department
Form No. 326-A

ASPHALT CEMENTS TEST REPORT

NO CHARGE

MATERIAL AC-20

Laboratory No. 69-1714-C
Date Received 6-12-69 Date Reported 7-25-69
Dist. or Res. Engr.
Address
Sampler H.S. Burkhart
Sampler's Title Inspector
Contractor
Sampled from Tank 6, Seal 157-8-9-60
(pit, quarry, car or stockpile)

Unassigned
Control No. Sect. No. Job No.

County Federal Project No. Hwy. No.

11
District No. Req. No. 6-11-69
Date sampled

Producer American Petrofina; Mt. Pleasant
Quantity represented by sample 500,000 Gals.
Has been used on
Proposed for use as

Identification marks Batch No. 105-E
Specification Item No. 300-009 (AC-20)
Material from property of

Water, %	Nil
Viscosity at 275°F., Stokes	5.0
Viscosity at 140°F., Stokes	2386
Solubility in CCl_4, %	99.9+
Flash Point C.O.C., °F.	580
Ductility, 77°F., 5 cm/min., cm.	141+
Relative Viscosity (after oxidation, 15 u films for 2 hours at 225°F., viscosities determined at 77°F.)	5.0-
Penetration at 77°F., 100 g., 5 Sec.	74
Specific Gravity at 77°F.	1.029

D-9 Remarks:

J

Division of Materials and Tests
MEETS
SPECIFICATIONS

719542—667-10M

Form 470A ...y Department 39319-365-40m

SOILS AND BASE MATERIALS TEST REPORT

Laboratory No. 69-2242
Date Rec'd 6-20-69 Reported 7-11-69
Engineer Johnny N. Dominey
Address Lufkin, Texas
Contractor Maintenance
Sampler Otis E. Clark
Sampler's Title Engr.Aide III
Sampled From Stockpile
Producer East Texas Asph. Co.
Quantity Represented by Sample
Has been Used on

Control Number	Section Number	Job Number
176-10-3	PD 5011	
Angelina	N 176-10-3	Loop 266
County	Project No.	Highway No.
11	11-80-Y	6-20-69
District No.	I.P.E. No.	Req. No.	Date Sampled

Specification Item No. 340---066 & Supplement
Material from Property of Sand Pit off St.Hwy. 94 near Neches River

Proposed for Use as Aggr. for HMAC Pvmt.

Lab. No.	LL	PI	SL	LS	SR	Class	Soil Binder	WBM % Loss	% Moist.	
69-2242	25.5	2.9	19.8	1.2	1.72		98.0			

PERCENT RETAINED ON

Lab No.	Square Mesh Sieve Opening in Inches								Sieve Numbers							Grain Diam. in Millimeters			Specific Gravity	
	3	2½	2	1¾	1½	¾	⅜	¾	4	10	20	40	60	100	200	.05	.005	.001		
69-2242									0	1	-	2	6	56	87	88	97	99	2.63	Tex-110-E
Recheck									0	1	-	2	7	55	86	88	97	99	2.63	

SAMPLE IDENTIFICATION

Lab. No.	Identification Marks	Location—Properties—Station Numbers	Type of Materials
69-2242		Stockpile Sample at East Texas Asphalt Co. Plant	Sand

(7)

Texas Highway Department
Form 231

GENERAL TEST REPORT

Laboratory No. 69-2208, etc.
Date Received 6-20-69 Date Reported 7-11-69
Engr. Johnny N. Dominey
Address Lufkin, Texas
Sampler Otis E. Clark
Sampler's Title Engr. Aide III
Contractor Maintenance
Sampled from Stockpile (pit, quarry, cut or stockpile)

Material Sand

176-10-3 (Control No.) FD 5011 (Sect. No.) (Job. No.)
Angelina (County) N 176-10-3 (Federal Project No.) Loop 266 (Hwy. No.)
11 (District No.) 11-20-Y (Req. No.) 6-20-69 (Date Sampled)

Producer East Texas Asph. Co.
Quantity represented by sample
Has been used on
Proposed for use as Aggr. for HMAC Pvmt.

Identification marks
Specification Item No. 340---066 & Supplement
Material from property of Stand Pit off St. Hwy. 94 near Neches River

DETERMINATIONS

GRADATION - % by Wt. Tex-200-F

Sieve Size	Laboratory Serial Numbers 69-2208	69-2209	69-2210	Average
Ret. ½"	0.0	0.0	0.0	0.0
½" - 3/8"	0.0	0.0	0.0	0.0
3/8" - 4	0.5	0.5	0.4	0.5
4 - 10	0.5	0.7	0.8	0.7
Ret. 10	1.0	1.2	1.2	1.2
10 - 40	1.0	1.0	1.1	1.0
40 - 80	49.9	49.6	44.3	47.9
80 - 200	40.6	40.8	45.3	42.2
Pass 200	7.5	7.4	8.1	7.7

Lab. No. 69-2243, Sand Equivalent Value = 63

Lab. No. 69-2361, Dry Unit Weight (Loose) = 83.8 Lbs./Cu.Ft.

Texas Highway Department
Form 231

GENERAL TEST REPORT

Laboratory No. 69-2224, etc.
Date Received 6-20-69 Date Reported 7-11-69
Dist/Div/Rgn Engr. Johnny N. Dominey
Address Lufkin, Texas
Sampler Otis E. Clark
Sampler's Title Engr.Aide III
Contractor Maintenance
Sampled from Stockpile (pit, quarry, car or stockpile)

Material Sand

176-3-10 (Control No.) PD 5011 (Sect. No.) (Job. No.)
Angelina (County) N 176-3-10 (Federal Project No.) Loop 266 (Hwy. No.)
11 (District No.) 11-60-Y (Req. No.) 6-20-69 (Date Sampled)

Producer East Texas Asphalt Co.
Quantity represented by sample
Has been used on
Proposed for use as Aggr. for HMAC Pvmt.

Identification marks
Specification Item No. 340---066 & Supplement
Material from property of Sand Pit off St. Hwy. 94 near Neches River

DETERMINATIONS

SPECIFIC GRAVITY & % WATER ABSORPTION (24 HRS.)

Lab. No.	Bulk Sp.Gr.	Absorption % by Wt.
Determined from samples used for Test Method TEX-433-A		
69-2232	2.620	0.56
69-2233(Rech)	2.612	0.58
Average	2.616	0.57

Lab.No.	Sieve Size	Sample % by Wt.	Specific Gravity SSD	Bulk	Apparent	Absorption % by Wt.
Determined by Test Method TEX-201-F & TEX-202-F						
69-2224	+80	50	2.618	2.598	-	0.74
69-2242	-80	50	- -	- -	2.627*	-
		Combined Sand		2.612		
* Used for computing combined bulk Sp.Gr.						
Recheck of above tests						
69-2225	+80	50	2.625	2.601	-	0.91
69-2242	-80	50	- -	- -	2.635*	
		Combined Sand		2.618		

Average of all tests: $G_{Bulk} = 2.616$

Texas Highway Department
Form 272 (Revised)

AGGREGATE TEST REPORT

Charge $28.00

Laboratory No. 69-2574-A
Date Received 7-1-69 Date Reported 7-22-69
Dist. or Res. Engr. J. M. York
Address Lufkin, Texas
Contractor
Sampler Robert W. Walker
Sampler's Title Engr. Tech. III
Sampled from Stockpile (Pit, quarry, car or stockpile)

Material: Lwt. Aggregate

B/C 29073
Control No. Sect. No. Job No.

County Federal Project No. Hwy No.
11 80 6-26-69
Dist. No. I.P.E. No. Req. No. Date Sampled

Producer Texas Industries, Inc., Arlington, Texas
Quantity represented by sample 800 tons
Has been used on
Proposed for use as Aggr. for HMAC

Identification Marks L-1
Specification Item No. 1862
Material from property of East Texas Asphalt Co., in Angelina County, 3 miles W. of Lufkin on State 94.

SIZES	Grams	Per Cent
Ret'd. on 3½" sieve		
Ret'd. on 3" sieve		
Ret'd. on 2½" sieve		
Ret'd. on 2" sieve		
Ret'd. on 1¾" sieve		
Ret'd. on 1½" sieve		
Ret'd. on 1¼" sieve		
Ret'd. on 1" sieve		
Ret'd. on ⅞" sieve		
Ret'd. on ¾" sieve		
Ret'd. on ⅝" sieve		
Ret'd. on ½" sieve		
Ret'd. on ⅜" sieve		
Ret'd. on ¼" sieve		
Ret'd. on #4 sieve		
Ret'd. on #8 sieve		
Ret'd. on #10 sieve		
Ret'd. on #16 sieve		
Ret'd. on #20 sieve		
Ret'd. on #30 sieve		
Ret'd. on #40 sieve		
Ret'd. on #50 sieve		
Ret'd. on #60 sieve		
Ret'd. on #80 sieve		
Ret'd. on #100 sieve		
Ret'd. on #200 sieve		
Loss by elutriation		
Total	100.0	100.0
Fineness Modulus		

GRADING OF FINE-AGGREGATE

Grams	Per Cent

TENSILE STRENGTH
1:3 Mortar at 8 days H.E.S.
This Sand Ottawa

L.A. Abrasion 21.2
Type C
Organic Color
Type of Soundness Mg. SO_4
% Unsound 0.0
Loss By Decantation
Wt. Per C.F. S.S.D. 42.98
Specific Gravity
Absorption
Weight Solids
% Solids
% Voids

Division of Materials and Tests
MEETS QUALITY SPECIFICATIONS

Remarks: This sample of material consists of Lwt. Exp. Shale.

ed

D4-P-3069-F74 12-67 30M

(c)

Texas Highway Department
Form 231

GENERAL TEST REPORT

Laboratory No. 69-2203 thru 2207
Date Received 6-20-69 Date Reported 7-11-69
Engr. Johnny N. Dominey
Address Lufkin, Texas
Sampler Otis E. Clark
Sampler's Title Engr.Aide III
Contractor Maintenance
Sampled from R R Car
(pit, quarry, car or stockpile)

Material Lightweight Aggr.

176-10-3 PD 5011
Control No. Sect. No. Job. No.
Angelina N 176-10-3 Loop 266
County Federal Project No. Hwy. No.
11 11-80-Y 6-20-69
District No. Req. No. Date Sampled

Producer Texas Industries, Inc.
Quantity represented by sample
Has been used on
Proposed for use as Aggr. for HMAC Pavement

Identification marks
Specification Item No. 340---066, & Supplement
Material from property of
East Texas Asphalt Co., Lufkin, Texas

DETERMINATIONS

GRADATION - % by WT.

Sieve Size	Laboratory Serial No. 69-2203	69-2204	69-2205	69-2206	Average
Ret. ½"	0.0	0.0	0.0	0.0	0.0
½" - 3/8"	0.0	0.0	0.0	0.0	0.0
3/8" - 4	39.8	50.4	42.4	46.9	47.4
4 - 10	57.7	48.3	46.3	51.7	51.0
Ret. 10	97.5	98.7	98.7	98.6	98.4
10 - 40	1.6	-	-	0.8	1.0(Est.)
40 - 80	0.0	-	-	0.1	0.1(Est.)
80-200	0.0	-	-	0.1	0.0(Est.)
Pass 200	0.9	-	-	0.4	0.5(Est.)

Remarks: Gradation meets Grade 6 of Item 1862

MOISTURE CONTENT - IN R.R. CAR

Lab. No.	% by Wt.
69-2207	18.9

Remarks: Oven dried samples accumulated 0.5% hygroscopic moisture overnight outside Laboratory building.

Texas Highway Department
Form 231

GENERAL TEST REPORT

Laboratory No. 69-2326 thru 2332
Date Received 6-26-69 Date Reported 7-11-69
Engr. Johnny N. Dominey
Address Lufkin, Texas
Sampler Otis E. Clark
Sampler's Title Engr. Aide III
Contractor Maintenance
Sampled from Stockpile
(pit, quarry, car or stockpile)

Material Lightweight Aggr.

176-10-3 (Control No.) PR 5011 (Sect. No.) (Job. No.)
Angelina (County) M 176-10-3 (Project No.) Loop 266 (Hwy. No.)
11 (District No.) 11-80-Y (Req. No.) 6-26-69 (Date Sampled)

Producer Texas Industries, Inc.
Quantity represented by sample
Has been used on
Proposed for use as Aggr. for HMAC Pavement

Identification marks
Specification Item No. 340---066 & Supplement
Material from property of
East Texas Asphalt Co., Lufkin, Texas

DETERMINATIONS

MOISTURE CONTENT - IN STOCKPILE

	% by Wt.
Lab. No. 69-2326,	7.6

GRADATION % by WT.

Sieve Size	Laboratory Serial Number 69-2327	69-2328	69-2329	69-2330	69-2331	69-2332	Average
Ret. ½"	0.0	0.0	0.0	0.0	0.0	0.0	0.0
½" - 3/8"	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3/8" - 4	52.2	55.7	45.2	47.3	50.6	47.7	49.8
4 - 10	46.4	43.1	53.6	51.5	48.2	51.1	49.0
Ret. 10	98.6	98.8	98.8	98.8	98.8	98.8	98.8
10 - 40	0.7	0.6	0.5	0.6	0.5	0.5	0.6
40 - 80	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80 - 200	0.1	0.1	0.1	0.1	0.2	0.1	0.1
Pass 200	0.6	0.5	0.6	0.5	0.5	0.6	0.5

Remarks: Gradation meets Grade 6 of Item 1862

Dry Unit Weight(Loose) = 42.0 #/Cu.Ft.

Texas Highway Department
Form 231

GENERAL TEST REPORT

Laboratory No. 69-2501
Date Received 7-9-69 Date Reported 7-11-69
District Engr. Johnny N. Dominey
Address Lufkin, Texas
Sampler Otis E. Clark
Sampler's Title Engr.Aide III
Contractor Maintenance
Sampled from Stockpile
(pit, quarry, car or stockpile)
Producer Texas Industries, Inc.
Quantity represented by sample
Has been used on
Proposed for use as Aggr. for IHAC Pavement

Material Lightweight Aggr.

Control No.	Sect. No.	Job. No.
176-10-3	FD 5011	

County	Federal Project No.	Hwy. No.
Angelina	M 176-10-3	Loop 266

District No.	Req. No.	Date Sampled
11	11-00-Y	7-9-69

Identification marks
Specification Item No. 340——066 & Supplement
Material from property of
East Texas Asphalt Co., Lufkin, Texas

DETERMINATIONS

Moisture Content - In Stockpile

% by Wt.
17.7

Remarks: Stockpile sample obtained 6-26-69 indicated 7.6% moisture. Sample taken from railroad car 6-20-69 indicated 18.9% moisture. Possibly, the sample taken 6-26-69 may have been obtained where the aggregate was exposed and dried out considerably.

Texas Highway Department
Form 231

GENERAL TEST REPORT

Laboratory No. 69-2362 & 2421
Date Received 6-26-69 Date Reported 7-16-69
Engr. Johnny N. Dominey
Address Lufkin, Texas
Sampler Donald R. Johnson
Sampler's Title Engr. Aide IV
Contractor Maintenance
Sampled from Stockpile (Pit, quarry, car or stockpile)

Material Lightweight Aggr.

176-10-3 (Control No.) PD 5011 (Sect. No.) (Job. No.)
Angelina (County) H-176-10-3 (Federal Project No.) Loop 266 (Hwy. No.)
11 (District No.) 11-60-Y (Req. No.) 6-26-69 (Date Sampled)

Producer Texas Industries, Inc.
Quantity represented by sample
Has been used on
Proposed for use as Aggr. for HMAC Pavement

Identification marks
Specification Item No. 340---066 & Supplement
Material from property of
East Texas Asphalt Co., Lufkin, Texas

DETERMINATIONS

Determination of the Ability to Withstand Degradation

Laboratory No. 69-2362

Wet Ball Mill Method was used for this determination. A total dry weight of 3-1/2 pounds of lightweight material was used for the test. The percentage of soil binder after the test was found to be 5.7%.

Determination of the Ability to Withstand Breakdown by Slaking and Drying

Laboratory No. 69-2421

A pressure pycnometer was used to slake the material. Sieve analysis of the sample before and after testing is as follows:

	Sieve Size							
	+3/8"	3/8"-4	4-10	+ 10	10-40	40-80	80-200	Pass 200
Before Testing	0.0	48.2	50.0	98.2	0.8	0.2	0.2	0.6
After Testing	0.0	47.7	50.2	97.9	0.9	0.2	0.2	0.8

Texas Highway Department
Form 231

GENERAL TEST REPORT

Laboratory No. 69-2229, etc.
Date Received 6-20-69 Date Reported 7-11-69
Engr. Johnny N. Dunlavy
Address Lufkin, Texas
Sampler Otis D. Clark
Sampler's Title Engr. Aide III
Contractor Maintenance
Sampled from R. P. Car (pit, quarry, car or stockpile)

Producer Texas Industries, Inc.
Quantity represented by sample
Has been used on
Proposed for use as Aggr. for HMAC Pavement

Material Lightweight Aggr.

176-10-3 (Control No.) FD 5011 (Sect. No.) (Job. No.)
Angelina (County) F 176-10-3 (Federal Project No.) Loop 266 (Hwy. No.)
11 (District No.) 11-60-X (Req. No.) 6-20-69 (Date Sampled)

Identification marks
Specification Item No. 340-066 & Supplement
Material from property of
East Texas Asphalt Co., Lufkin, Texas

DETERMINATIONS

SSD & BULK SPECIFIC GRAVITY & % WATER ABSORPTION (24 HRS.)

Lab. No.	Sieve Size	Sample % by Wt.	Specific Gravity SSD	Specific Gravity Bulk	Absorption % by Wt.	
Using Test Method Tex-201-F						
69-2239	3/8" - 4	50	1.524	1.251	21.9	
69-2240	4 - 10	50	1.557	1.270	22.7	
	Combined Aggregate		1.540	1.260	22.3	
Rechecks for Above Test						
69-2239	3/8" - 4	50	1.524	1.256	21.4	
~~69-2240~~	~~4 - 10~~	~~50~~	~~1.559~~	~~1.093~~	~~36.2~~	~~VOID~~
69-2240Rech.	4 - 10	50	1.594	1.295	23.0	
	Combined Aggregate		1.557	1.275	22.2	

Texas Highway Department
Form 231

FS-967-10M

GENERAL TEST REPORT

Laboratory No. 69-2272
Date Received 6-20-69 Date Reported 8-7-69
Dist./or Res. Engr. Johnny N. Dominey
Address Lufkin, Texas
Sampler Otis E. Clark
Sampler's Title Engr. Aide III
Contractor Maintenance
Sampled from R R Car
(pit, quarry, car or stockpile)
Producer Texas Industries Inc., Arlington
Quantity represented by sample
Has been used on
Proposed for use as Aggr. for HMAC Pavement

Material Lightweight Aggr.

Control No.	Sect. No.	Job. No.
176-10-3	FD 5011	
County	**Federal Project No.**	**Hwy. No.**
Angelina	H 176-10-3	Loop 266
District No.	**Req. No.**	**Date Sampled**
11	11-80-Y	6-26-69

Identification marks Dallas Haydite
Specification Item No. 340---066 & Supp.
Material from property of
East Texas Asphalt Co., Lufkin, Texas

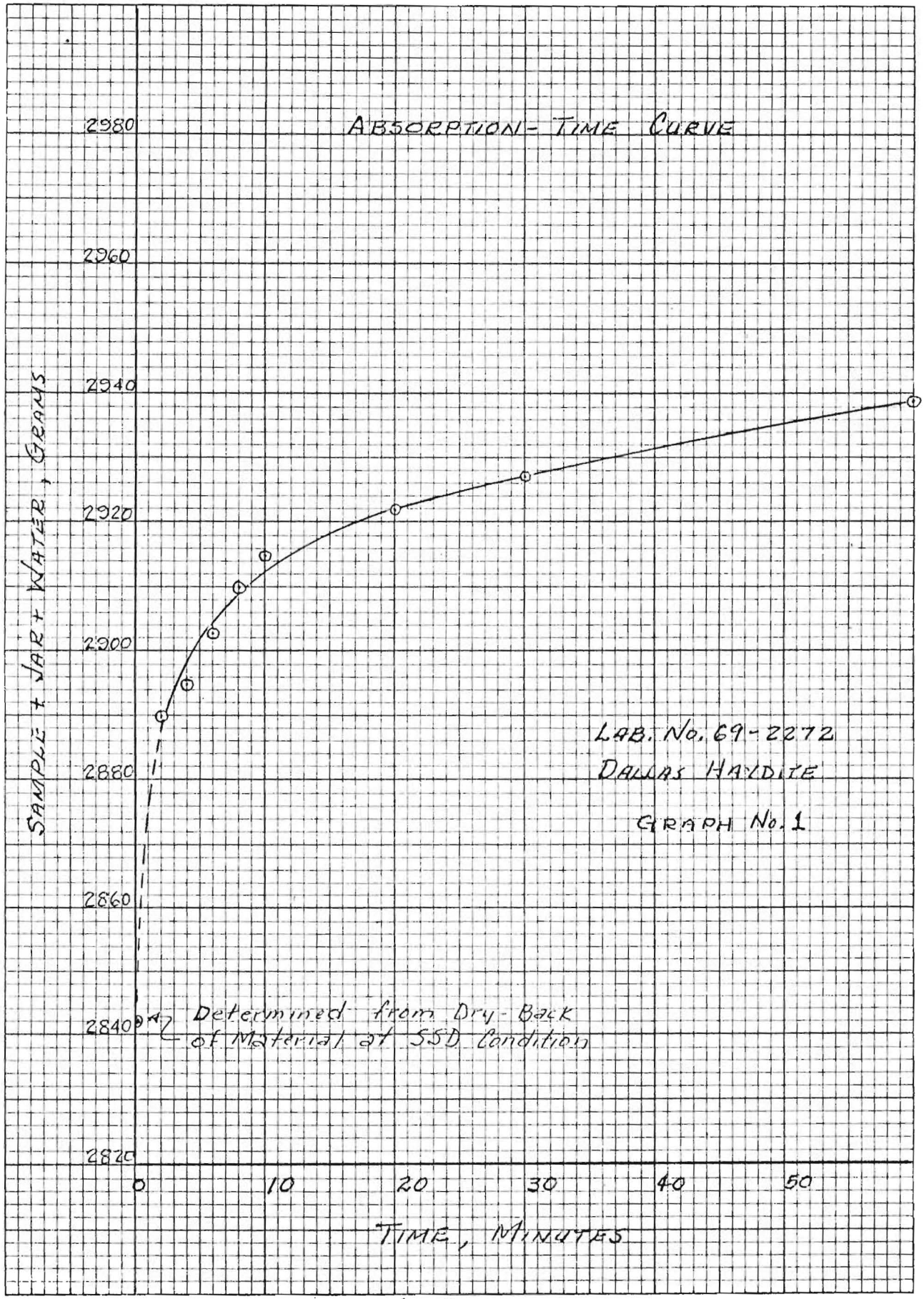
DETERMINATIONS

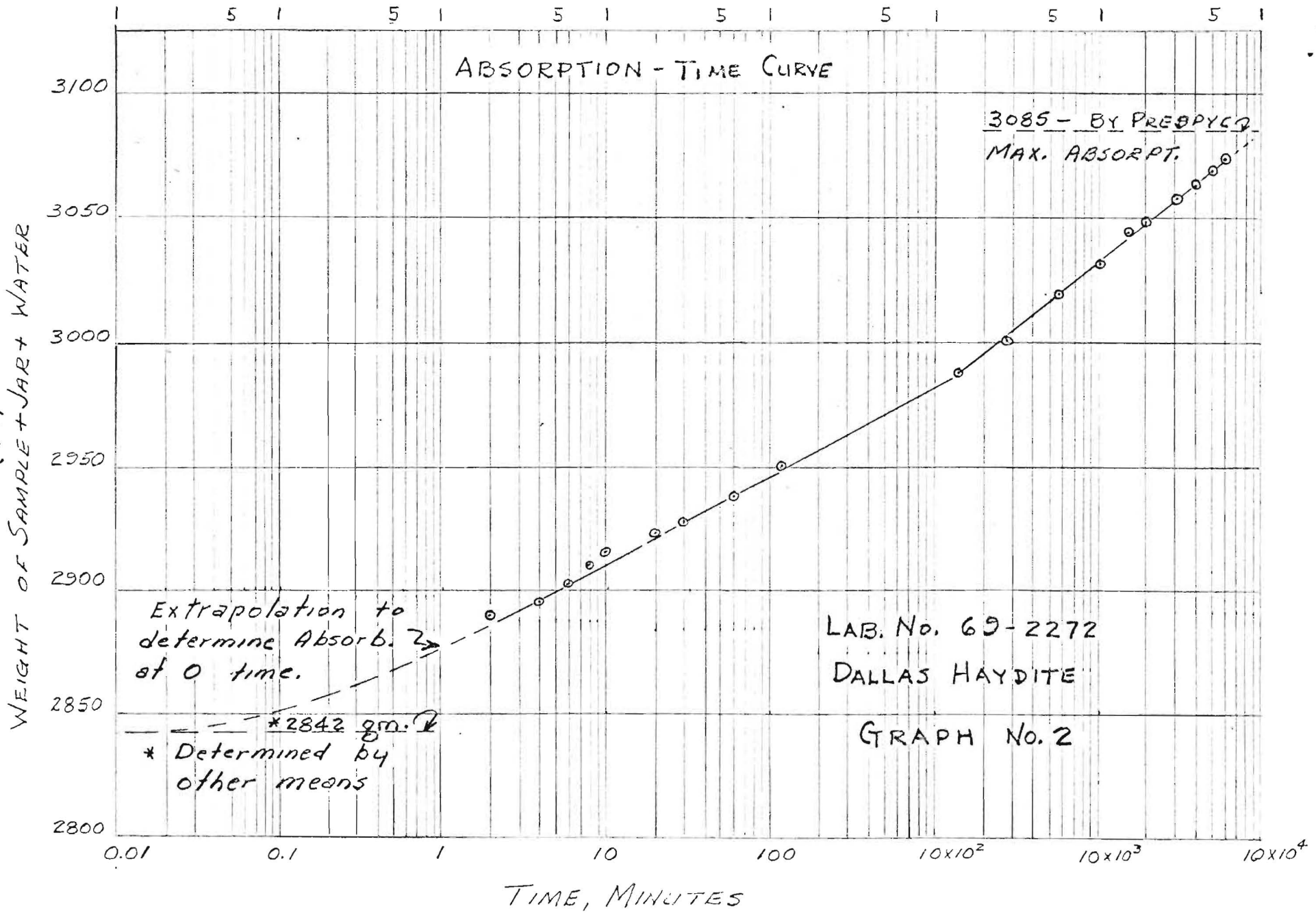
Lightweight Aggregate (Dallas Haydite) was subjected to water soaking to study the absorption characteristics of the material. The test was carried through a period of 42 days, after which the sample was subjected to absorption using the pressure pycnometer. After saturation, the material was brought to saturated surface dry condition and the amount of moisture determined. From this data, the weight of pycnometer jar plus sample plus water was determined for zero time(no water absorption).

Since the material being tested has a high rate of absorption, it is thought that tentative Test Method Tex-433-A is of little value. Actually, the bulk specific gravity was determined from Test Method Tex-201-F. The bulk specific gravity was found to be 1.255, and the percent water absorption was found to be 34.5 using the pressure pycnometer.

Absorption-Time Curves were plotted on graphs. Graph No. 1 illustrates the absorption-time relationship plotted on rectangular coordinate paper. Graph No. 2 on semi-logarithmic paper depicts the absorption for a time period of 2 minutes to 47 days. Graph No. 2 illustrates an apparent change in the rate of absorption after one day, but no explanation is offered at this time. No check tests have been undertaken.

The above data was obtained to determine the absorption characteristics of the material, and to check the feasibility of the determination of the bulk specific gravity to an acceptable degree of accuracy.




ABSORPTION - TIME CURVE
3085 - BY PREDPYCO
MAX. ABSORPT.
Extrapolation to determine Absorb. ≥ at 0 time.
*2842 gm. ≥
* Determined by other means
LAB. No. 69-2272
DALLAS HAYDITE
GRAPH No. 2
WEIGHT OF SAMPLE + JAR + WATER
3100
3050
3000
2950
2900
2850
2800
0.01
0.1
1
10
100
10x10²
10x10³
10x10⁴
TIME, MINUTES

SAMPLE No: 69-2272 DATE: 6-26-69
MATERIAL: DALLAS HAYDITE

Wt. of Sp. Gr. Bottle + H_2O: 2699 gms (W_2)
Wt of Aggregate: 704 gms (W_3)

(1) Time after Starting	(2) Time Elapsed min.	(3) Wt. of Bottle + Sample + H_2O gms.	(4) Wt. of Abs. H_2O = (3) − W_o	(5) Absorption % (3)/W_3 × 100
9:28	0	2842		
9:30	2	2890		
9:32	4	2895		
9:34	6	2903		
9:36	8	2910		
9:38	10	2915		
9:48	20	2922		
9:58	30	2927		
10:28	60	2939		
11:38	120	2950		
1 Day	1440	2987		
2 Day	2880	3002		
4 Day	5760	3020		
7	10080	3033		
11	15840	3045		
14	20160	3048		
21	30240	3058		
28	40320	3064		
35	50,400	3069		
42	60,480	3074		
Pyc.	—	3085	243	34.5

W_o (from graph) = 2842 gms (see below)

X = 927 gms, sample at SSD following pycnometer
X_1 = 689 gms, Sample oven-dried following testing
$A = \frac{X - X_1}{X_1} \times 100 = \frac{238}{689} \times 100 = 34.5\%$ Absorption
Total H_2O ABSORPT. $= \frac{704}{689} \times 238 = 243$ gms

Dry Bulk Sp. Gr. $= \frac{W_3}{(W_2 + W_3 - W_o)} = \frac{704}{2699 + 704 - 2842} = \underline{\underline{1.255}}$

(16A)

Texas Highway Department
Form 231

GENERAL TEST REPORT

Laboratory No. Preliminary Design
Date Received 6-20-69 Date Reported 7-11-69
Dist. Engr. Johnny H. Dominey
Address Lufkin, Texas
Sampler Otis E. Clark
Sampler's Title Engr. Aide III
Contractor Reinhardt
Sampled from PR Car & Stockpile (pit, quarry, car or stockpile)

Material LWAC Aggr.

176-10-3 (Control No.) PR 6011 (Sect. No.) Job. No.
Angelina (County) H 176-10-3 (Federal Project No.) Loop 266 (Hwy. No.)
11 (District No.) 11-00-Y (Req. No.) 6-20,26-69 (Date Sampled)

Producer Texas Industires, Inc.
Quantity represented by sample
Has been used on
Proposed for use as Aggregate for LWAC Pvmt.

Identification marks Dallas Haydite & Sand
Specification Item No. 340---066 & Supplement
Material from property of East Texas Asphalt Co., Lufkin, Texas

DETERMINATIONS

SUMMARY OF DESIGN SERIES

Sieve Size	Regular Master Grading	Percentages By Volume Series No. 5	Series No. 6	Series No. 7	Series No. 8
+ 1/2"	0	0.0	0.0	0.0	0.0
1/2" - 3/8"	0-5	0.0	0.0	0.0	0.0
3/8" - # 4	20 - 50	28.5	33.2	23.2	19.8
4 - 10	10 - 30	29.2	33.8	23.8	20.3
+ 10	50 - 70	57.7	67.0	47.0	40.1
10 - 40	0 - 30	0.8	0.8	0.8	0.9
40 - 80	4-25	20.1	15.6	25.4	28.8
80 - 200	3-25	17.8	13.7	22.4	25.3
Pass 200	0-6	3.6	2.9	4.4	4.9

Series No. 5: 58.0% Lightweight Aggr. & 42.0% Sand(By Volume)
Series No. 6: 67.5% Lightweight Aggr. & 32.5% Sand(By Volume)
Series No. 7: 47.1% Lightweight Aggr. & 52.9% Sand(By Volume)
Series No. 8: 40.0% Lightweight Aggr. & 60.0% Sand(By Volume)

Texas State Highway Department
Form 451

34266-1064-10m

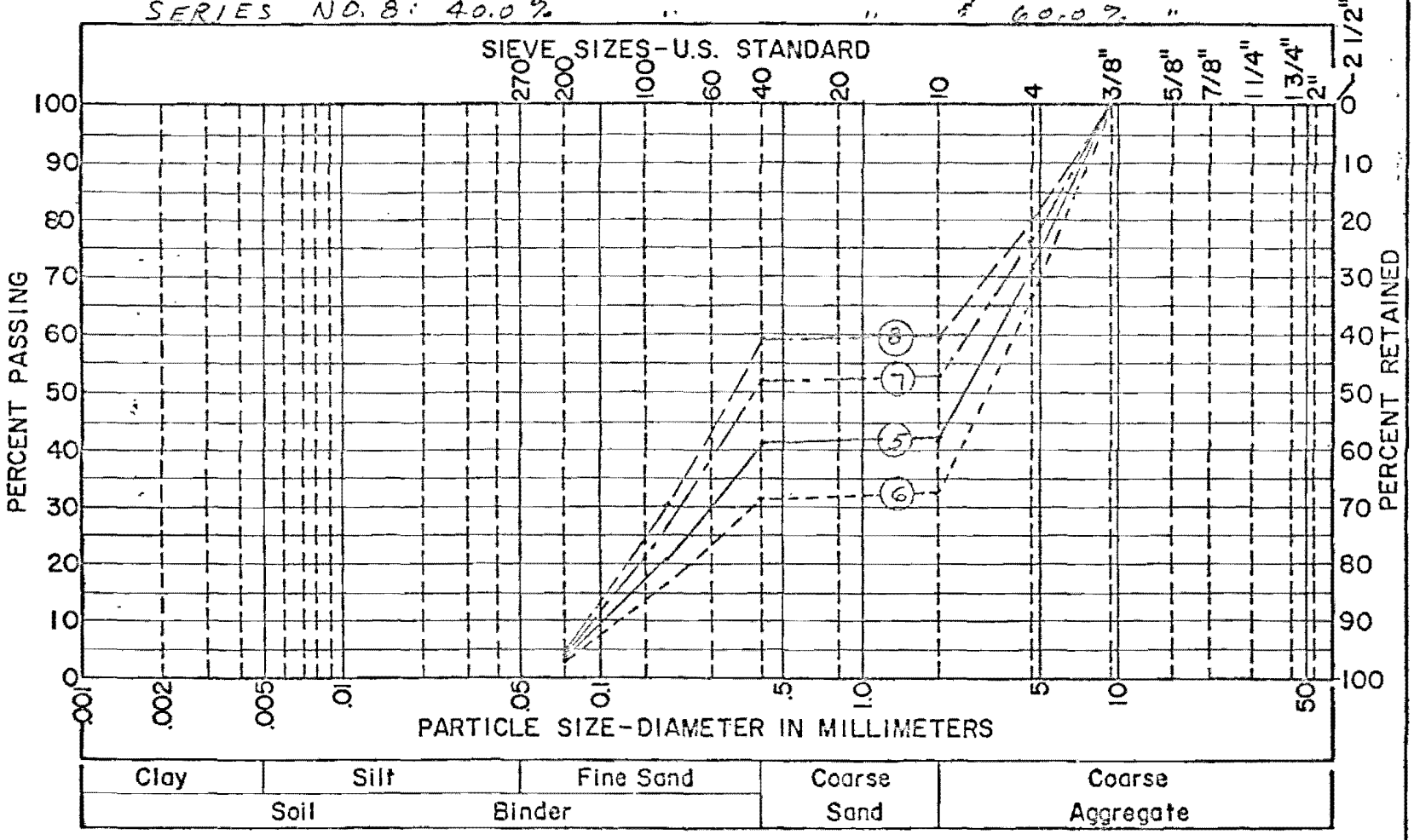
CUMULATIVE MECHANICAL ANALYSIS

PD 5011

Sample No. _____ County Angelina Project M 176-1C-3 Highway Loop 266

By VOLUME

SERIES NO. 5 : 58 % Lightweight Aggr. & 42 % Sand
SERIES NO. 6 : 67.5 % " " & 32.5 % "
SERIES NO. 7 : 47.1 % " " & 52.9 % "
SERIES NO. 8 : 40.0 % " " & 60.0 % "



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Texas Highway Department
Form 231

GENERAL TEST REPORT

Laboratory No. Preliminary Design
Date Received 6-20-69 Date Reported 7-11-69
Dist. Engr. Johnny W. Dominey
Address Lufkin, Texas
Sampler Otis E. Clark
Sampler's Title Engr. Aide III
Contractor Maintenance
Sampled from In Car & Stockpile
(pit, quarry, car or stockpile)

Producer Texas Industries, Inc.
Quantity represented by sample
Has been used on
Proposed for use as Aggregate for LWAC Pvmt.

Material LWAC Aggr.

176-10-3 PD 5011
Control No. Sect. No. Job. No.

Angelina 11 176-10-3 Loop 266
County Federal Project No. Hwy. No.

11 11-80-Y 6-20626-69
District No. Req. No. Date Sampled

Identification marks Dallas Haydite & Sand
Specification Item No. 340---066 & Supplement
Material from property of
East Texas Asphalt Co., Lufkin, Texas

DETERMINATIONS

SUMMARY OF DESIGN SERIES

Sieve Size	Modified Master Grading	Percentages by Weight Series No. 5	Series No. 6	Series No. 7	Series No. 8
+ ½"	0	0.0	0.0	0.0	0.0
½" - 3/8"	0-5	0.0	0.0	0.0	0.0
3/8" - 4	10-35	19.8	24.6	14.9	12.3
4 - 10	5-20	20.3	25.3	15.5	12.6
4 - 10	35-55	40.1	49.9	30.4	24.9
10 - 40	0 - 30	0.9	0.9	0.9	1.0
40 - 80	5 - 35	28.8	23.9	33.5	36.2
80 - 200	3-35	25.3	21.1	29.6	32.0
Pass 200	0-10	4.9	4.2	5.6	5.9

Series No. 5: 40% Lightweight Aggregate & 60% Sand (By Weight)
Series No. 6: 50% Lightweight Aggregate & 50% Sand (By Weight)
Series No. 7: 30% Lightweight Aggregate & 70% Sand (By Weight)
Series No. 8: 24.3% Lightweight Aggregate & 75.7% Sand(By Weight)

Texas State Highway Department
Form 4Si

24266-1064-10m

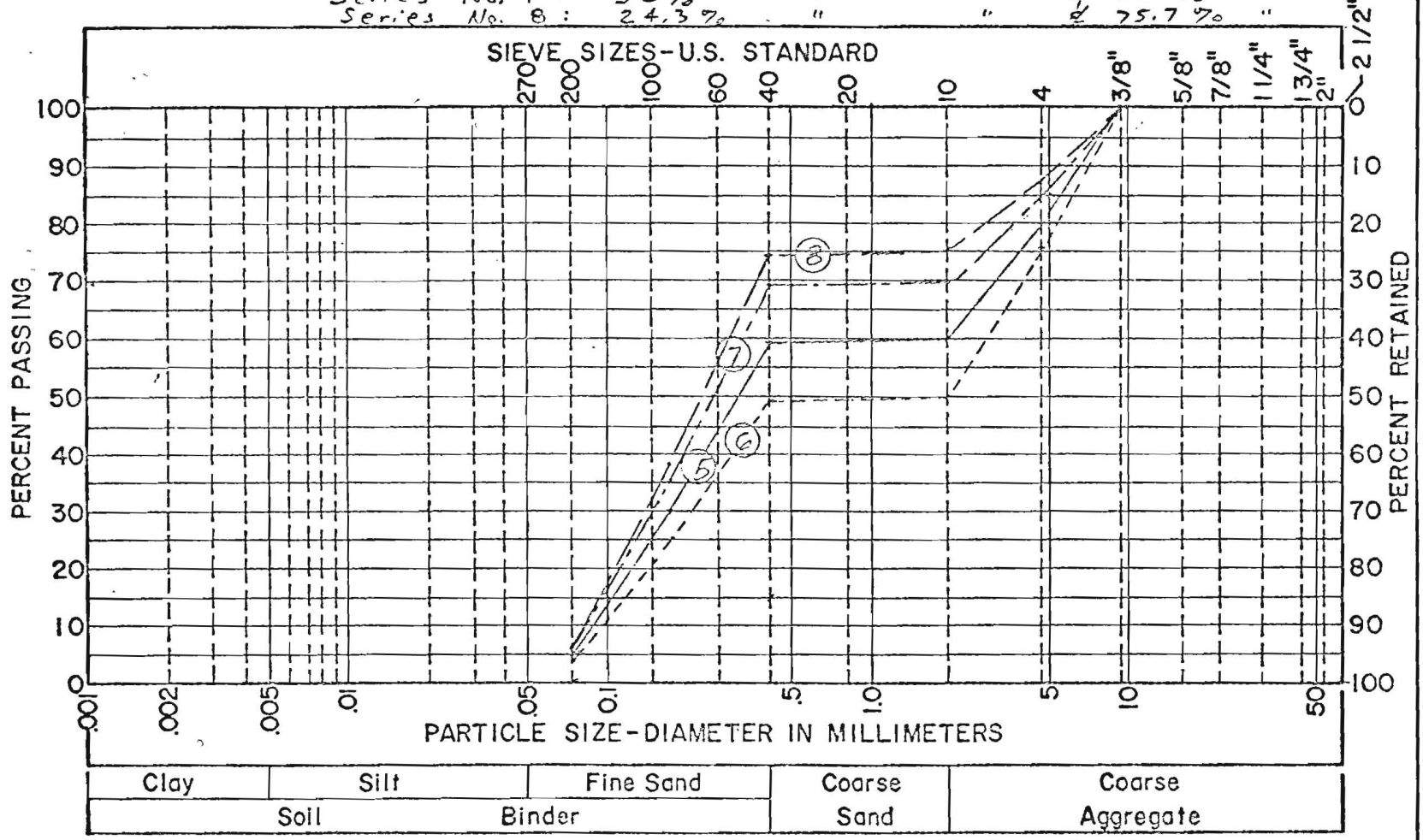
PD 5011

CUMULATIVE MECHANICAL ANALYSIS

Sample No. _____ County Angelina Project M 176-10-3 Highway Loop 266

BY WEIGHT

Series No. 5 : 40% Lightweight Aggr. & 60% Sand.
Series No. 6 : 50% " " & 50% "
Series No. 7 : 30% " " & 70% "
Series No. 8 : 24.3% " " & 75.7% "



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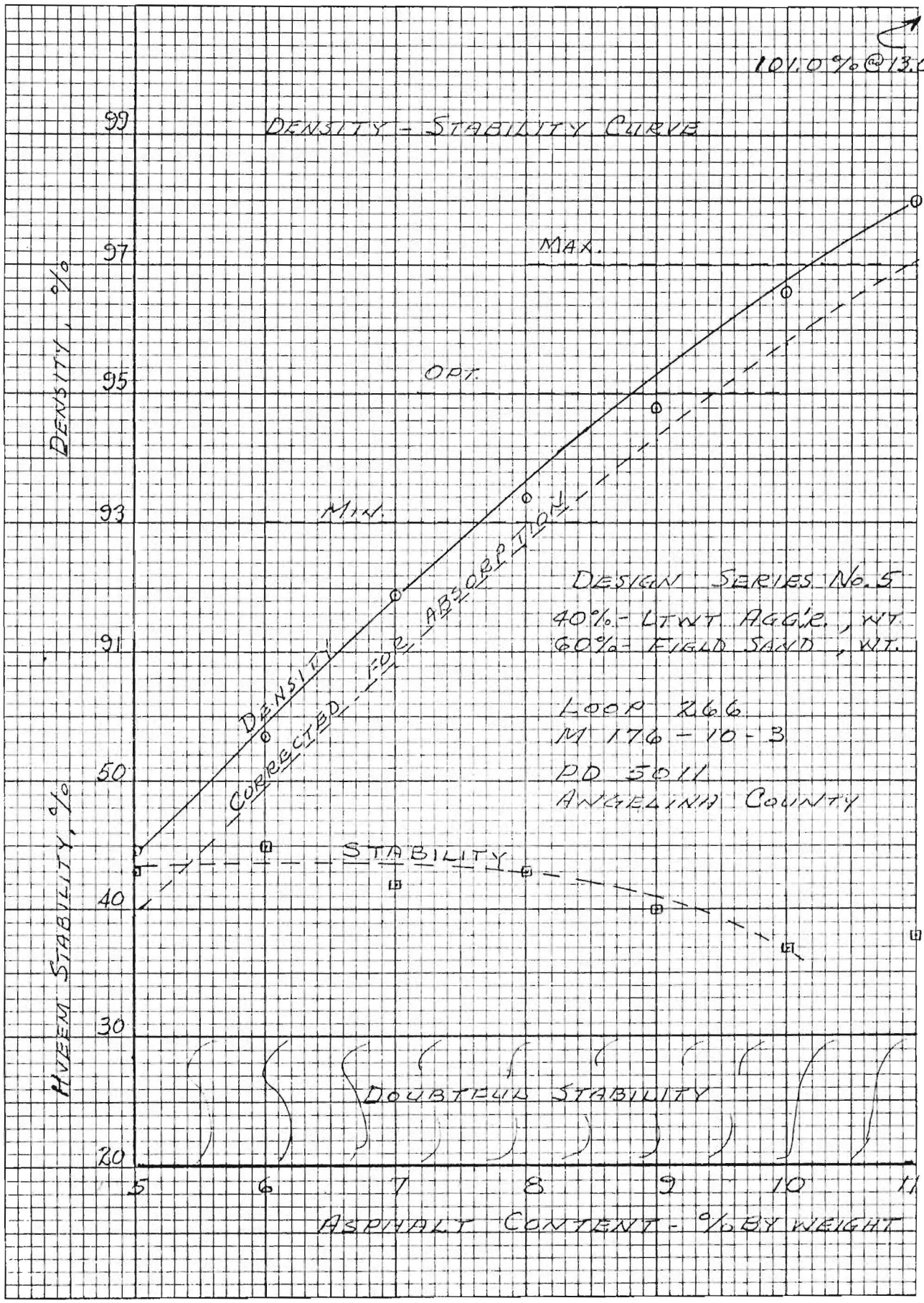
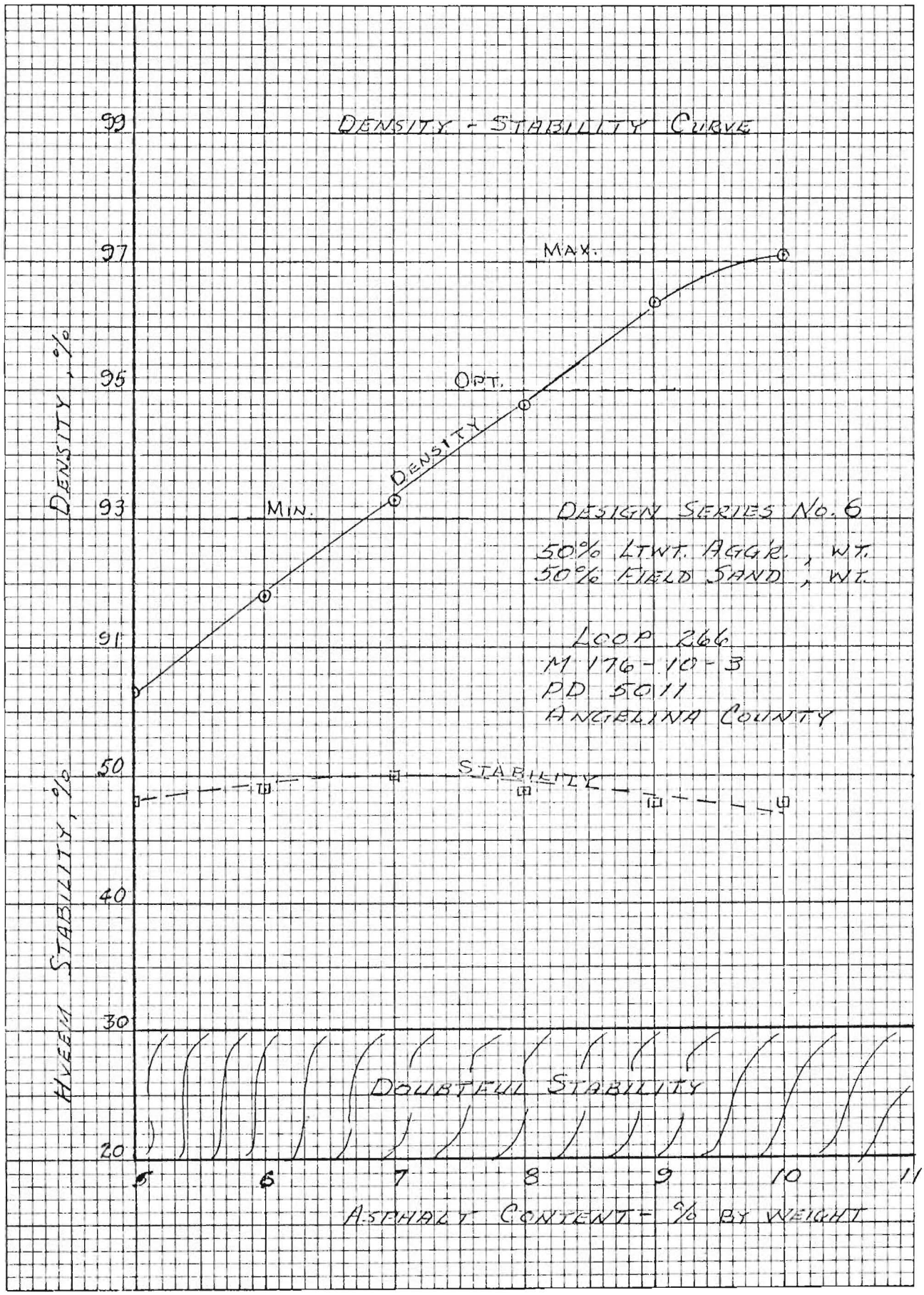
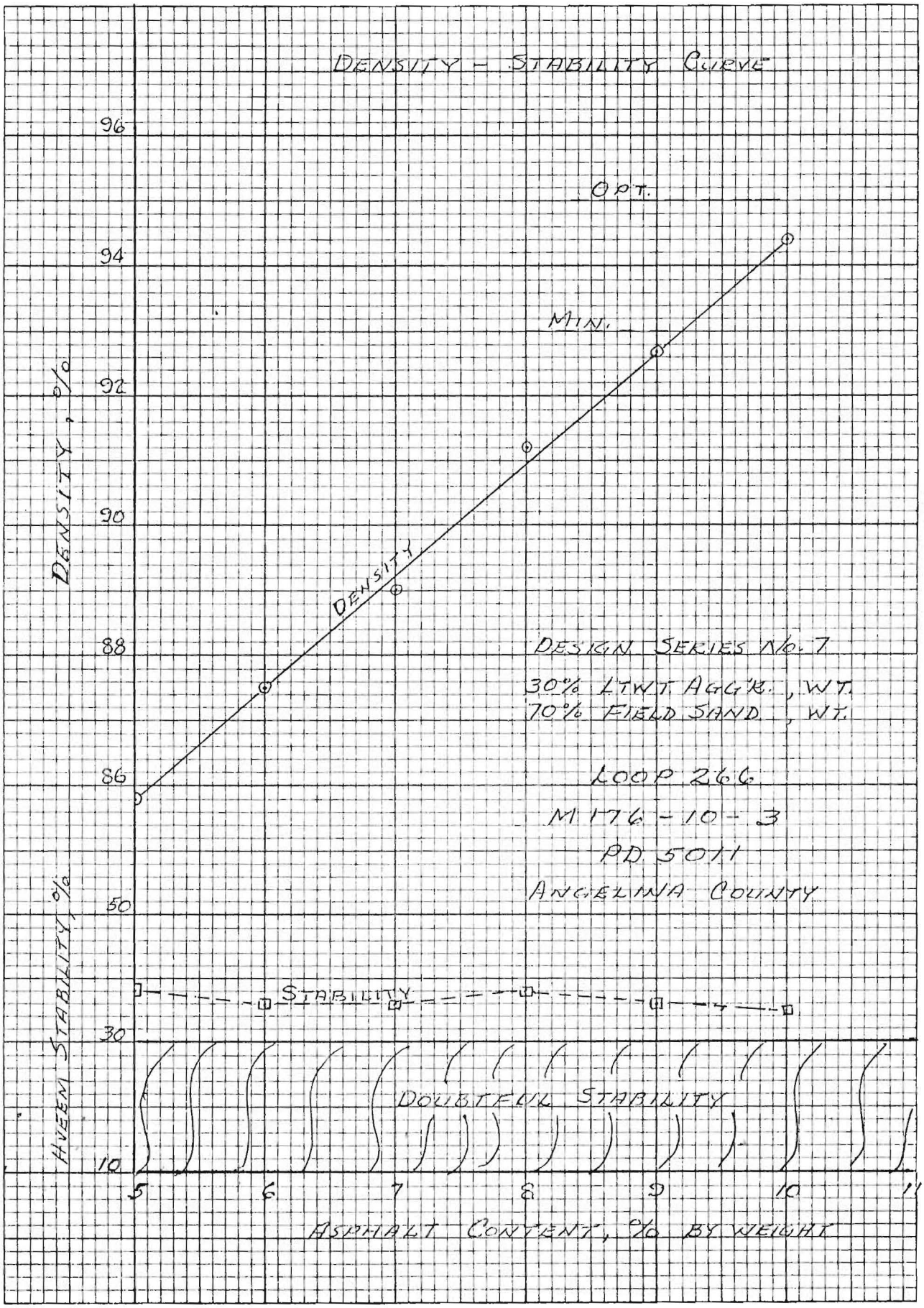


EUGENE DIETZGEN CO.
MADE IN U. S. A.

NO 340 -10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH





Tentative Method of Test for

MAXIMUM SPECIFIC GRAVITY OF BITUMINOUS PAVING MIXTURES[1]

ASTM Designation: D 2041 – 64 T

This Tentative Method has been approved by the sponsoring committee and accepted by the Society in accordance with established procedures, for use pending adoption as standard. Suggestions for revisions should be addressed to the Society at 1916 Race St., Philadelphia 3, Pa.

In accordance with the Society's policy that tentatives should not be continued indefinitely, this tentative will be discontinued in March, 1970, unless some other definitive action is taken with respect to it prior to that time.

Scope

1. This method of test is intended for determining the maximum specific gravity of uncompacted bituminous paving mixtures.

Apparatus

2. (*a*) *Balance.*—A balance sensitive to 0.1 g at the maximum weight to be determined.

(*b*) *Container.*—The container may be either a glass or metal bowl or a volumetric flask having a capacity of at least 1600 ml. Containers shall be sufficiently strong to withstand a partial vacuum and shall have covers as follows: for use with the bowl, a cover fitted with a rubber gasket and a hose connection; for use with the flask, a rubber stopper with a hose connection. A small piece of fine wire mesh covering the hose opening will minimize the possibility of loss of fine material. The top surfaces of all containers shall be smooth and substantially plane.

NOTE 1.—The bottom section of a 1.5-qt capacity, borosilicate glass, double boiler unit makes a satisfactory bowl.

(*c*) *Vacuum Pump or Water Aspirator*, for evacuating air from the container.

(*d*) *Water Bath.*—For use with the bowl, a water bath suitable for immersing the bowl and apparatus for suspending bowl from center of scale pan of balance; for use with the flask, a constant-temperature water bath.

Calibration of Flask

3. Calibrate the volumetric flask by accurately determining the weight of water at 25 ± 0.5 C (77 ± 0.9 F) required to fill it. Accurate filling of the flask may be ensured by the use of a glass cover plate.

Test Samples

4. (*a*) The sample shall be obtained in accordance with the Methods of Sampling Bituminous Paving Mixtures (ASTM Designation: D 979).[2]

[1] Under the standardization procedure of the Society, this method is under the jurisdiction of the ASTM Committee D-4 on Road and Paving Materials. A list of members may be found in the ASTM Year Book.

Accepted Annual Meeting 1964.

[2] Appears in this publication.

(24)

(*b*) The size of the sample shall conform to the following requirements. Samples larger than the capacity of the container may be tested a portion at a time.

Size of Largest Particle of Aggregate in Mixture, in.	Minimum Sample Size, g
1	2500
¾	2000
½	1500
⅜	1000
No. 4	500

Procedure

5. (*a*) Separate the particles of the sample, using care not to fracture the mineral particles, so that the particles of the fine aggregate portion are not larger than ¼ in. If the mixture is not sufficiently soft to be separated manually, place it in a large flat pan and warm in an oven only until it can be so handled.

(*b*) Cool the sample to room temperature, place in the flask or bowl, and weigh. Designate the net weight of sample as *A*. Add sufficient water at approximately 25 C (77 F) to cover the sample.

(*c*) Remove entrapped air by subjecting the contents to a partial vacuum (air pressure less than 3 cm of mercury) for 15 ± 2 min. Agitate the container and contents either continuously by mechanical device or manually by vigorous shaking at intervals of about 2 min.

NOTE 2.—The release of entrapped air may be facilitated by the addition of a suitable wetting agent such as Aerosol OT in concentration of 0.01 per cent or 1 ml of 10 per cent solution in 1000 ml of water.

(*d*) *Bowl Determination.*—Suspend the bowl and contents in water at 25 ± 1 C (77 ± 1.8 F) and weigh after 10 ± 1 min immersion. Designate the net weight of sample in water as *C*.

(*e*) *Flask Determination.*—Fill the flask with water and bring the contents to a temperature of 25 ± 0.5 C (77 ± 0.9 F) in a constant-temperature water bath. Determine the weight of flask (filled) and contents 10 ± 1 min after completing 5(*c*).

Calculation

6. Calculate the specific gravity of the sample as follows:

(*a*) *Bowl Determination:*

$$\text{Specific Gravity} = \frac{A}{A - C} \quad \ldots\ldots (1)$$

where:

A = weight of dry sample in air, grams, and

C = weight of sample in water, grams.

(*b*) *Flask Determination:*

$$\text{Specific Gravity} = \frac{A}{A + D - E} \quad \ldots (2)$$

where:

A = weight of dry sample in air, grams,

D = weight of flask filled with water at 25 C (77 F), grams, and

E = weight of flask filled with water and sample at 25 C (77 F), grams.

Supplemental Procedure for Mixtures Containing Porous Aggregate Not Completely Coated

7. (*a*) If the pores of the aggregates are not thoroughly sealed by a bituminous film they may become saturated with water during the evacuation procedure. To determine if this has occurred, proceed as follows after completing the procedure in accordance with Section 5(*d*) or (*e*). Drain water from sample. To prevent loss of fine particles, decant water through a towel held over top of container. Break several large pieces of aggregate and examine broken surfaces for wetness.

(*b*) If aggregate has absorbed water, spread sample before an electric fan to remove surface moisture. Weigh at 15 min intervals and when the loss in weight

(25)

is less than 0.5 g for this interval, the sample may be considered to be surface dry. This procedure requires about 2 hr and should be accompanied by intermittent stirring of the sample. Conglomerations of mixture should be broken by hand. Care must be taken to prevent loss of particles of mixture.

(c) To calculate the specific gravity of the sample, the final surface-dry weight is substituted for *A* in the denominator of Eq 1 or 2.

Precision

8. The following criteria should be used for judging the acceptability of results at a 95 per cent confidence level:

(a) *Repeatability.*—Two results obtained by the same operator should not be considered suspect unless they differ by more than 0.011 unit of specific gravity.

(b) *Reproductibility.*—Two results obtained by operators in different laboratories should not be considered suspect unless they differ by more than 0.019 unit of specific gravity.

(c) The above criteria are not applicable to results obtained in accordance with Section 7 because of insufficient data to provide a reliable estimate of precision.

NOTE 3.—The above precision estimates are based on an interlaboratory study of five mixtures by five laboratories. Each laboratory prepared a sufficient number of individual samples of a mixture for testing by each of the cooperating laboratories. Each laboratory tested three samples of each mixture using a single operator and a single day for the replicate samples of each mixture. The order of distribution and testing of samples was randomized.

Item	Repeatability	Reproducibility
Number of laboratories	5	5
Number of materials (mixtures)	5	5
Replicate tests per material	3	....
Degrees of freedom	60	20
Estimated standard deviation	0.0040	0.0064

NOTE 4.—Additional interlaboratory testing is being planned to develop precision criteria for application to results obtained in accordance with Section 7.

LAB. SER. NO.: 69-2697 DATE: 7-30-69

MATERIAL: HMAC - DES. #6
LOOP 266

(1) TIME, MINUTES	(2) WT. SAMPLE + PAN, GMS
0	2161
20	2141
40	2121
60	2103
80	2093
100	2091
120	2090
	2082 - DRIED OVERNIGHT IN 220°F OVEN

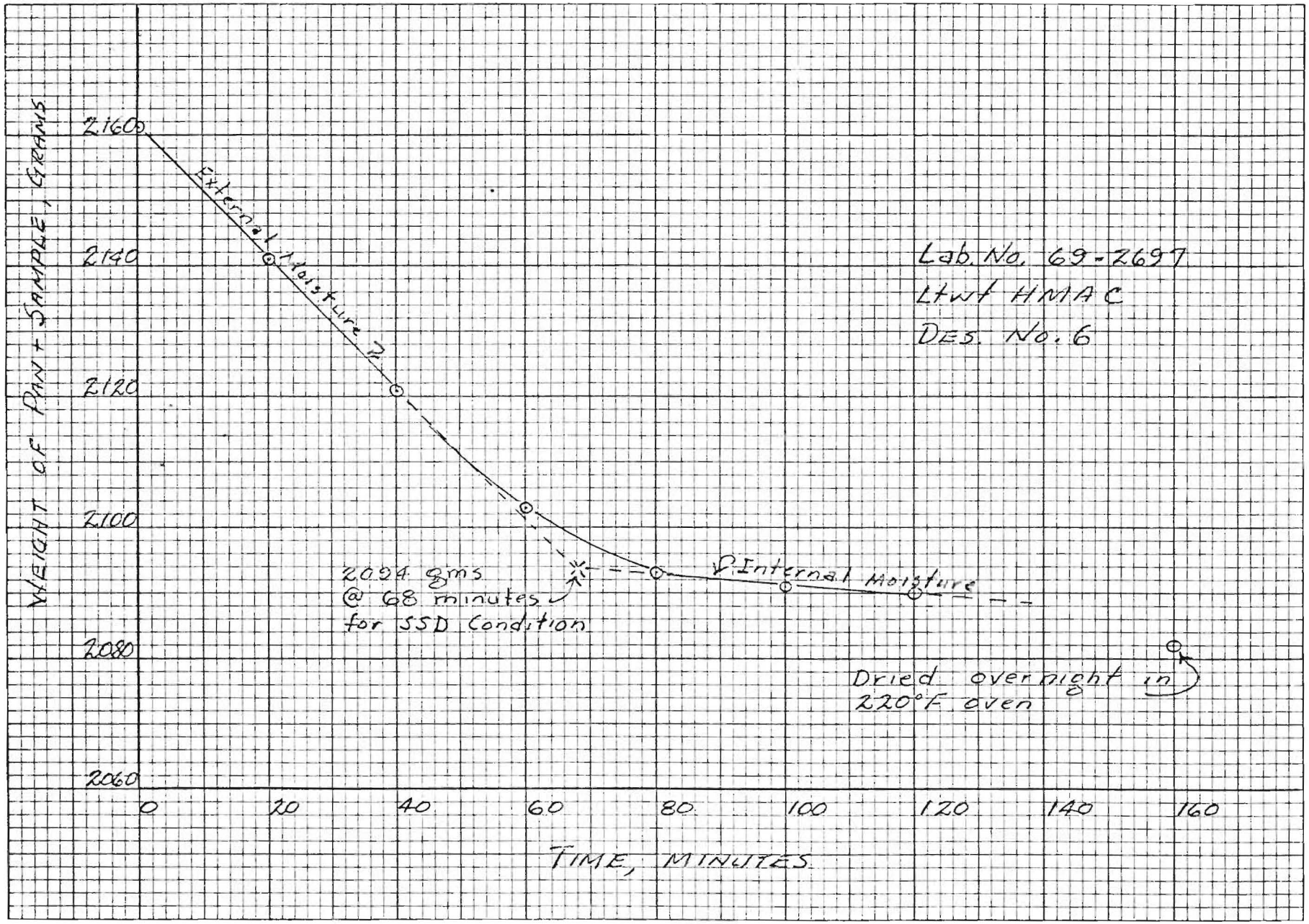
Pan weight = 1658 gms
Sample = 2082 - 1658 = 424 gms
Absorbed H_2O = 2094 - 2082 = 12 gms
% Absorption = (12 ÷ 424) 100 = 2.8%

X = SSD weight of sample, gms: (425+12)	437
Y = Pycnometer + H_2O, gms :	2728
Z = Pycnometer + H_2O + Sample, gms	2897
X_1 = Dry weight of sample, gms :	425

$$G_{BULK} = \frac{X_1}{X+Y-Z} = \frac{425}{437+2728-2897} = \frac{425}{268} = 1.586$$

Note: Bulk Sp. Gr. corrected for absorption

Bulk gravity not corrected = $\frac{425}{425+2728-2897} = 1.660$



(28)

Texas Highway Department
Form 231

GENERAL TEST REPORT

Laboratory No. 69-2218 thru 2223
Date Received 6-20-69 Date Reported 7-16-69
Dist./Co. Engr. Johnny H. Denney
Address Lufkin, Texas
Sampler Otis D. Clark
Sampler's Title Engr. Aide III
Contractor Maintenance
Sampled from RR Car (pit, quarry, car or stockpile)

Material HMAC Mix

176-10-3 (Control No.) FD 5011 (Sect. No.) (Job. No.)
Angelina (County) 1 176-10-3 (Federal Project No.) Loop 266 (Hwy. No.)
11 (District No.) (Req. No.) 6-20-69 (Date Sampled)

Producer Texas Industries, Inc.
Quantity represented by sample
Has been used on
Proposed for use as HMAC Mat. for surfacing

Identification marks
Specification Item No. 340-066 & Supplement
Material from property of
East Texas Asphalt Co., Lufkin, Texas

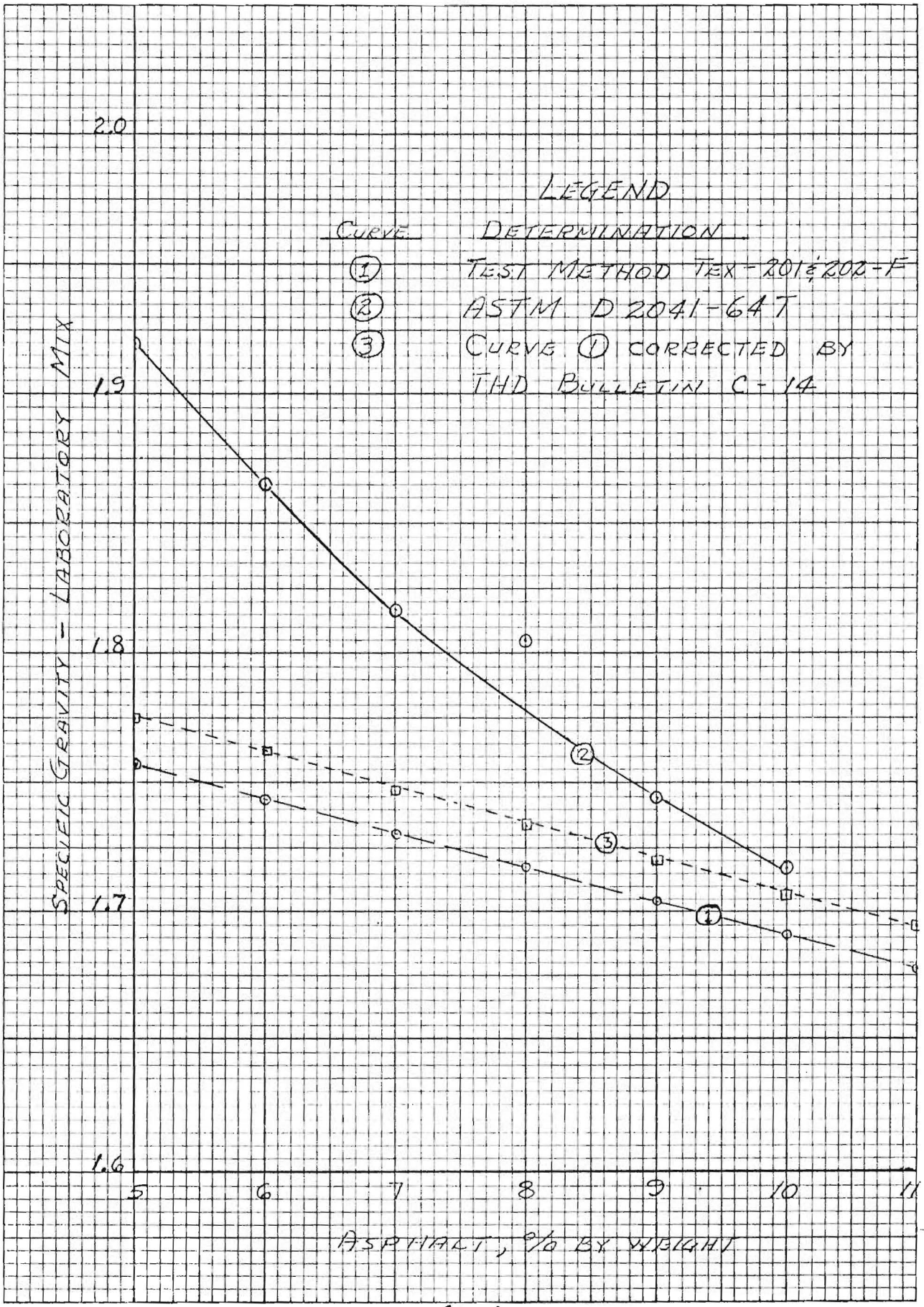
DETERMINATIONS

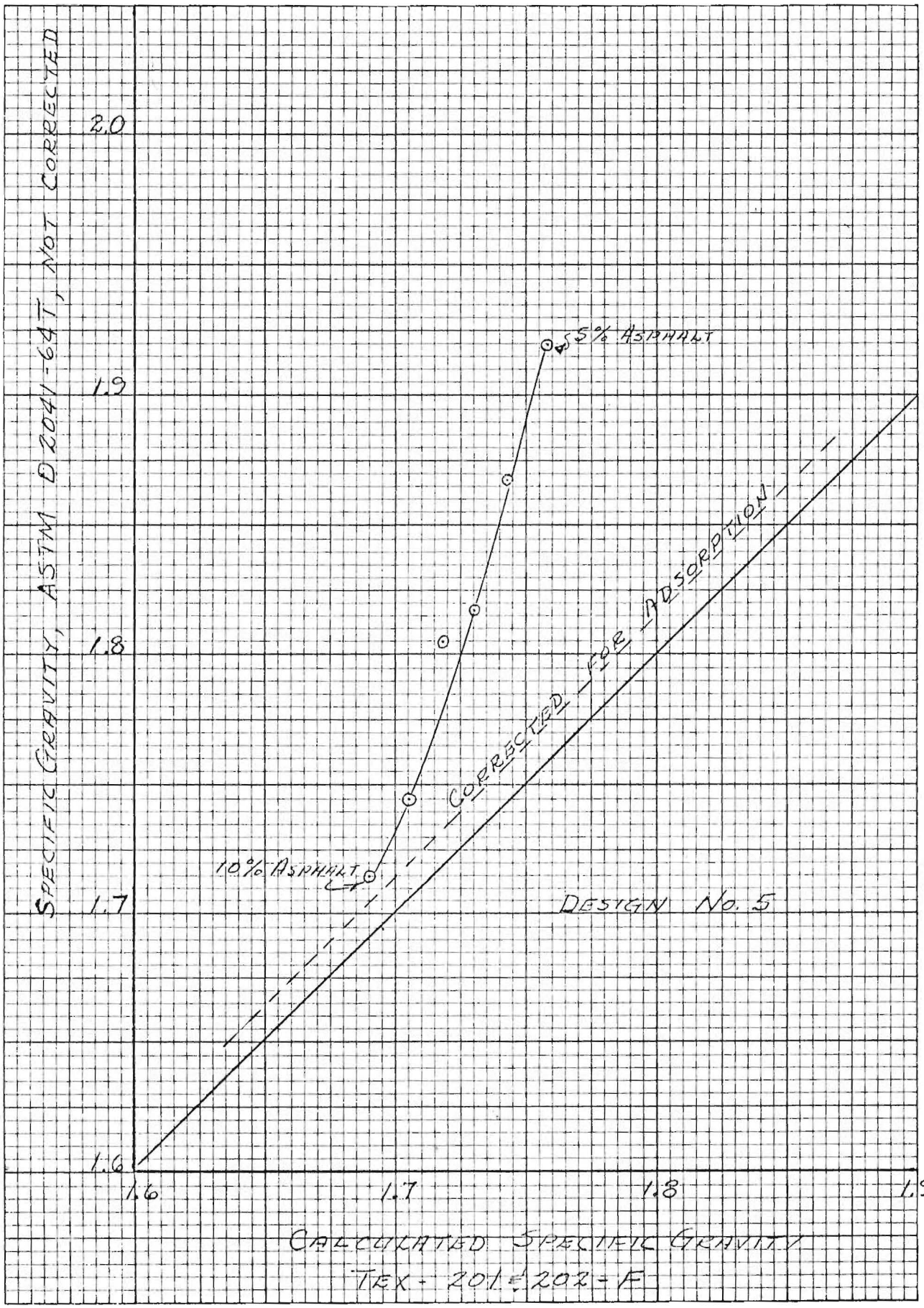
Determination of Specific Gravity of Mix for Design Series No. 5

Mix No.	Asphalt Content (% by Wt)	Uncorrected Theo.Sp.Gr. (G_{sp})	Corrected Theo Sp.Gr. (G_{sa})	Sp.Gr.of Mix by Pyc.Jar (G)
1	5.0	1.757	1.776	1.920
2	6.0	1.743	1.762	1.868
3	7.0	1.729	1.748	1.817
4	8.0	1.716	1.734	1.805
5	9.0	1.703	1.720	1.746
6	10.0	1.690	1.707	1.717

Remarks: Theoretical specific gravities were determined using the bulk specific gravities of the materials. The corrected theoretical specific gravity was determined from specimens molded with 13% asphalt which were believed to be saturated. The last column lists specific gravities of the mix determined by a pycnometer jar. Cooled, dry, loose laboratory mixture was used for this test. An aerosol wetting agent was used in the water and an aspirator was also used to facilitate the removal of air bubbles around the aggregate.

Charts, identified as Graph No. 1 and No. 2, are attached to illustrate the relationship of the different tests. Evidently, in the jar method of determination, there is water absorption in the aggregate. Water absorption results in a higher specific gravity determination. Water absorption decreases with an increase in the asphalt content of the mix. Above 10% asphalt content(by weight) the aggregate particles become sufficiently coated to prevent the absorption of water during the test.





Project N 176-10-3, FD 5011
Loop 266
Angelina County

SUMMARY OF DESIGNS USED

Sieve Size	Design No. 1	2	3	4	5	6	7&8	9	10
1/2"-3/8"	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3/8" - 4	18.2	18.2	18.3	22.9	23.0	20.6	20.5	13.7	25.1
4 - 10	18.6	18.7	18.8	23.5	23.7	21.1	21.0	14.3	25.8
+ 10	36.8	36.9	37.1	46.4	46.7	41.7	41.5	28.0	50.9
10 - 40	0.8	0.8	0.8	0.7	0.7	0.8	0.8	0.8	0.7
40 - 80	26.3	26.5	26.7	22.3	22.4	24.3	24.2	30.9	20.1
80 - 200	23.2	23.3	23.4	19.7	19.8	21.5	21.3	27.1	17.8
Pass 200	4.4	4.5	4.5	3.9	3.9	4.2	4.2	5.2	3.5
% Asphalt	8.5	8.0	7.5	7.0	6.5	7.5	8.0	8.0	7.0

AGGREGATE COMBINATIONS FOR DESIGNS

Design No. 1, 2 & 3: By Weight, 40% Lightweight Aggr. & 60% Sand
By Volume, 50% Lightweight Aggr. & 42% Sand

Design No. 4 & 5: By Weight, 50% Lightweight Aggr. & 50% Sand
By Volume, 67.5% Lightweight Aggr. & 32.5% Sand

Design No. 6, 7 & 8: By Weight, 45% Lightweight Aggr. & 55% Sand
By Volume, 63% Lightweight Aggr. & 37% Sand

Design No. 9: By Weight: 30% Lightweight Aggr. & 70% Sand
By Volume: 47.1% Lightweight Aggr. & 52.9% Sand

Design No. 10: By Weight, 55% Lightweight Aggr. & 45% Sand
By Volume, 71.7% Lightweight Aggr. & 28.3% Sand

Remarks: Design gradations were determined from preliminary stockpile samples. Plant production yielded some variation from the design as calculated. Adjustments of designs to conform with actual production was not attempted since numerous changes were being made for the mixture. Design Numbers 7 & 8 are of the same gradation. Design No. 8 was assigned to the mix when an adjustment of hot bins was made in order to more closely satisfy the theoretical gradation intended.

Texas Highway Department
Construction Form No. 404 Rev. (2)

TEXAS HIGHWAY DEPARTMENT
DAILY CONSTRUCTION REPORT—ASPHALTIC CONCRETE PAVEMENT

County Angelina Highway Loop 266 Project K 176-10-3 Control 176-10-3 PD 5011
Location of Plant Lufkin Type of Plant D Contractor Maintenance
Date 7-22-69 Specification Item 340-066 Type Mod Plant Started ____ M. Plant Stopped ____ M.

Location No.								
	1	Main Lane	3	Decel. Lane	5	Entr. Ramp	7	
	2	Fr. Rd. Lane	4	Accel. Lane	6	Exit Ramp	8	

Combined Bin Analysis										Extractions		
Sieve Size	Design No. 4	1	2	3	Design No. 2	5	6	7	8	1	2	3
1¾" - ⅞"												
⅞" - ⅝"												
⅝" - ⅜"												
½" - ⅜"	0.0	0.0	0.0		0.0	0.0				0.0	0.0	
⅜" - 4	18.2	17.5	19.7		18.2	19.5				25.5	21.5	
¼" - 10												
4 - 10	18.6	19.2	17.2		18.7	18.4				10.6	16.7	
+ 10	36.8	36.7	36.9		36.9	37.9				36.1	38.2	
10 - 40	0.8	0.8	0.8		0.8	1.2				0.8	1.1	
40 - 80	26.5	18.0	20.4		26.5	18.4				20.7	17.3	
80 - 200	23.2	30.2	29.1		23.1	28.2				27.5	28.6	
Pass 200	4.4	5.8	4.3		4.5	5.6				6.1	6.9	
Asphalt	8.5	8.5	8.5		8.0	8.0				8.8	7.9	
Total	100.0	100.0	100.0		100.0	100.0				100.0	100.0	

Bin Analy. No.	Extr. No.	Time	Location No.	Course of Courses		Station No.	Mix Temp. °F. Plant	Mix Temp. °F. Road	Specimen Nos.	Lab Dens.	% Stab.
1	1	9:30							A-1,2,3	92.4	40
2		11:15									
	2	3:15							B-1,2,3	93.6	40
5		3:30									

Materials Used	Design 1 Asphalt (Tons)	Design 2 Asphalt (Tons)	Design 1 Aggregate (Tons)	Design 2 Aggregate (Tons)
Previous Report	-	-	-	-
This Report	17.0	8.0	183	92
Total To Date	25		275	

Percent Complete-Asphaltic Concrete Pavement	
Percent Complete—This Type	18 %
Percent Complete—All Types	%

Days Run

Location No.	Course of Courses		Station	to Station	Width (Feet)	Rate of Application: 14 / 94 Inches Lbs/Sq. Yd. Sq. Yds.	Tons	Inches Lbs/Sq. Yd. Sq. Yds.	Tons	1 / 68 Inches Lbs/Sq. Yd. Sq. Yds.	Tons
1 C	1	1	7+00	42+30	13	766	36	4333	136		
1 R	1	1	38+10	42+00	13			563	28		
2 R	1	1	18+00	38+10	13			2903	100		
Total Today						766	36	7799	264		
Previous Report						-	-	--	--		
Total To Date						766	36	7799	264		
Avg. Rate To Date						94 Lbs/Sq. Yd.		68 Lbs/Sq. Yd.		Lbs/Sq. Yd.	

Weather Partly Cloudy
Min. Temp. 225 °F.
Max. Temp. 350 °F.
Remarks 225° Temp 7:00 to 12:30) (12:30 - 275° to 350°
(Temp on road 190° @ 10:30 to 11:50 C.L.

Inspector

Type D Mod Date 7-22-69 Report No. 1

Texas Highway Department
Construction Form No. 404 Rev. (2)

TEXAS HIGHWAY DEPARTMENT
DAILY CONSTRUCTION REPORT—ASPHALTIC CONCRETE PAVEMENT

County Angelina Highway Loop 266 Project K 176-10-3 Control 176-10-3 FD 5011
Location of Plant Lufkin Type of Plant _____ Contractor Maintenance
Date 7-23-69 Specification Item 340-066 Type D Plant Started _____ M. Plant Stopped _____ M.

Location No.							
1	Main Lane	3	Decel. Lane	5	Entr. Ramp	7	
2	Fr. Rd. Lane	4	Accel. Lane	6	Exit Ramp	8	

Sieve Size	Combined Bin Analysis: Design No. 3	1	2	3	Design No. 4	5	6	Design No. 5	8	Extractions 1	2	3
1¾" - ⅞"												
⅞" - ⅝"												
⅝" - ⅜"												
½" - ⅜"	0.0	0.0	0.0		0.0	0.0		0.0	0.3	0.0	0.0	0.0
⅜" - 4	18.3	16.6	19.0		22.9	30.0		23.0	28.1	20.4	30.5	29.7
¼" - 10												
4 - 10	18.8	21.7	17.6		23.5	16.1		23.7	19.3	17.0	15.7	16.5
+ 10	37.1	38.3	36.6		46.4	46.1		46.7	47.7	37.4	46.2	45.2
10 - 40	0.8	1.9	1.4		0.7	1.4		0.7	1.4	2.2	1.4	1.1
40 - 80	25.7	20.1	20.3		22.3	21.3		22.4	18.7	22.6	17.0	16.6
80 - 200	23.4	27.9	28.5		19.7	21.1		19.8	21.5	24.9	23.0	22.8
Pass 200	4.5	4.4	5.7		3.9	2.8		3.9	4.2	5.5	5.5	6.8
Asphalt	7.5	7.5	7.5		7.0	7.0		6.5	6.5	7.4	6.9	6.5
Total	100.0	100.0	100.0		100.0	100.0		100.0	100.0	100.0	100.0	100.0

Bin Analy. No.	Extr. No.	Time	Location No.	Course of Courses	Station No.	Mix Temp. °F. Plant	Mix Temp. °F. Road	Specimen Nos.	Lab Dens.	% Stab.
1		7:15								
	1	7:20						C-1,2,3	90.5	47
2		9:30								
5	2	11:45						D-1,2,3	91.7	46
	3	2:15						E-1,2,3	90.5	46
8		3:00								

Materials Used

	Asphalt (Tons)			Aggregate (Tons)		
	# 3	# 4	# 5	# 3	# 4	# 5
Previous Report	11.4	84	6.2	1405	116	826
This Report		51.0			616.8	
Total To Date						

Percent Complete-Asphaltic Concrete Pavement

Percent Complete—This Type	40.2 %
Percent Complete—All Types	%

Design

Location No.	Course of Courses	Station	to Station	Width (Feet)	Days Run: 1 — Rate of Application: 68 Lbs/Sq. Yd. — Sq. Yds.	Tons	Inches Lbs/Sq. Yd. — Sq. Yds.	Tons	Inches Lbs/Sq. Yd. — Sq. Yds.	Tons
3 R		0+55	2+20	14	257	8				
3 R		2+20	18+00	13	2282	92				
3 L		0+55	7+50	14	1051	36				
3 L		7+50	9+90	13	347	16				
4 L		9+90	37+50	13	3987	120				
5 L&R		[illegible]			2275	96				
					1067	32				
			Total Today							
			Previous Report		8545	300				
			Total To Date		19,114	688				
			Avg. Rate To Date		68	Lbs/Sq. Yd.		Lbs/Sq. Yd.		Lbs/Sq. Yd.

Weather Cloudy
Min. Temp. 250 °F.
Max. Temp. 275 °F.

Remarks Design 5 (37+50 - 47+60 L 13') (42+30 - 47+80 R 10")(42+00 - 47+05 R 13')
1452 Sq. 48 Tons 611 Sq. 24 Tons 845 Sq. 24 Tons

Inspector

Type D Hot Date 7-23-69 Report No. 2

Texas Highway Department
Construction Form No. 404 Rev. (2)

TEXAS HIGHWAY DEPARTMENT
DAILY CONSTRUCTION REPORT—ASPHALTIC CONCRETE PAVEMENT

County Angelina Highway Loop 266 Project M 176-10-3 Control 176-10-3 FD 5011
Location of Plant Lufkin Type of Plant Portable Contractor Maintenance
Date 7-24-69 Specification Item 340-666 Type Mod Plant Started ____ M. Plant Stopped ____ M.

Location No.								
1	Main Lane	3	Decel. Lane	5	Entr. Ramp	7		
2	Fr. Rd. Lane	4	Accel. Lane	6	Exit Ramp	8		

Combined Bin Analysis

Sieve Size	Design No. 6	1	2	3	Design No. 7	5	6	7	8	Extractions 1	2	3
1¾" - ⅞"												
⅞" - ⅝"												
⅝" - ⅜"												
½" - ⅜"	0.0	0.0	0.0		0.0	0.0	0.0			0.0	0.0	
⅜" - 4	20.6	21.6	21.8		20.5	26.0	23.6			26.0	25.2	
¼" - 10												
4 - 10	21.1	19.6	19.5		21.0	17.6	23.0			20.3	20.3	
+ 10	41.7	41.2	43.3		41.5	43.8	46.6			46.3	45.5	
10 - 40	0.8	1.7	1.8		0.8	1.7	3.4			1.7	1.6	
40 - 80	24.3	25.3	25.0		24.2	17.5	24.1			22.1	22.5	
80 - 200	21.5	21.3	20.9		21.3	24.7	15.9			18.7	19.0	
Pass 200	4.2	3.0	3.5		4.2	4.3	2.0			3.8	3.5	
Asphalt	7.5	7.5	7.5		8.0	8.0	8.0			7.4	7.9	
Total	100.0	100.0	100.0		100.0	100.0	100.0			100.0	100.0	

Bin Analy. No.	Extr. No.	Time	Location No.	Course of Courses	Station No.	Mix Temp. °F. Plant	Mix Temp. °F. Road	Specimen Nos.	Lab Dens.	% Stab.
1		7:20								
	1	7:30						F-1,2,3	88.4	43
2		9:50								
5	2	1:30						G-1,2,3	91.0	47
6		4:40								

Materials Used

	Asphalt (Tons)		Aggregate (Tons)	
~~Previous Report~~	# 6	# 7	# 6	# 7
This Report	12.3	14.1	151.7	161.5
Total To Date	77.4		930.4	

Percent Complete-Asphaltic Concrete Pavement

Percent Complete—This Type	60.6 %
Percent Complete—All Types	%

Days Run

Location No.	Course of Courses		Approximate Station	to Station	Width (Feet)	Rate of Application 1 Inches Lbs/Sq. Yd. Sq. Yds.	Tons	Inches Lbs/Sq. Yd. Sq. Yds.	Tons	Inches Lbs/Sq. Yd. Sq. Yds.	Tons
6 All	1	1	Frank	Burke		4,763	164				
7	1	1	Burke	Denman		5390	176				
					Total Today	10153	340				
					Previous Report	19434	668				
					Total To Date	29572	1008				
					Avg. Rate To Date	38	Lbs/Sq. Yd.		Lbs/Sq. Yd.		Lbs/Sq. Yd.

Weather Cloudy
Min. Temp. 230 °F.
Max. Temp. 380 °F.
Remarks

Inspector

Type D Mod Date 7-24-69 Report No. 3

Texas Highway Department
Construction Form No. 404 Rev. (2)

TEXAS HIGHWAY DEPARTMENT
DAILY CONSTRUCTION REPORT—ASPHALTIC CONCRETE PAVEMENT

County Angelina Highway Loop 266 Project M 176-10-3 Control 176-10-3 PD 5011
Location of Plant Lufkin Type of Plant Contractor Maintenance
Date 7-25-69 Specification Item 340-666 Type Hot Plant Started M. Plant Stopped M.

Location No.							
1	Main Lane	3	Decel. Lane	5	Entr. Ramp	7	
2	Fr. Rd. Lane	4	Accel. Lane	6	Exit Ramp	8	

Combined Bin Analysis										Extractions		
Sieve Size	Design No. 7	1	2	3	Design No. 6	5	6	7	8	1	2	3
1¾" - ⅞"												
⅞" - ⅝"												
⅝" - ⅜"												
½" - ⅜"	0.0	0.0	0.0		0.0	0.0				0.0	0.0	
⅜" - 4	20.5	21.7	23.3		20.5	20.2				24.6	24.2	
¼" - 10												
4 - 10	21.0	21.7	24.3		21.0	20.1				20.4	20.7	
+ 10	41.5	43.4	47.6		41.5	40.3				45.0	44.9	
10 - 40	0.8	1.8	2.6		0.8	3.4				1.4	1.3	
40 - 80	24.2	23.8	21.7		24.2	21.2				22.8	23.1	
80 - 200	21.3	19.9	17.8		21.3	20.1				19.2	19.3	
Pass 200	4.2	3.1	2.3		4.2	7.0				3.6	3.5	
Asphalt	8.0	8.0	8.0		8.0	8.0				8.0	7.9	
Total	100.0	100.0	100.0		100.0	100.0				100.0	100.0	

Bin Analy. No.	Extr. No.	Time	Location No.	Course of Courses	Station No.	Mix Temp. °F. Plant	Mix Temp. °F. Road	Specimen Nos.	Lab Dens.	% Stab.
1		7:20								
	1	8:15						H-1,2,3	91.9	49
2		10:30								
5		1:45								
	2	1:50						I-1,2,3	93.4	47

Materials Used	Asphalt (Tons)		Aggregate (Tons)	
	#7	#8	#7	#8
Previous Report				
This Report	22.1	96	253.9	110.4
Total To Date	109.1		1294.7	

Percent Complete-Asphaltic Concrete Pavement	
Percent Complete—This Type	84.5 %
Percent Complete—All Types	%

Design

Location No.	Course of Courses		Station	to Station	Width (Feet)	Days Run	Rate of Application 1 71.7 Inches Lbs/Sq. Yd. Sq. Yds.	Tons	Inches Lbs/Sq. Yd. Sq. Yds.	Tons	Inches Lbs/Sq. Yd. Sq. Yds.	Tons
7	CL		74+35	111+20			5214	172				
7	NL		61+25	74+35			1164	48				
7	EL		84+10	88+00			563	24				
7	WL		65+90	74+35			751	32				
6			88+00	111+20	13		3351	120				
						Total Today	11043	396				
						Previous Report	29572	1008				
						Total To Date	40615	1404				
						Avg. Rate To Date	69.3	Lbs/Sq. Yd.		Lbs/Sq. Yd.		Lbs/Sq. Yd.

Weather Partly Cloudy
Min. Temp. 275 °F.
Max. Temp. 350 °F.

Remarks

Inspector

Type D Mod Date 7-25-69 Report No. 4

Texas Highway Department
Construction Form No. 404 Rev. (2)

TEXAS HIGHWAY DEPARTMENT
DAILY CONSTRUCTION REPORT—ASPHALTIC CONCRETE PAVEMENT

County Angelina Highway Loop 266 Project N 176-10-3 Control 176-10-3 FD 5011
Location of Plant Lufkin Type of Plant Contractor Maintenance
Date 7-28-69 Specification Item 340-066 Type D Plant Started M. Plant Stopped M.

Location No.								
	1	Main Lane	3	Decel. Lane	5	Entr. Ramp	7	
	2	Fr. Rd. Lane	4	Accel. Lane	6	Exit Ramp	8	

Combined Bin Analysis										Extractions		
Sieve Size	Design No. 8	1	2	Design No. 9	4	5	Design No. 10	7	8	1	2	3
1¾" - ⅞"												
⅞" - ⅝"												
⅝" - ⅜"												
½" - ⅜"	0.0	0.0		0.0	0.0		0.0	0.1		0.0	0.0	0.0
⅜" - 4	20.5	25.5		13.7	14.1		25.1	34.7		23.3	15.3	29.3
¼" - 10												
4 - 10	21.0	15.8		14.3	15.1		25.8	17.2		21.4	12.0	22.9
+ 10	41.5	41.3		28.0	29.2		50.9	52.7		44.7	27.3	52.2
10 - 40	0.8	2.2		0.8	2.7		6.7	2.9		1.2	1.8	1.1
40 - 80	24.2	17.8		30.9	17.5		20.1	17.8		22.7	25.7	19.4
80 - 200	21.3	23.3		27.1	29.1		17.8	16.5		20.0	29.7	17.3
Pass 200	4.2	7.4		5.2	11.0		3.5	3.1		3.5	7.4	3.0
Asphalt	8.0	8.0		8.0	8.0		7.0	7.0		7.9	8.1	7.0
Total	100.0	100.0		100.0	100.0		100.0	100.0		100.0	100.0	100.0

Bin Analy. No.	Extr. No.	Time	Location No.	Course of Courses		Station No.	Mix Temp. °F. Plant	Mix Temp. °F. Road	Specimen Nos.	Lab Dens.	% Stab.
1		8:25									
	1	8:30							K-1,2,3	92.2	46
4		9:25									
	2	9:30							J-1,2,3	89.5	36
	3	10:10							I-1,2,3	91.4	49
7		10:55									

Materials Used	Asphalt (Tons)	Aggregate (Tons)
Previous Report	109.1	1294.7
This Report	16.8	195.2
Total To Date	125.9	1489.9

Percent Complete-Asphaltic Concrete Pavement	
Percent Complete—This Type	%
Percent Complete—All Types	%

Days Run							Rate of Application					
Location No.	Course	of Courses	Approximate Station	to Station	Width (Feet)		1"-1/2" Inches Lbs/Sq. Yd. Sq. Yds.	1"-1/2" Inches Lbs/Sq. Yd. Tons	____ Inches Lbs/Sq. Yd. Sq. Yds.	____ Inches Lbs/Sq. Yd. Tons	____ Inches Lbs/Sq. Yd. Sq. Yds.	____ Inches Lbs/Sq. Yd. Tons
8 All	1	1	74+35	108+50			5,060	156				
9 L	1	1	91+60	95+20	13		320	20				
10 L	1	1	97+70	101+70	13		578	20				
1 All	1	1	101+50	111+20			537	16				
1 Intersection			Placed	7-29-69				(38)*				
						Total Today	6695	212				
						Previous Report	40615	1404				
						Total To Date	47310	1616				
						Avg. Rate To Date	6.3	Lbs/Sq. Yd.		Lbs/Sq. Yd.		Lbs/Sq. Yd.

Weather Cloudy
Min. Temp. 250 °F.
Max. Temp. 350 °F.

Remarks * 38 Tons placed 7-29, not in totals. Total of 1666 Tons
8 Tons voided, Total of 42 Tons put on Intersection.

Inspector

Type D Mod Date 7-27-69 Report No. 5

M 176-10-3 PD 5011
Loop 266
Angelina County

MOISTURE TESTS ON MATERIALS DURING PRODUCTION OF H.M.A.C.

Sand & Lightweight Aggregate

Date	Sample Ref.Nos.	% Moisture in: Sand	Lightweight Aggregate	Remarks
7-22-69	1	5.9	18.4	Stockpile & Before Plant Start
"	2	6.9	16.5	Cold Bins
"	3	6.3	14.5	" "
"	4	8.1	15.0	" "
"	5	8.5	13.9	" " @ 2:00 P.M.
7-23-69	1	9.9	19.2	Stockpile @ 7:20 A.M.
"	2	8.0	17.4	Cold Bins @ 7:20 A.M.
"	3	9.4	22.1	Cold Bins @ 11:30 A.M.
"	4	10.7	16.6	Stockpile @ 2:00 P.M.
7-24-69	1	5.8	15.7	Stockpile @ 7:00 A.M.
"	2	8.5	15.3	Cold Bins @ 7:15 A.M.
"	3	5.9	15.8	Cold Bins @ 2:30 P.M.
7-25-69	1	8.7	17.5	Stockpile
"	2	5.3	6.9	Cold Bins @ 7:30 A.M.
"	3	8.0	20.1	Cold Bins
7-28-69	1	7.7	18.9	Cold Bins

COMPLETED MIXTURE

Date	Ref.No.	% Moisture	Remarks
7-22-69	1	0.3	9:30 A.M.
"	2	0.7	11:30 A.M.
"	3	0.2	2:15 P.M.
7-23-69	1	0.6	7:40 A.M.
	2	0.3	1:15 P.M.
7-24-69	1	0.4	8:15 A.M.
	2	0.5	11:45 A.M.
	3	0.3	2:30 P.M.
7-25-69	1	0.2	-
	2	0.2	8:15 A.M.
7-28-69	1	0.3	-

Remarks: The completed mixture was sampled from trucks immediately after loading of trucks.

H 176-10-3 FD 5011
Loop 266
Angelina County

SUMMARY OF TEST RESULTS

Date Sampled	Ident. Mark	Design No.	Asph. %Bit.	Theo. Sp.Gr.	Actual Sp.Gr.	Lab. Den. %	Lab. Den. #/CF	Equivalent Lb./Sq.Yd. Per In./Depth	100% Aggr. Comp. by Volume %Lt.Wt.	%Sand	Cohes. Value	Hveem Stab. %	* Corrected Sp.Gr. of Mix	Corrected % Density
7-22-69	A-1,2,3	1	8.5	1.709	1.579	92.4	98.5	73.9	58	42	66	40	1.69	93.4
7-22-69	B-1,2,3	2	8.0	1.716	1.606	93.6	100.2	75.2	58	42	81	40	1.70	94.4
7-23-69	C-1,2,3	3	7.5	1.723	1.559	90.5	97.3	73.0	58	42	222	47	1.70	91.7
7-23-69	D-1,2,3	4	7.0	1.622	1.487	91.7	92.8	69.6	67.5	32.5	158	46	1.62	91.8
7-23-69	E-1,2,3	5	6.5	1.627	1.473	90.5	91.9	68.9	67.5	32.5	70	46	1.59	92.6
7-24-69	F-12,3,	6	7.5	1.668	1.475	88.4	92.0	69.0	63	37	120	43	1.58	93.3
7-24-69	G-1,2,3	7	8.0	1.661	1.511	91.0	94.3	70.7	63	37	82	47	1.57	96.3
7-25-69	H-1,2,3	7	8.0	1.661	1.527	91.9	95.3	71.5	63	37	99	49	-	-
7-25-69	I-1,2,3	8	8.0	1.661	1.552	93.4	96.8	72.6	63	37	74	47	1.61	96.4
7-28-69	J-1,2,3	9	8.0	1.836	1.642	89.5	102.5	76.8	47	53	71	36	1.78	92.3
7-28-69	L-1,2,3	10	7.0	1.573	1.438	91.4	89.7	67.3	72	28	101	49	1.57	91.6

* Specific gravities were determined by the Rice Method from the mixture. This test was incomplete for mixtures of Design Nos. 1 through 5 and absorption was assumed as 2.5% for determination of a corrected specific gravity. From tests made on the other mixtures, averages were used casting out questionable determinations. Test results were erratic indicating need for improvement in laboratory techniques.

SUMMARY OF SKID FACTOR VALUES FOR LIGHTWEIGHT AGGREGATE ASPHALTIC CONCRETE

Loop 266 - K 176-10-3

Asph.Conc. Des. No.	Lt.Wt. Agg'r. %, by Wt.	Asph. %, Wt.	Hveem Stab.,%	Density, %	SKID FACTOR VALUES		
					No.of Read.	Range	Average
1	40	8.5	40	92.4	10	0.41-0.60	0.50
2	40	8.0	40	93.6	4	0.36-0.41	0.39
3	40	7.5	47	90.5	4	0.43-0.51	0.47
4	50	7.0	46	91.7	5	0.43-0.55	0.48
5	50	6.5	46	92.2	3	0.36-0.48	0.43
6	45	7.5	43	91.7	4	0.47-0.54	0.50
7	45	8.0	47	91.3	15	0.47-0.65	0.56
8	45	8.0	49	93.0	8	0.36-0.52	0.46
9	30	8.0	36	89.5	1	0.46	0.46
10	55	7.0	49	91.4	1	0.48	0.48

SPECIFICATIONS

"A"

SPECIAL SPECIFICATION

(1) Utilizes ltwt. aggregate as Coarse aggregate

(2) Ltwt Aggregate to meet requirements of Specification 1989, "Aggregate for Surface Treatments" (Lightweight)

(3) Measurement of asphaltic concrete by the following:

a. Asphalt by the ton

b. Aggregate by the ton

TEXAS HIGHWAY DEPARTMENT

SPECIAL SPECIFICATION

ITEM____

HOT-MIX ASPHALTIC-CONCRETE PAVEMENT
(CLASS-A)(LIGHTWEIGHT)

1. DESCRIPTION. This item shall consist of a base course, a leveling-up course, a surface course or any combination of these courses as shown on the plans, each to be composed of a compacted mixture of mineral aggregate and asphaltic material.

The pavement shall be constructed on the previously-completed and approved subgrade, base, existing pavement, bituminous surface or in the case of a structure, on the prepared floor slab, as herein specified and in accordance with the details shown on the plans.

2. MATERIALS.

(1) Mineral Aggregates. The mineral aggregate shall be composed of a coarse aggregate and 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 of the source of supply must be obtained from the Engineer prior to delivery.

The combined mineral aggregate after final processing by the mixing plant, and prior to addition of asphalt, shall have a sand equivalent value of not less than 55, unless otherwise shown on the plans, when tested in accordance with Test Method Tex-203-F.

(a) Coarse Aggregate. The coarse aggregate shall be that part of the aggregate retained on the No. 10 sieve; shall consist of clean tough durable fragments of lightweight cellular and granular inorganic material produced by fuzing raw shale or clay in a rotary kiln under intense heat into predominantely amorphous silicate.

The coarse aggregate shall contain not more than 1 percent of organic matter, impurities or objectionable matter when tested in accordance with Test Method Tex-217-F (Part 1, Separation of Deleterious Material). When the coarse aggregate is tested in accordance with Test Method Tex 217-F (Part II, Decantation), the material removed shall not exceed 2 percent.

The dry loose unit weight of coarse lightweight aggregate shall not be less than 35 and shall not exceed 55 pounds per cubic foot. If the unit weight of any shipment of lightweight aggregate differs by more than 4 percent from that of the sample submitted for acceptance tests, the aggregates in the shipment may be rejected. Tests shall be in accordance with Test Method Tex-404-A, except that the aggregate shall be tested in an oven-dry condition.

The 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.

The Aggregate Freeze Thaw Loss shall not exceed 7% when tested in accordance with Test Method Tex-432-A Tentative. (This requirement may be waived by a note on the plans, when in the judgement of the Engineer, the aggregate will not become exposed to freezing and thawing.)

The Pressure Slaking Value shall not exceed 6 percent when the lightweight aggregate is tested in accordance with Test Method Tex-431-A Tentative.

(b) Fine Aggregate. The fine aggregate shall be that part of the aggregate passing the No. 10 sieve and shall consist of sand, screenings or a combination of sand and screenings.

Sand shall be composed of durable stone particles free from injurous foreign matter. Screenings shall be secured from processing crushed stone, gravel, slag or lightweight aggregates. The plasticity index of that part of the fine aggregate passing the No. 40 sieve shall not exceed 6% when tested in accordance with Test Method Tex-106-E.

(2) Asphaltic Material.

(a) Paving mixture. Asphalt for the paving mixture shall be of the types of oil asphalt as determined by the Engineer and shall meet the requirements of the Item, "Asphalts, Oils and Emulsions." The grade of asphalt used shall be designated by the Engineer after design tests have been made using the mineral aggregates that are to be used in the project. If more than one type of asphaltic-concrete mixture is specified for the project, only one grade of asphalt will be required for all types of mixtures, unless otherwise shown on the plans. The Contractor shall notify the Engineer of the source of his asphaltic material prior to production of the asphaltic mixture and this source shall not be changed during the course of the project except on written permission of the Engineer.

(b) Tack Coat. The asphaltic material for tack coat shall meet the requirements for emulsified asphalt EA-11M, cut-back asphalt RC-2, or shall be a cut-back asphalt made by combining 50 to 70 percent by volume of the asphaltic material as specified for the type of paving mixture with 30 to 50 percent by volume of gasoline and/or kerosene, not to exceed 15 percent by volume. Asphaltic materials shall meet the requirements of the Item, "Asphalts, Oils and Emulsions."

3. PAVING MIXTURE.

(1) Type: The paving mixture 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, when tested in accordance with Test Method Tex-200-F (Dry Sieve Analysis), will conform to the limitations for master grading given below:

	Percent by Weight
Passing ½" sieve	100

	Percent by Weight
Passing 3/8" sieve	95-100
Passing 3/8" sieve, retained on No. 4 Sieve	10-35
Passing No. 4 Sieve, retained on No. 10 Sieve	5-20
Total retained on No. 10 Sieve	35-55
Passing No. 10 Sieve, retained on No. 40 Sieve	0-30
Passing No. 40 Sieve, retained on No. 80 Sieve	5-35
Passing No. 80 Sieve, retained on No. 200 Sieve	3-35
Passing No. 200 Sieve	0-10

The asphaltic material shall form from 5.0 to 9.0 percent of the mixture by weight.

(2) Tolerances: For the initial plant production of asphaltic concrete, the Engineer will designate the exact grading of the mineral aggregate and asphalt content based on preliminary laboratory design data, within the specified limits, to be used in the mixture. Changes may be made by the Engineer to a designated mineral aggregate grading and/or asphalt content to select a more appropriate design, within limits of the particular master grading, in order to operate the plant more efficiently provided that the quality of the mixture is not jeopardized. The paving mixture produced shall not vary from the designated grading and asphalt content by more than the tolerances allowed herein. The respective tolerances, based on the percent by weight of the mixture, are listed as follows:

	Percent by Weight
Passing 3/8" sieve, retained on No. 4 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 5
Passing No. 40 sieve, retained on No. 80 sieve	plus or minus 5
Passing No. 80 sieve, retained on No. 200 sieve	plus or minus 5
Passing No. 200 sieve	plus or minus 4
Asphaltic Material	plus or minus0.5

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.

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 the asphalt content designated by the Engineer by more than the respective tolerances specified above.

(3) 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 methods outlined in THD Bulletin C-14, will have the following laboratory density and stability, unless otherwise shown on the plans:

Density, Percent			Stability, Percent
Min	Max	Optimum	
91	97	94	Not less than 30 unless otherwise shown on the plans.

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

4. EQUIPMENT

(1) Mixing Plants. Mixing plants that will not continuously produce a mixture meeting all of the requirements of this specification will be condemned.

Mixing plants may be either the weight-batching type or the continuous-mixing type (See section 5 also). Both types of plants shall be equipped with satisfactory conveyours, power units, aggregate-handling equipment, hot-aggregate screens and bins and dust collectors and shall consist of the following essential pieces of equipment.

(a) Weight-batching Type.

Cold-Aggregate Bin and Proportioning Device. The aggregate bin shall have at least four compartments 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 proportioning device shall be such as will provide a uniform and continuous flow of aggregate in the desired proportion to the dryer. Each aggregate shall be proportioned in a separate compartment.

Dryer. The dryer shall be of the type that continually agitates the aggregate during heating and in which the temperature can be so controlled that aggregate will not be injured in the necessary drying and heating operations required to obtain a mixture of the specified temperature. The burner, or combination of burners, and type of fuel shall be such that in the process of heating the aggregate to the desired or specified temperature, no residue from the fuel shall adhere to the heated

aggregate. A recording thermometer shall be provided which will record the temperature of the aggregate when it leaves the dryer. The dryer shall be of sufficient size to keep the plant in continuous operation.

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 three bins. These bins shall contain the following sizes of aggregate.

Bin No. 1--will contain aggregates of which 85 to 100 percent by weight will pass the No. 10 sieve.
Bin No. 2--will contain aggregates of which at least 70 percent by weight will be of such sizes 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 70 percent by weight will be of such sizes as to pass the $\frac{1}{2}$-inch sieve and be retained on the No. 4 sieve.

Aggregate Weigh Box and Batching Scales. The aggregate weigh box and batching scales shall be of sufficient capacity to hold and weigh a complete batch of aggregate. The weigh box and scales shall conform to the requirements of the Item, "Weighing and Measuring Equipment".

Asphaltic Material Bucket and Scales. The asphaltic-material bucket and scales shall be of sufficient capacity to hold and weigh the necessary asphaltic material for one batch. If the material is measured by weight, the bucket and scales shall conform to the requirements of the Item, "Weighing and Measuring Equipment".

If a pressure-type flow meter is used to measure the asphaltic material, the requirements of the Item, "Weighing and Measuring Equipment" shall apply, and an accurate recording meter shall be placed in the asphalt line leading to the spray bar so that the accumulative amount of asphalt used can be accurately determined.

Mixer. The mixer shall be of the pug-mill type and shall have a capacity of not less than 1200 pounds in a single batch. The number of blades and the position of same shall be such as to give a uniform and complete circulation of the batch in the mixer. The mixer shall be equipped with an approved spray bar that will distribute the asphaltic material quickly and uniformly throughout the mixer. Any mixer that has a tendency to segregate the mineral aggregate or fails to secure a thorough and uniform mixing with the asphalt material shall not be used. This shall be determined by mixing the standard batch for the required time, then dumping the mixture and taking samples from its different parts. This will be tested by the extraction tests and must show that the batch is uniform throughout. All mixers shall be provided with an automatic time lock that will lock the discharge doors of the mixer for the required mixing perion. The dump door or doors and the shaft seals of the mixer shall be

tight enough to prevent the spilling of aggregate or mixture from the pug mill.

(b) Continuous-Mixing Type.

Cold-Aggregate Bin and Proportioning Device. Same as for weight-batching type of plant.

Dryer. Same as for weight-batching type of plant.

Screening and Proportioning. Same as for weight-batching type of plant.

Hot-Aggregate Proportioning Device. The hot-aggregate proportioning device shall be so designed that when properly operated a uniform and continuous flow of aggregate into the mixer will be maintained.

Asphaltic-Material Spray Bar. The asphaltic-material spray bar shall be so designed that the asphalt will spray uniformly and continuously into the mixer.

Mixer. The mixer shall be of the pug-mill continuous type and shall have a capacity of not less than 40 tons of mixture per hour. Any mixer that has a tendency to segregate the aggregate or fails to secure a thorough and uniform mixing of the aggregate with the asphaltic material shall not be used.

Truck Scales. A set of standard platform truck scales, conforming to the Item, "Weighing and Measuring Equipment", shall be placed at a location approved by the Engineer.

(2) Asphaltic-Material Heating Equipment. Asphaltic-material heating equipment shall be adequate to heat the amount of asphaltic material required to the desired temperature. Asphaltic material may be heated by steam coils which shall be absolutely tight. Direct fire heating of asphaltic materials will be permitted, provided the heater used is manufactured by a reputable concern and there is positive circulation of the asphalt throughout the heater. Agitation with steam or air will not be permitted. The heating apparatus shall be equipped with a recording thermometer with a 24-hour chart that will record the temperature of the asphaltic material where it is at the highest temperature.

(3) Spreading-and-Finishing Machine. The spreading-and-finishing machine shall be of a type approved by the Engineer, shall be capable of producing a surface that will meet the requirements of the typical cross section and the surface test, when required, and shall have adequate power to propel the delivery vehicles in a satisfactory manner when the mixture is dumped into the finishing machine. The finishing machine shall be equipped with a flexible spring and/or hydraulic-type hitch sufficient in design and capacity to maintain contact between the rear wheels of the hauling equipment and the pusher rollers of the finishing machine while the mixture is being unloaded.

Any vehicle which the finishing machine cannot push or propel in such a manner as to obtain the desired lines and grades without resorting to hand finishing will not be allowed to dump directly into the finishing machine. Vehicles of the semi-trailer type are specifically prohibited from dumping directly into the finishing machine. Vehicles dumping into the finishing machine can be mechanically and/or automatically operated in such a manner that overloading the finishing machine being used cannot occur and the required lines and grades will be obtained without resorting to hand finishing.

Dumping of the asphaltic mixture in a windrow and then placing the mixture in the finishing machine with loading equipment will be permitted provided that the loading equipment is constructed and operated in such manner that substantially all of the mixture deposited on the roadbed is picked up and placed in the finishing machine without contamination by foreign material of the mixture. The loading equipment will be so designed and operated that the finishing machine loaded will obtain the required lines, grades and surface without resorting to hand finishing. Any operation of the loading equipment resulting in the accumulation and subsequent shedding of this accumulated material into the asphaltic mixture will not be permitted.

(4) Pneumatic-Tire Rollers. The rollers shall be acceptable medium-pneumatic-tire(Ty B) rollers conforming to the requirements of the Item, "(Rolling Pneumatic Tire)".

The tire pressure of each tire shall be adjusted as directed by the Engineer and this pressure shall not vary by more than 5 pounds per square inch.

(5) Two-Axle Tandem Roller. This roller shall be an acceptable power-driven tandem roller weighing not less than 8 tons.

(6) Three-Wheel Roller. This roller shall be an acceptable power-driven three-wheel roller weighing not less than 10 tons.

(7) Straightedges and Templates. When directed by the Engineer, the Contractor shall provide acceptable 10-foot straightedges for surface testing. Satisfactory templates shall be provided as required by the Engineer.

(8) All equipment shall be maintained in good repair and operating condition and shall be approved by the Engineer.

5. STOCKPILING, STORAGE, PROPORTIONING AND MIXING.

(1) Stockpiling of Aggregate. Prior to stockpiling of aggregates the area shall be cleaned of trash, weeds, and grass and be relative smooth. Aggregates shall be handled in such a manner to prevent segregation, the mixing of the various materials or sizes, and contamination with foreign materials.

Slight variations in grading from that of the preliminary design in each aggregate can be expected to occur during stockpiling, which will affect the grading of the plant produced mixture. A departure from the preliminary grading of the aggregates for stockpiled material may be accepted

provided that a mixture can be produced which will be within the applicable requirements of the specifications. Fluctuation from preliminary grading of any aggregate proposed or stockpiled may be cause for rejection of material if in the opinion of the Engineer undue changes would be required to be made to any designated grading of mineral aggregate and/or asphalt content of the mixture.

(2) Storage and Heating of Asphaltic Materials. The asphaltic-material storage shall be ample to meet the requirements of the plant. Asphalt shall not be heated to a temperature in excess of 400°F. All equipment used in the storage and handling of asphaltic material shall be kept in a clean condition at all times and shall be operated in such manner that there will be no contamination with foreign matter.

(3) Feeding and Drying of Aggregate. The feeding of various sizes of aggregate to the dryer shall be done through the cold-aggregate bin and proportioning device in such a manner that a uniform and constant flow of materials in the required proportions will be maintained. The aggregate shall be dried and heated to the extent directed by the Engineer not to exceed 400°F.

(4) Proportioning. The proportioning of the various materials entering into the asphaltic mixture shall be as directed by the Engineer and in accordance with these specifications. Aggregate shall be proportioned by weight using the weigh box and batching scales herein specified when the weigh-batch type of plant is used and by volume using the hot-aggregate-proportioning device when the continuous-mixer type of plant is used. The asphaltic material shall be proportioned by weight or by volume based on weight using the specified equipment.

(5) Mixing.

(a) Batch-Type Mixer. In charging the weigh box and charging the mixer from the weigh box, such methods or devices shall be used as are necessary to secure a uniform asphaltic mixture. In introducing the batch into the mixer, all mineral aggregate shall be introduced first; shall be mixed thoroughly for a period of 5 to 20 seconds, as directed, to uniformly distribute the various sizes throughout the batch before the asphaltic material is added; the asphaltic material shall then be added and mixing continued for a total mixing period of not less than 30 seconds. This mixing period may be increased, if, in the opinion of the Engineer, the mixture is not uniform.

(b) Continuous-Type Mixer. The amount of aggregate and asphaltic material entering the mixer and the rate of travel through the mixer shall be so coordinated that a uniform mixture of the specified grading and asphalt content will be produced.

(c) The Mixture produced from each type of mixer shall not vary from the specified mixture by more than the tolerance herein specified.

(d) The asphaltic mixture shall be at a temperature between 225°F and 350°F when dumped from the mixer. The Engineer will determine the temperature, within the above limitations, and the mixture when dumped from the

mixer shall not vary from this selected temperature more than 25°F.

6. CONSTRUCTION METHODS.

The tack coat or the asphaltic mixture when placed with a spreading-and-finishing machine, shall not be placed when the air temperature is below 50°F and is falling, but it may be placed when the air temperature is above 40°F and is rising. The asphaltic mixture when placed with a motor grader, shall not be placed when the air temperature is below 60°F and is falling, but may be placed when the air temperature is above 50°F and is rising. The air temperature shall be taken in the shade away from artificial heat. It is further provided that the tack coat or asphaltic mixture shall be placed only when the humidity, general-weather conditions and temperature and moisture condition of the base, in the opinion of the Engineer, are suitable. If the temperature of a load or any part of a load of the asphaltic mixture becomes 50°F or more, less than the temperature selected by the Engineer, under Article 5(5) of this specification after being dumped from the mixer and prior to placing, all or any part of the load may be rejected and payment will not be made for the rejected material.

(1) Tack Coat. Before the asphaltic mixture is laid, the surface upon which the tack coat is to be placed shall be cleaned throughly to the satisfaction of the Engineer. The surface shall be given a uniform application of tack coat using asphaltic materials of this specification. This tack coat shall be applied, as directed by the Engineer, with an approved sprayer at a rate not to exceed 0.10 gallon per square yard of surface. Where the mixture will adhere to the surface on which it is to be placed without the use of a tack coat, the tack coat may be eliminated by the Engineer. All contact surfaces of curbs and structures and all joints shall be painted with a thin uniform coat of the asphaltic material meeting the requirements for tack coat. The tack coat shall be rolled with a pneumatic-tire roller as directed by the Engineer.

(2) Transporting Asphaltic Concrete. The asphaltic mixture, prepared as specified above, shall be hauled to the work in tight vehicles previously cleaned of all foreign material. The dispatching of the vehicles shall be arranged so that all material delivered may be placed, and all rolling shall be completed during daylight hours. In cool weather or for long hauls, canvas covers and insulating of the truck bodies may be required. The inside of the truck body may be given a light coating of oil, if necessary, to prevent the mixture from adhering to the body.

(3) Placing.

(a) Generally the asphaltic mixture shall be dumped and spread on the approved prepared surface with the specified spreading-and-finishing machine, in such manner that when properly compacted the finished pavement will be smooth, of uniform density and will meet the requirements of the typical cross sections and the surface tests. During the application of asphaltic material, care shall be taken to prevent splattering of adjacent pavement, curb and gutter and structures.

(b) When the asphaltic mixture is used to level up small areas of the existing pavement or placed in small irregular areas where the use of a finishing machine is not practical, the finishing machine may be eliminated

when authorized by the Engineer, provided a satisfactory surface can be obtained by other approved methods.

(4) Compacting.

(a) As directed by the Engineer, the pavement shall be compressed thoroughly and uniformly with the specified rollers.

(b) Rolling with the three-wheel and tandem rollers shall start longitudinally at the sides and proceed toward the center of the pavement, overlapping on successive trips by at least half the width of the rear wheels unless otherwise directed by the Engineer. Alternate trips of the roller shall be slightly different in length. On super-elevated curves, rolling shall begin at the low side and progress toward the high side unless otherwise directed by the Engineer. Rolling with pneumatic-tire-roller shall be done as directed by the Engineer. Rolling shall be continued until no further compression can be obtained and all roller marks are eliminated. One tandem roller, one pneumatic-tire-roller and at least one three-wheel roller, as specified above shall be provided for each job. In no case shall less than three rollers be in use on each job. Additional rollers shall be provided if needed. The motion of the roller shall be slow enough at all times to avoid displacement of the mixture. If any displacement occurs, it shall be corrected at once by the use of rakes and of fresh mixture where required. The roller shall not be allowed to stand on pavement which has not been fully compacted. To prevent adhesion of the surface mixture to the roller, the wheels shall be kept thoroughly moistened with water, but an excess of water will not be permitted. All rollers must be in good mechanical condition. Necessary precautions shall be taken to prevent the dropping of gasoline, oil, grease or other foreign matter on the pavement, either when the rollers are in operation or when standing. Rollers may be allowed to stand on new pavement after initial rolling is completed provided all roller marks are satisfactorily removed.

(c) Hand Tamping. The edges of the pavement along curbs, headers, and similar structures, and all places not accessible to the roller, or in such positions as will not allow thorough compaction with the roller, shall be thoroughly compacted with lightly-oiled tamps.

(5) Surface Tests. The surface of the pavement, after compression, shall be smooth and true to the established line, grade, and cross section, and when tested with a 10-foot straightedge placed parallel to the centerline of the roadway or tested by other equivalent and acceptable means, except as provided herein, the maximum deviation shall not exceed 1/8 inch in 10 feet, and any point in the surface not meeting this requirement shall be corrected as directed by the Engineer. When placed on existing surfaces, the 1/8 inch deviation in 10 feet requirement may be waived by the Engineer.

If, in the opinion of the Engineer, after application of the level up course or courses shown on the plans, an acceptable profile and/or section is not accomplished over short sections due to existing extreme irregularity of pavement surface, the Contractor will be required to apply an additional level up course or courses with compensation to be made under the provisions

for payment of this item.

(6) Opening to Traffic. The pavement shall be opened to traffic when directed by the Engineer. All construction traffic allowed on the pavement shall comply with the State laws governing traffic on highways.

7. MEASUREMENT.

(1) Asphaltic concrete will be measured separately by the ton of 2000 pounds of "Asphalt" and"Aggregate" of the type actually used in the completed and accepted work in accordance with the plans and specifications for the project. Measurement, if mixing is done by a continuous mixer, will be made on truck scales. Measurement, if batched by weight, may be made on the batch scales and records of the number of batches, batch designs and weight of "Asphalt" and "Aggregate" shall be kept.

(2) Tack coat will be measured at the point of application on the road in gallons at the applied temperature. When gasoline and/or kerosene is added to the cut-back asphalt for tack coat, as ordered, measurement will be made after mixing.

8. PAYMENT.

(1) The work performed and materials furnished as prescribed by this item and measured as provided under "Measurement", will be paid for at the unit prices bid for "Asphalt" and "Aggregate", which prices shall each be full compensation for all stripping required, furnishing all materials, freight and royalty involved; for all heating, mixing, hauling, cleaning of the existing base course or pavement, placing asphaltic concrete mixture, rolling and finishing; and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work except tack coat when required.

(2) The tack coat, measured as provided under "Measurement" will be paid for at the unit price bit for "Tack Coat," which price shall be full compensation for furnishing, preparing, hauling and placing the asphaltic materials of the grade used; and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work.

(3) All templates, straightedges, scales and other weighing and measuring devices necessary for the proper construction, measuring and checking of the work shall be furnished, operated and maintained by the Contractor at his expense.

"B"

SPECIAL SPECIFICATION

(1) Utilizes ltwt. aggregate as coarse aggregate

(2) Ltwt. Aggregate to meet requirements for Specification 1989, "Aggregate for Surface Treatments" (Lightweight)

(3) Measurement of asphaltic concrete by the following:

(a) Asphalt by the ton.

(b) Aggregate by the cubic yard or volume determined by converting weight of asphaltic concrete mixture by the specific gravity of molded laboratory specimen.

This procedure will result in paying twice for the asphalt.

TEXAS HIGHWAY DEPARTMENT

SPECIAL SPECIFICATION

ITEM____

HOT-MIX ASPHALTIC-CONCRETE PAVEMENT
(CLASS-A)(LIGHTWEIGHT)

1. DESCRIPTION. This item shall consist of a base course, a leveling-up course, a surface course or any combination of these courses as shown on the plans, each to be composed of a compacted mixture of mineral aggregate and asphaltic material.

The pavement shall be constructed on the previously-completed and approved subgrade, base, existing pavement, bituminous surface or in the case of a structure, on the prepared floor slab, as herein specified and in accordance with the details shown on the plans.

2. MATERIALS.

(1) Mineral Aggregates. The mineral aggregate shall be composed of a coarse aggregate and 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 of the source of supply must be obtained from the Engineer prior to delivery.

The combined mineral aggregate after final processing by the mixing plant, and prior to addition of asphalt, shall have a sand equivalent value of not less than 55, unless otherwise shown on the plans, when tested in accordance with Test Method Tex-203-F.

(a) Coarse Aggregate. The coarse aggregate shall be that part of the aggregate retained on the No. 10 sieve; shall consist of clean tough durable fragments of lightweight cellular and granular inorganic material produced by fuzing raw shale or clay in a rotary kiln under intense heat into predominantely amorphous silicate.

The coarse aggregate shall contain not more than 1 percent of organic matter, impurities or objectionable matter when tested in accordance with Test Method Tex-217-F (Part 1, Separation of Deleterious Material). When the coarse aggregate is tested in accordance with Test Method Tex 217-F (Part II, Decantation), the material removed shall not exceed 2 percent.

The dry loose unit weight of coarse lightweight aggregate shall not be less than 35 and shall not exceed 55 pounds per cubic foot. If the unit weight of any shipment of lightweight aggregate differs by more than 4 percent from that of the sample submitted for acceptance tests, the aggregates in the shipment may be rejected. Tests shall be in accordance with Test Method Tex-404-A, except that the aggregate shall be tested in an oven-dry condition.

The 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.

The Aggregate Freeze Thaw Loss shall not exceed 7% when tested in accordance with Test Method Tex-432-A Tentative. (This requirement may be waived by a note on the plans, when in the judgement of the Engineer, the aggregate will not become exposed to freezing and thawing.)

The Pressure Slaking Value shall not exceed 6 percent when the lightweight aggregate is tested in accordance with Test Method Tex-431-A Tentative.

(b) Fine Aggregate. The fine aggregate shall be that part of the aggregate passing the No. 10 sieve and shall consist of sand, screenings or a combination of sand and screenings.

Sand shall be composed of durable stone particles free from injurous foreign matter. Screenings shall be secured from processing crushed stone, gravel, slag or lightweight aggregates. The plasticity index of that part of the fine aggregate passing the No. 40 sieve shall not exceed 6% when tested in accordance with Test Method Tex-106-E.

(2) Asphaltic Material.

(a) Paving mixture. Asphalt for the paving mixture shall be of the types of oil asphalt as determined by the Engineer and shall meet the requirements of the Item, "Asphalts, Oils and Emulsions." The grade of asphalt used shall be designated by the Engineer after design tests have been made using the mineral aggregates that are to be used in the project. If more than one type of asphaltic-concrete mixture is specified for the project, only one grade of asphalt will be required for all types of mixtures, unless otherwise shown on the plans. The Contractor shall notify the Engineer of the source of his asphaltic material prior to production of the asphaltic mixture and this source shall not be changed during the course of the project except on written permission of the Engineer.

(b) Tack Coat. The asphaltic material for tack coat shall meet the requirements for emulsified asphalt EA-11M, cut-back asphalt RC-2, or shall be a cut-back asphalt made by combining 50 to 70 percent by volume of the asphaltic material as specified for the type of paving mixture with 30 to 50 percent by volume of gasoline and/or kerosene, not to exceed 15 percent by volume. Asphaltic materials shall meet the requirements of the Item, "Asphalts, Oils and Emulsions."

3. PAVING MIXTURE.

(1) Type: The paving mixture 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, when tested in accordance with Test Method Tex-200-F (Dry Sieve Analysis), will conform to the limitations for master grading given below:

	Percent by Weight
Passing ½" sieve	100

	Percent by Weight
Passing 3/8" sieve	95-100
Passing 3/8" sieve, retained on No. 4 Sieve	10-35
Passing No. 4 Sieve, retained on No. 10 Sieve	5-20
Total retained on No. 10 Sieve	35-55
Passing No. 10 Sieve, retained on No. 40 Sieve	0-30
Passing No. 40 Sieve, retained on No. 80 Sieve	5-35
Passing No. 80 Sieve, retained on No. 200 Sieve	3-35
Passing No. 200 Sieve	0-10

The asphaltic material shall form from 5.0 to 9.0 percent of the mixture by weight.

(2) Tolerances: For the initial plant production of asphaltic concrete, the Engineer will designate the exact grading of the mineral aggregate and asphalt content based on preliminary laboratory design data, within the specified limits, to be used in the mixture. Changes may be made by the Engineer to a designated mineral aggregate grading and/or asphalt content to select a more appropriate design, within limits of the particular master grading, in order to operate the plant more efficiently provided that the quality of the mixture is not jeopardized. The paving mixture produced shall not vary from the designated grading and asphalt content by more than the tolerances allowed herein. The respective tolerances, based on the percent by weight of the mixture, are listed as follows:

	Percent by Weight
Passing 3/8" sieve, retained on No. 4 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 5
Passing No. 40 sieve, retained on No. 80 sieve	plus or minus 5
Passing No. 80 sieve, retained on No. 200 sieve	plus or minus 5
Passing No. 200 sieve	plus or minus 4
Asphaltic Material	plus or minus0.5

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.

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 the asphalt content designated by the Engineer by more than the respective tolerances specified above.

(3) 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 methods outlined in THD Bulletin C-14, will have the following laboratory density and stability, unless otherwise shown on the plans:

Density, Percent			Stability, Percent
Min	Max	Optimum	
91	97	94	Not less than 30 unless otherwise shown on the plans.

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

4. EQUIPMENT

(1) Mixing Plants. Mixing plants that will not continuously produce a mixture meeting all of the requirements of this specification will be condemned.

Mixing plants may be either the weight-batching type or the continuous-mixing type (See section 5 also). Both types of plants shall be equipped with satisfactory conveyours, power units, aggregate-handling equipment, hot-aggregate screens and bins and dust collectors and shall consist of the following essential pieces of equipment.

(a) Weight-batching Type.

Cold-Aggregate Bin and Proportioning Device. The aggregate bin shall have at least four compartments 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 proportioning device shall be such as will provide a uniform and continuous flow of aggregate in the desired proportion to the dryer. Each aggregate shall be proportioned in a separate compartment.

Dryer. The dryer shall be of the type that continually agitates the aggregate during heating and in which the temperature can be so controlled that aggregate will not be injured in the necessary drying and heating operations required to obtain a mixture of the specified temperature. The burner, or combination of burners, and type of fuel shall be such that in the process of heating the aggregate to the desired or specified temperature, no residue from the fuel shall adhere to the heated

aggregate. A recording thermometer shall be provided which will record the temperature of the aggregate when it leaves the dryer. The dryer shall be of sufficient size to keep the plant in continuous operation.

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 three bins. These bins shall contain the following sizes of aggregate.

Bin No. 1--will contain aggregates of which 85 to 100 percent by weight will pass the No. 10 sieve.
Bin No. 2--will contain aggregates of which at least 70 percent by weight will be of such sizes 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 70 percent by weight will be of such sizes as to pass the ½-inch sieve and be retained on the No. 4 sieve.

Aggregate Weigh Box and Batching Scales. The aggregate weigh box and batching scales shall be of sufficient capacity to hold and weigh a complete batch of aggregate. The weigh box and scales shall conform to the requirements of the Item, "Weighing and Measuring Equipment".

Asphaltic Material Bucket and Scales. The asphaltic-material bucket and scales shall be of sufficient capacity to hold and weigh the necessary asphaltic material for one batch. If the material is measured by weight, the bucket and scales shall conform to the requirements of the Item, "Weighing and Measuring Equipment".

If a pressure-type flow meter is used to measure the asphaltic material, the requirements of the Item, "Weighing and Measuring Equipment" shall apply, and an accurate recording meter shall be placed in the asphalt line leading to the spray bar so that the accumulative amount of asphalt used can be accurately determined.

Mixer. The mixer shall be of the pug-mill type and shall have a capacity of not less than 1200 pounds in a single batch. The number of blades and the position of same shall be such as to give a uniform and complete circulation of the batch in the mixer. The mixer shall be equipped with an approved spray bar that will distribute the asphaltic material quickly and uniformly throughout the mixer. Any mixer that has a tendency to segregate the mineral aggregate or fails to secure a thorough and uniform mixing with the asphalt material shall not be used. This shall be determined by mixing the standard batch for the required time, then dumping the mixture and taking samples from its different parts. This will be tested by the extraction tests and must show that the batch is uniform throughout. All mixers shall be provided with an automatic time lock that will lock the discharge doors of the mixer for the required mixing perion. The dump door or doors and the shaft seals of the mixer shall be

tight enough to prevent the spilling of aggregate or mixture from the pug mill.

(b) Continuous-Mixing Type.

Cold-Aggregate Bin and Proportioning Device. Same as for weight-batching type of plant.

Dryer. Same as for weight-batching type of plant.

Screening and Proportioning. Same as for weight-batching type of plant.

Hot-Aggregate Proportioning Device. The hot-aggregate proportioning device shall be so designed that when properly operated a uniform and continuous flow of aggregate into the mixer will be maintained.

Asphaltic-Material Spray Bar. The asphaltic-material spray bar shall be so designed that the asphalt will spray uniformly and continuously into the mixer.

Mixer. The mixer shall be of the pug-mill continuous type and shall have a capacity of not less than 40 tons of mixture per hour. Any mixer that has a tendency to segregate the aggregate or fails to secure a thorough and uniform mixing of the aggregate with the asphaltic material shall not be used.

Truck Scales. A set of standard platform truck scales, conforming to the Item, "Weighing and Measuring Equipment", shall be placed at a location approved by the Engineer.

(2) Asphaltic-Material Heating Equipment. Asphaltic-material heating equipment shall be adequate to heat the amount of asphaltic material required to the desired temperature. Asphaltic material may be heated by steam coils which shall be absolutely tight. Direct fire heating of asphaltic materials will be permitted, provided the heater used is manufactured by a reputable concern and there is positive circulation of the asphalt throughout the heater. Agitation with steam or air will not be permitted. The heating apparatus shall be equipped with a recording thermometer with a 24-hour chart that will record the temperature of the asphaltic material where it is at the highest temperature.

(3) Spreading-and-Finishing Machine. The spreading-and-finishing machine shall be of a type approved by the Engineer, shall be capable of producing a surface that will meet the requirements of the typical cross section and the surface test, when required, and shall have adequate power to propel the delivery vehicles in a satisfactory manner when the mixture is dumped into the finishing machine. The finishing machine shall be equipped with a flexible spring and/or hydraulic-type hitch sufficient in design and capacity to maintain contact between the rear wheels of the hauling equipment and the pusher rollers of the finishing machine while the mixture is being unloaded.

Any vehicle which the finishing machine cannot push or propel in such a manner as to obtain the desired lines and grades without resorting to hand finishing will not be allowed to dump directly into the finishing machine. Vehicles of the semi-trailer type are specifically prohibited from dumping directly into the finishing machine. Vehicles dumping into the finishing machine can be mechanically and/or automatically operated in such a manner that overloading the finishing machine being used cannot occur and the required lines and grades will be obtained without resorting to hand finishing.

Dumping of the asphaltic mixture in a windrow and then placing the mixture in the finishing machine with loading equipment will be permitted provided that the loading equipment is constructed and operated in such manner that substantially all of the mixture deposited on the roadbed is picked up and placed in the finishing machine without contamination by foreign material of the mixture. The loading equipment will be so designed and operated that the finishing machine loaded will obtain the required lines, grades and surface without resorting to hand finishing. Any operation of the loading equipment resulting in the accumulation and subsequent shedding of this accumulated material into the asphaltic mixture will not be permitted.

(4) Pneumatic-Tire Rollers. The rollers shall be acceptable medium-pneumatic-tire(Ty B) rollers conforming to the requirements of the Item, "(Rolling Pneumatic Tire)".

The tire pressure of each tire shall be adjusted as directed by the Engineer and this pressure shall not vary by more than 5 pounds per square inch.

(5) Two-Axle Tandem Roller. This roller shall be an acceptable power-driven tandem roller weighing not less than 8 tons.

(6) Three-Wheel Roller. This roller shall be an acceptable power-driven three-wheel roller weighing not less than 10 tons.

(7) Straightedges and Templates. When directed by the Engineer, the Contractor shall provide acceptable 10-foot straightedges for surface testing. Satisfactory templates shall be provided as required by the Engineer.

(8) All equipment shall be maintained in good repair and operating condition and shall be approved by the Engineer.

5. STOCKPILING, STORAGE, PROPORTIONING AND MIXING.

(1) Stockpiling of Aggregate. Prior to stockpiling of aggregates the area shall be cleaned of trash, weeds, and grass and be relative smooth. Aggregates shall be handled in such a manner to prevent segregation, the mixing of the various materials or sizes, and contamination with foreign materials.

Slight variations in grading from that of the preliminary design in each aggregate can be expected to occur during stockpiling, which will affect the grading of the plant produced mixture. A departure from the preliminary grading of the aggregates for stockpiled material may be accepted

provided that a mixture can be produced which will be within the applicable requirements of the specifications. Fluctuation from preliminary grading of any aggregate proposed or stockpiled may be cause for rejection of material if in the opinion of the Engineer undue changes would be required to be made to any designated grading of mineral aggregate and/or asphalt content of the mixture.

(2) Storage and Heating of Asphaltic Materials. The asphaltic-material storage shall be ample to meet the requirements of the plant. Asphalt shall not be heated to a temperature in excess of 400°F. All equipment used in the storage and handling of asphaltic material shall be kept in a clean condition at all times and shall be operated in such manner that there will be no contamination with foreign matter.

(3) Feeding and Drying of Aggregate. The feeding of various sizes of aggregate to the dryer shall be done through the cold-aggregate bin and proportioning device in such a manner that a uniform and constant flow of materials in the required proportions will be maintained. The aggregate shall be dried and heated to the extent directed by the Engineer not to exceed 400°F.

(4) Proportioning. The proportioning of the various materials entering into the asphaltic mixture shall be as directed by the Engineer and in accordance with these specifications. Aggregate shall be proportioned by weight using the weigh box and batching scales herein specified when the weigh-batch type of plant is used and by volume using the hot-aggregate-proportioning device when the continuous-mixer type of plant is used. The asphaltic material shall be proportioned by weight or by volume based on weight using the specified equipment.

(5) Mixing.

(a) Batch-Type Mixer. In charging the weigh box and charging the mixer from the weigh box, such methods or devices shall be used as are necessary to secure a uniform asphaltic mixture. In introducing the batch into the mixer, all mineral aggregate shall be introduced first; shall be mixed thoroughly for a period of 5 to 20 seconds, as directed, to uniformly distribute the various sizes throughout the batch before the asphaltic material is added; the asphaltic material shall then be added and mixing continued for a total mixing period of not less than 30 seconds. This mixing period may be increased, if, in the opinion of the Engineer, the mixture is not uniform.

(b) Continuous-Type Mixer. The amount of aggregate and asphaltic material entering the mixer and the rate of travel through the mixer shall be so coordinated that a uniform mixture of the specified grading and asphalt content will be produced.

(c) The Mixture produced from each type of mixer shall not vary from the specified mixture by more than the tolerance herein specified.

(d) The asphaltic mixture shall be at a temperature between 225°F and 350°F when dumped from the mixer. The Engineer will determine the temperature, within the above limitations, and the mixture when dumped from the

mixer shall not vary from this selected temperature more than 25°F.

6. CONSTRUCTION METHODS.

The tack coat or the asphaltic mixture when placed with a spreading-and-finishing machine, shall not be placed when the air temperature is below 50°F and is falling, but it may be placed when the air temperature is above 40°F and is rising. The asphaltic mixture when placed with a motor grader, shall not be placed when the air temperature is below 60°F and is falling, but may be placed when the air temperature is above 50°F and is rising. The air temperature shall be taken in the shade away from artificial heat. It is further provided that the tack coat or asphaltic mixture shall be placed only when the humidity, general-weather conditions and temperature and moisture condition of the base, in the opinion of the Engineer, are suitable. If the temperature of a load or any part of a load of the asphaltic mixture becomes 50°F or more, less than the temperature selected by the Engineer, under Article 5(5) of this specification after being dumped from the mixer and prior to placing, all or any part of the load may be rejected and payment will not be made for the rejected material.

(1) Tack Coat. Before the asphaltic mixture is laid, the surface upon which the tack coat is to be placed shall be cleaned throughly to the satisfaction of the Engineer. The surface shall be given a uniform application of tack coat using asphaltic materials of this specification. This tack coat shall be applied, as directed by the Engineer, with an approved sprayer at a rate not to exceed 0.10 gallon per square yard of surface. Where the mixture will adhere to the surface on which it is to be placed without the use of a tack coat, the tack coat may be eliminated by the Engineer. All contact surfaces of curbs and structures and all joints shall be painted with a thin uniform coat of the asphaltic material meeting the requirements for tack coat. The tack coat shall be rolled with a pneumatic-tire roller as directed by the Engineer.

(2) Transporting Asphaltic Concrete. The asphaltic mixture, prepared as specified above, shall be hauled to the work in tight vehicles previously cleaned of all foreign material. The dispatching of the vehicles shall be arranged so that all material delivered may be placed, and all rolling shall be completed during daylight hours. In cool weather or for long hauls, canvas covers and insulating of the truck bodies may be required. The inside of the truck body may be given a light coating of oil, if necessary, to prevent the mixture from adhering to the body.

(3) Placing.

(a) Generally the asphaltic mixture shall be dumped and spread on the approved prepared surface with the specified spreading-and-finishing machine, in such manner that when properly compacted the finished pavement will be smooth, of uniform density and will meet the requirements of the typical cross sections and the surface tests. During the application of asphaltic material, care shall be taken to prevent splattering of adjacent pavement, curb and gutter and structures.

(b) When the asphaltic mixture is used to level up small areas of the existing pavement or placed in small irregular areas where the use of a finishing machine is not practical, the finishing machine may be eliminated

when authorized by the Engineer, provided a satisfactory surface can be obtained by other approved methods.

(4) Compacting.

(a) As directed by the Engineer, the pavement shall be compressed thoroughly and uniformly with the specified rollers.

(b) Rolling with the three-wheel and tandem rollers shall start longitudinally at the sides and proceed toward the center of the pavement, overlapping on successive trips by at least half the width of the rear wheels unless otherwise directed by the Engineer. Alternate trips of the roller shall be slightly different in length. On super-elevated curves, rolling shall begin at the low side and progress toward the high side unless otherwise directed by the Engineer. Rolling with pneumatic-tire-roller shall be done as directed by the Engineer. Rolling shall be continued until no further compression can be obtained and all roller marks are eliminated. One tandem roller, one pneumatic-tire-roller and at least one three-wheel roller, as specified above shall be provided for each job. In no case shall less than three rollers be in use on each job. Additional rollers shall be provided if needed. The motion of the roller shall be slow enough at all times to avoid displacement of the mixture. If any displacement occurs, it shall be corrected at once by the use of rakes and of fresh mixture where required. The roller shall not be allowed to stand on pavement which has not been fully compacted. To prevent adhesion of the surface mixture to the roller, the wheels shall be kept thoroughly moistened with water, but an excess of water will not be permitted. All rollers must be in good mechanical condition. Necessary precautions shall be taken to prevent the dropping of gasoline, oil, grease or other foreign matter on the pavement, either when the rollers are in operation or when standing. Rollers may be allowed to stand on new pavement after initial rolling is completed provided all roller marks are satisfactorily removed.

(c) Hand Tamping. The edges of the pavement along curbs, headers, and similar structures, and all places not accessible to the roller, or in such positions as will not allow thorough compaction with the roller, shall be thoroughly compacted with lightly-oiled tamps.

(5) Surface Tests. The surface of the pavement, after compression, shall be smooth and true to the established line, grade, and cross section, and when tested with a 10-foot straightedge placed parallel to the centerline of the roadway or tested by other equivalent and acceptable means, except as provided herein, the maximum deviation shall not exceed 1/8 inch in 10 feet, and any point in the surface not meeting this requirement shall be corrected as directed by the Engineer. When placed on existing surfaces, the 1/8 inch deviation in 10 feet requirement may be waived by the Engineer.

If, in the opinion of the Engineer, after application of the level up course or courses shown on the plans, an acceptable profile and/or section is not accomplished over short sections due to existing extreme irregularity of pavement surface, the Contractor will be required to apply an additional level up course or courses with compensation to be made under the provisions

for payment of this item.

(6) Opening to Traffic. The pavement shall be opened to traffic when directed by the Engineer. All construction traffic allowed on the pavement shall comply with the State laws governing traffic on highways.

7. MEASUREMENT.

(1) Asphaltic Concrete. 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 shall be calculated from the measured weights of the asphaltic concrete by the following formula:

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

V = Cubic Yards of compacted aggregate
W = Total weight of asphaltic concrete in pounds
Ga = Average specific gravity of three molded specimen 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, will be determined by truck scales. 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.

(2) Tack Coat. Tack coat will be measured at the point of application on the road in gallons at the applied temperature. When gasoline and/or kerosene is added to the cut-back asphalt for tack coat, as ordered, measurement will be made after mixing.

8. PAYMENT

(1) The work performed and materials furnished as prescribed by this item and measured as provided under "Measurement", will be paid for at the unit prices bid for "Asphalt" and "Aggregate" which prices shall each be full compensation for all stripping required, furnishing all materials, freight and royalty involved; for all heating, mixing, hauling, cleaning of the existing base course or pavement, placing asphaltic concrete mixture, rolling and finishing; and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work, except tack coat.

(2) The tack coat, measured as provided under "Measurement" will be paid for at the unit price bid for "Tack Coat", which price shall be full compensation for furnishing, preparing, hauling and placing the asphaltic materials of the grade used; and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work.

(3) All templates, straightedges, scales and other weighing and measuring devices necessary for the proper construction, measuring and checking of the work shall be furnished, operated and maintained by the Contractor at his expense.

"C"

Special Provision to Item 340, "Hot Mix Asphaltic Concrete Pavement"

1. Modification to Sp. Prov. 340...066
2. Eliminate Pavement Mixtures, type "G" and "H".
3. Permits lightweight material to be used in coarse aggregate but limits the amount to 25 percent of total mineral aggregate.
4. Requirements for lightweight patterned after specification 1989 "Aggregate for Surface Treatments" (Lightweight)
5. Measurement of asphaltic concrete by the following:
   a. Asphalt by the ton
   b. Aggregate by the cubic yard or volume determined by converting weight of asphaltic concrete mixture by the specific gravity of molded laboratory specimen.

   This procedure will result in paying twice for the asphalt.

TEXAS HIGHWAY DEPARTMENT

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 340.1. Description is voided and replaced by the following:

This item shall consist of a base course, and a leveling-up course, a surface course or any combination of these courses as shown on the plans, each to be composed of a compacted mixture of mineral aggregate and asphaltic material.

The pavement shall be constructed on the previously completed and approved subgrade, base, existing pavement, bituminous surface or in the case of a bridge, on the prepared slab as herein specified and in accordance with the details shown on the plans.

Article 340.2. Materials Subarticle (1) Mineral Aggregate is voided and replaced by the following:

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 of the source of supply must be obtained from the Engineer prior to delivery.

Except where iron ore topsoil is used, the combined mineral aggregate, after final processing by the mixing plant, and prior to addition of asphalt and mineral filler, shall have a sand equivalent value of not less than 45 when tested in accordance with Test Method Tex-203-F unless otherwise shown on plans. Mineral aggregate from each source will meet the quality tests specified hereafter unless otherwise specified.

Article 340.2. Materials Subarticle (1) Mineral Aggregate Section (a) Coarse Aggregate is voided and replaced by the following:

(a) Coarse Aggregate. Coarse aggregate shall be that part of the aggregate retained on No. 10 sieve; shall consist of clean, tough, durable fragments of stone, crushed blast furnace slag, lightweight cellular and granular inorganic material (prepared by expanding, calcining, or sintering products such as clay or shale), gravel, iron ore topsoil, or combinations thereof as hereinafter specified, of uniform quality throughout. The percentage of lightweight shall be that amount that will produce a satisfactory mix and will be limited to a maximum of 25 percent by weight

of the total mixture. The coarse aggregate shall be tested in accordance with Test Method Tex-217-F (Part II) to determine its acceptability as a material for stockpiling, and the frequency of testing shall be as directed by the Engineer to prevent unacceptable material from being incorporated into the stockpile. Coarse aggregate samples shall be obtained from the designed mineral aggregate. The designed mineral aggregate shall contain the individual aggregates combined according to their proposed designed proportions. The amount of the material removed from the coarse aggregate sample, when tested with Test Method Tex-217-F (Part II, Decantation); will be limited to a maximum two percent. The plasticity index of the material passing the No. 40 sieve shall not be more than six percent.

For Types "A", "B", "C", and "D" paving mixtures the following requirement will govern:

The coarse aggregate (each coarse aggregate when a combination of materials is used) shall have an abrasion of not more than 50 percent loss by weight when subjected to Test Method Tex-410-A, except lightweight aggregate which shall have not more than 35 percent loss by weight, when tested in the same manner.

For Type "F" paving mixture the following requirements will govern:

1. If the coarse aggregate is composed entirely of iron ore topsoil, the loss by abrasion shall not be more than 45 percent. If iron ore topsoil is used in combination with other coarse aggregate, the maximum loss by abrasion shall not exceed 55 percent, with the combined loss by abrasion for all other coarse aggregates shall not be more than 45 percent. The maximum loss by abrasion for all other coarse aggregates shall not be more than 35 percent. Testing shall be in accordance with Test Method Tex-410-A.

2. If gravel is used, it shall be so crushed that 90 percent of the particles retained on the No. 4 sieve shall have more than one crushed face when tested in accordance with Test Method Tex-413-A (Particle Count).

Mineral Aggregate for Iron Ore Topsoil Mixture. The mineral aggregate shall be composed of iron ore topsoil from pits or other sources approved by the Engineer. The material shall be of the best quality obtainable in the pits and shall be from those parts of the pits designated by the Engineer and shall be free from organic or other injurious matter. All trees, brush, weeds, grass and other undesirable material shall be removed from the pits and the exposed material throughly mixed before any of the mineral aggregate is secured.

The dry loose unit weight of lightweight aggregate shall not be less than 35 and shall not exceed 55 pounds per cubic foot. If the unit weight of any shipment of lightweight aggregate differs by more than 4 percent from that of the sample submitted for acceptance tests, the aggregates in the shipment may be rejected. Tests shall be in accordance with Test Method Tex-404-A, except that the aggregate shall be listed in an oven-dry condition.

The pressure slaking value shall not exceed 6 percent when the lightweight aggregate is tested in accordance with Test Method Tex-431-A Tentative.

Article 340.2. Materials Subarticle (1) Mineral Aggregate Section (c) Mineral Filler is voided and not replaced.

Article 340.2. Materials Subarticle (2) Asphaltic Material Section (a). Paving Mixture. The first sentence is voided and replaced by the following:

Asphalt for the paving mixture shall be of the grades of Asphalt Cement as determined by the Engineer and shall meet the requirements of the Item "Asphalts, Oils, Emulsions."

Article 340.3. Paving Mixtures Subarticle (1) Types is amended as follows:

The second sentence of the first paragraph is voided and replaced by the following:

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 (Dry Sieve Analysis), will conform to the limitations for master grading given below for the type specified.

Grading requirements for Type "A", Type "B", Type "C", Type "D", and Type "F" aggregates are amended as follows:

The amount of aggregate passing the No. 200 sieve shall be from zero to six percent of the mixture by weight; except for mixtures containing lightweight aggregate. For mixtures containing lightweight aggregate the amount of aggregate passing the No. 200 sieve shall be from zero to eight percent of the mixture by weight.

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

For the initial plant production of asphaltic concrete, the Engineer will designate the exact grading of the mineral aggregate and asphalt content based on preliminary laboratory design data, within the specified limits, to be used in the mixture. Changes may be made by the Engineer to a designated mineral aggregate grading and/or asphalt content to select a more appropriate design, within limits of the particular master grading, in order to operate the plant more efficiently provided that the quality of the mixture is not jeopardized. The paving mixture produced shall not vary from the designated grading and asphalt content by more than the tolerances allowed herein. The respective tolerances, based on the percent by weight of the mixture, are listed as follows:

	Percent by Weight
Passing 1-3/4" sieve retained on 7/8" sieve	plus or minus 5
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

	Percent by Weight
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
Asphalt Material	plus or minus 0.5

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.

The type and amount of the mixture used shall be as specified on the plans.

Article 340.3. Paving Mixtures Subarticle (3) Extraction Test is voided and replaced by the following:

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 the asphalt content designated by the Engineer by more than the respective tolerances specified above.

Article 340.3. Paving Mixtures is supplemented by the following:

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 methods outlined in THD Bulletin C-14, will have the following laboratory density and stability, unless otherwise shown on the plans:

Density, Percent			Stability, Percent
Min	Max	Optimum	Not less than 30 unless otherwise shown on the plans
95	99	97	

Stability and density tests are control tests. If the laboratory stability and/or density of the mixture produced has a value lower than that specified, and in the opinion of the Engineer is not due to change in source or quality of materials, production may proceed, and the mix shall be changed until the laboratory stability and density falls within the specified limits and as near the optimum value as it is practicable. If there is, in the opinion of the Engineer, a fundamental change in any material from that used in the design mixtures, production will be discontinued until a new design mixture is determined by trial mixes.

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

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 "A", Type "B"

and Type "C" mixtures, at least three bins when producing Type "D" mixtures and at least two bins when producing Type "E" and Type "F". These bins shall contain the following sizes of aggregates.

Type "A" (Coarse Graded Base Course):

Bin No. 1 - will contain aggregates of which 85 to 100 percent by weight will pass the No. 10 sieve.
Bin No. 2 - will contain aggregates of which at least 70 percent by weight will be of such size as to pass the 3/8" sieve and be retaine on the No. 10 sieve.
Bin No. 3 - will contain aggregates of which at least 75 percent by weight will be of such size as to pass the 7/8" sieve and be retained on the 3/8" sieve.
Bin No. 4 - will contain aggregates of which at least 75 percent by weight will be of such size as to pass the 2" sieve and be retained on the 7/8" sieve.

Type "B" (Fine Graded Base or Leveling-Up Course):
Bin No. 1 - will contain aggregates of which 85 to 100 percent by weight will pass the No. 10 sieve.
Bin No. 2 - will contain aggregates of which at least 70 percent by weight 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 by weight will be of such size as to pass the 3/8" sieve and be retained on the No. 4 sieve.
Bin No. 4 - will contain aggregates of which at least 75 percent by weight will be of such size as to pass the 1" sieve and be retained on the 3/8" sieve.

Type "C" (Coarse Graded Surface Course):
Bin No. 1 - will contain aggregates of which 85 to 100 percent by weight will pass the No. 10 sieve.
Bin No. 2 - will contain aggregates of which at least 80 percent by weight will be of such size as to pass the 3/8" sieve and be retained on the No. 10 sieve.
Bin No. 3 - will contain aggregates of which at least 80 percent by weight will be of such size as to pass the 1/2" sieve and be retained on the No. 4 sieve.
Bin No. 4 - will contain aggregates of which at least 80 percent by weight will be of such size as to pass the 1" sieve and be retained on the 3/8" sieve.

Type "D" (Fine Graded Surface Course):

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

Bin No. 2 - will contain aggregates of which at least 80 percent by weight will be of such size as to pass the 3/8" sieve and be retained on the No. 10 sieve.

Bin No. 3 - will contain aggregates of which at least 75 percent by weight will be of such size as to pass the 1/2" sieve and be retained on the No. 4 sieve.

Type "E" (Sheet Asphalt Surface Course):

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

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

Type "F" (Non-Skid Surface Course):

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

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

Article 340.4. Equipment Subarticle (1) Mixing Plants Section (a) Weight-Batching Type: The subsection Cold Aggregate Bin and Proportioning Device is supplemented by the following:

Unless otherwise indicated on the plans, this device will not be required if the mineral aggregate is composed entirely of iron ore topsoil.

Article 340.4. Equipment Subarticle (1) Mixing Plants Section (a) Weight-Batching Type: The second paragraph of the subsection Aggregate Material Bucket and Scales is voided and replaced by the following:

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

Article 340.4. Equipment Subarticle (1) Mixing Plants Section (b) Continuous Mixing Type: The subsection Asphaltic Material Meter is voided and not replaced.

Article 340.4. Equipment Subarticle (3) Spreading and Finishing Machine is voided and replaced by the following:

The spreading and finishing machine shall be of a type approved by the Engineer, shall be capable of producing a surface that will meet the requirements of the typical cross section and the surface test, when required, and shall have adequate power to propel the delivery vehicles in a satisfactory manner when the mixture is dumped into the finishing machine. The finishing machine shall be equipped with a flexible spring and/or hydraulic type hitch sufficient in design and capacity to maintain contact between the rear wheels of the hauling equipment and the pusher roller of the finishing machine while the mixture is being unloaded.

Any vehicle which the finishing machine cannot push or propel in such a manner as to obtain the desired lines and grade without resorting to hand finishing will not be allowed to dump directly into the finishing machine. Vehicles of the semi-trailer type are specifically prohibited from dumping directly into the finishing machine. Vehicles dumping into the finishing machine shall be so designed and equipped that unloading into the finishing machine can be mechanically and/or automatically operated in such a manner that overloading the finishing machine being used cannot occur and the required line and grade will be obtained without resorting to hand finishing.

Dumping of the asphaltic mixture in a windrow and then placing the mixture in the finishing machine with loading equipment will be permitted provided that the loading equipment is constructed and operated in such a manner that substantially all of the mixture deposited on the roadbed is picked up and placed in the finishing machine without contamination by foreign material of the mixture. The loading equipment will be so designed and operated that the finishing machine being loaded will obtain the required line, grade and surface without resorting to hand finishing. Any operation of the loading equipment resulting in the accumulation and subsequent shedding of this accumulated material into the asphaltic mixture will not be permitted.

Article 340.4. Equipment Subarticle (11) Straightedges and Templates is voided and replaced by the following:

When directed by the Engineer, the Contractor shall provide acceptable 10-foot straightedges for surface testing. Satisfactory templates shall be provided as required by the Engineer.

Article 340.4. Equipment Subarticle (5) Motor Grader is supplemented by the following:

On courses applied with a blade, a motor grader shall be provided. A windrow evener box may be required for quantity control on level up courses when directed by the Engineer in writing.

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

If the aggregates are stored or stockpiled, they shall be handled in such a manner to prevent segregation, the mixing of the various materials or sizes, and contamination with foreign materials.

Slight variations in grading from that of the preliminary design in each aggregate can be expected to occur during stockpiling, which will affect the grading of the plant produced mixture. A departure from the preliminary grading of the aggregates for stockpiled material may be accepted provided that a mixture can be produced which will be within the applicable requirements of the specifications. Fluctuation from preliminary grading of any aggregate proposed or stockpiled may be cause for rejection of material if in the opinion of the Engineer undue changes would be required to be made to any designated grading of mineral aggregate and/or asphalt content of the mixture.

Article 340.6. Construction Methods. The first paragraph is supplemented 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(5) of this specification after being dumped from the mixer and prior to placing all or any part of the load may be rejected and payment will not be made for the rejected material.

Article 340.6. Construction Methods. Subarticle (2) Tack Coat is voided and replaced by the following:

Before the asphaltic mixture is laid, the surface upon which the tack coat is to be placed shall be cleaned thoroughly to the satisfaction of the Engineer. The surface shall be given a uniform application of tack coat using asphaltic materials of this specification. This tack coat shall be applied, as directed by the Engineer, with an approved sprayer at a rate of not to exceed 0.10 gallon per square yard of surface. Where the mixture will adhere to the surface on which it is to be placed without the use of a tack coat, the tack coat may be eliminated by the Engineer. All contact surfaces of curbs and structures and all joints shall be painted with a thin uniform coat of the asphaltic material meeting the requirements for tack coat. The tack coat shall be rolled with a pneumatic tire roller as directed by the Engineer

Article 340.6. Construction Methods Subarticle(5) Compacting. Section (b) is voided and replaced by the following:

Rolling with the three wheel and tandem rollers shall start longitudinally at the sides and proceed toward the center of the pavement, overlapping on successive trips by at least half the width of the rear wheels unless otherwise directed by the Engineer. Alternate trips of the roller shall be slightly different in length. On super-elevated curves, rolling shall begin at the low side and progress toward the high side unless otherwise directed by the Engineer. Rolling with pneumatic tire roller shall be done as directed by the Engineer. Rolling shall be continued until no further compression can be obtained and all roller marks are eliminated. One tandem roller, one pneumatic tire roller, and at least one three-wheel roller, as specified above shall be provided for each job. If the Contractor elects he may substitute the three axle tandem roller for the two axle tandem roller and/or the three wheel roller; but in no case shall less than three rollers be in use on each job. Additional rollers shall be provided if needed. The motion of the roller shall be slow enough at all times to avoid displacement of the mixture. If any displacement occurs, it shall be corrected at once by the use of rakes and of fresh mixture where required. The roller shall not be allowed to stand on pavement which has not been fully compacted. To prevent adhesion of the surface mixture to the roller, the wheels shall be kept thoroughly moistened with water, but an excess of water will not be permitted. All rollers must be in good mechanical condition. Necessary precautions shall be taken to prevent the dropping of gasoline, oil, grease, or other foreign matter on the pavement, either when the rollers are in operation or when standing.

The thickness of each course of asphaltic concrete shall not exceed the depth beyond which thorough compaction can be obtained with the rolling equipment in use. The Engineer will be the judge of the results obtained in the compaction of the asphaltic mixture, and may require the depth of compacted material to be reduced to the extent required to obtain thorough compaction. However, the depth of the compacted material shall not be less than one inch except where the existing imperfections in grade line and/or transverse slope of the short sections of the roadbed can be improved by reducing the specified minimum thickness of a course of where courses of lesser thickness are indicated on the plans.

Article 340.6. Construction Methods Subarticle (6) Surface Tests is voided and replaced by the following:

The surface of the pavement, after compression, shall be smooth and true to the established line, grade, and cross section, and when tested with a 10-foot straightedge placed parallel to the center line of the roadway or tested by other equivalent and acceptable means, except as provided herein, the maximum deviation shall not exceed 1/8 inch in 10 feet, and any point in the surface not meeting this requirement shall be corrected as directed by the Engineer. When placed on existing surfaces, the 1/8 inch deviation in 10 feet requirement may be waived by the Engineer.

If, in the opinion of the Engineer, after application of the level up course or courses shown on the plans, an acceptable profile and/or section is not accomplished over short sections due to existing extreme irregularity of pavement surface, the Contractor will be required to apply an additional level up course or courses with compensation to be made under the provisions for payment of this item.

Article 340.6. Construction Methods Subarticle (7) Opening to Traffic is supplemented by the following:

If the surface ravels, it will be the Contractor's responsibility to correct this condition at his expense.

Article 340.7. Measurement. Subarticle (1) is voided and replaced by the following:

(1) 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 shall 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 in pounds
G_a = Average specific gravity of three molded specimen 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, will be determined by truck scales. 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.

"D"

Special Provision to Item 340, "Hot Mix Asphaltic Concrete Pavement"

1. Modification to Sp. Prov. 340...066 dated 9-66

2. Measurement of asphaltic concrete by the following:

   a. Asphalt by the ton

   b. Aggregate by the cubic yard or volume determined by converting weight of asphaltic mixture by the specific gravity of molded laboratory specimen... This procedure will result in paying twice for the asphalt.

TEXAS HIGHWAY DEPARTMENT

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 340.1. Description is voided and replaced by the following:

This item shall consist of a base course, and a leveling-up course, a surface course or any combination of these courses as shown on the plans, each to be composed of a compacted mixture of mineral aggregate and asphaltic material.

The pavement shall be constructed on the previously completed and approved subgrade, base, existing pavement, bituminous surface or in the case of a bridge, on the prepared slab as herein specified and in accordance with the details shown on the plans.

Article 340.2. Materials Subarticle (1) Mineral Aggregate is voided and replaced by the following:

The mineral aggregate shall be composed of a coarse aggregate, a fine aggregate, and if required a mineral filler. Samples of coarse aggregate, fine aggregate, and mineral filler shall be submitted in accordance with the methods prescribed in Item 6 of the Standard Specifications, and approval of both material and of the source of supply must be obtained from the Engineer prior to delivery.

Except where iron ore topsoil is used, the combined mineral aggregate, after final processing by the mixing plant, and prior to addition of asphalt and mineral filler, shall have a sand equivalent value of not less than 45 when tested in accordance with Test Method Tex-203-F unless otherwise shown on plans. Mineral aggregate from each source will meet the quality tests specified hereafter unless otherwise specified.

Article 340.2. Materials Subarticle (1) Mineral Aggregate Section (a) Coarse Aggregate is voided and replaced by the following:

(a) Coarse Aggregate. Coarse aggregate shall be that part of the aggregate retained on No. 10 sieve; shall consist of clean, tough, durable fragments of stone, crushed blast furnace slag, gravel, iron ore topsoil, or combinations thereof, as hereinafter specified, of uniform quality throughout. An intermediate size aggregate composed of oyster shell may be used, except in Type "E" and Type "F" mixtures, or as directed by the Engineer. When gravel is used as coarse aggregate, oyster shell or stone or iron ore topsoil as shown on plans or as directed by the Engineer must be used in conjunction therewith. When oyster shell is used, it shall constitute the intermediate size aggregate and the percentage of shell to be used in the total mixture will be determined by the Engineer. The percentage of oyster shell shall be that amount that will produce a satisfactory mix and resulting riding surface and will be limited to a maximum of 40 percent by weight of the total mixture. The coarse aggregate shall

be tested in accordance with Test Method Tex-217-F (Part II) to determine its acceptability as a material for stockpiling, and the frequency of testing shall be as directed by the Engineer to prevent unacceptable material from being incorporated into the stockpile. Coarse aggregate samples shall be obtained from the designed mineral aggregate. The designed mineral aggregate shall contain the individual aggregates combined according to their proposed designed proportions. Except for mixtures containing oyster shell, when the coarse aggregate is tested in accordance with Test Method Tex-217-F (Part II, Decantation), the amount of the material removed shall not exceed two percent and the plasticity index of the material passing the No. 40 sieve shall not be more than six.

When oyster shell is used in combination with aggregates , the coarse aggregate shall be tested in accordance with Test Method Tex-217-F (Part II, Decantation), and the amount of the material removed shall not exceed three percent by weight when the plasticity index of the material passing the No. 40 sieve from all the aggregates used in the combined mixture is lower than five and shall not exceed one percent by weight when the plasticity index of the material passing the No. 40 sieve from all of the aggregates used in the combined mixture is from five to six.

For Types "A", "B", "C", and "D" paving mixtures the following requirements will govern:

The coarse aggregate (each coarse aggregate when a combination of materials is used) shall have an abrasion of not more than 50 percent loss by weight when subjected to Test Method Tex-410-A.

For Types "F", "G", and "H" paving mixtures the following requirements will govern:

1. For oyster shell, the maximum loss by abrasion shall not be more than 50 percent and the combined loss for coarse aggregate containing oyster shell shall not exceed 40 percent. If the coarse aggregate is composed entirely of iron ore topsoil, the loss by abrasion shall not be more than 45 percent. If iron ore topsoil is used in combination with other coarse aggregate, the maximum loss by abrasion shall not exceed 55 percent, with the combined loss by abrasion not to exceed 45 percent. The maximum loss by abrasion for all other coarse aggregates shall not be more than 40 percent. Testing shall be in accordance with Test Method Tex-410-A.

2. For Type "F" (Non-Skid Surface Course) the maximum loss by abrasion shall be the same as in the preceding paragraph except that the 40 percent requirement shall be changed to 35 percent.

3. If gravel is used, it shall be so crushed that 90 percent of the particles retained on the No. 4 sieve shall have more than one crushed face when tested in accordance with Test Method Tex-413-A (Particle Count).

Mineral Aggregate for Iron Ore Topsoil Mixture. The mineral aggregate shall be composed of iron ore topsoil from pits or other sources approved by the Engineer. The material shall be of the best quality obtainable in the pits and shall be from those parts of the pits designated by the Engineer and shall be free from

organic or other injurious matter. All trees, brush, weeds, grass and other undesirable material shall be removed from the pits and the exposed material thoroughly mixed before any of the mineral aggregate is secured.

Article 340.2. Materials Subarticle (1) Mineral Aggregate Section (c) Mineral Filler. The third sentence is voided and replaced by the following:

When tested by Test Method Tex-200-F (Dry Sieve Analysis) it shall meet the following grading requirements:

	Percent by Weight
Passing a No. 30 sieve	100
Passing a No. 80 sieve, not less than	90
Passing a No. 200 sieve, not less than	65

Article 340.2. Materials Subarticle (2) Asphaltic Material Section (a). Paving Mixture. The first sentence is voided and replaced by the following:

Asphalt for the paving mixture shall be of the grades of Asphalt Cement as determined by the Engineer and shall meet the requirements of the Item "Asphalts, Oils, Emulsions."

Article 340.3. Paving Mixtures Subarticle (1) Types is amended as follows:

The second sentence of the first paragraph is voided and replaced by the following:

The grading or 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 (Dry Sieve Analysis), will conform to the limitations for master grading given below for the type specified.

Grading requirements for Type "A", Type "B", Type "C", Type "D", and Type "F" aggregates are amended as follows:

The amount of aggregate passing the No. 200 sieve shall be from zero to six percent of the mixture by weight.

Grading requirements for Types "G" and "H" are as follows:

Type "G" (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	60 to 75
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 3.5 to 7 percent of the mixture by weight.

Type "H" (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	60 to 75
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 4.0 to 8 percent of the mixture by weight.

For Types "G" and "H", it is the intent that the mixture be proportioned so that the percentage of the total retained on the No. 10 sieve shall be approximately 65.

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

For the initial plant production of asphaltic concrete, the Engineer will designate the exact grading of the mineral aggregate and asphalt content based on preliminary laboratory design data, within the specified limits, to be used in the mixture. Changes may be made by the Engineer to a designated mineral aggregate grading and/or asphalt content to select a more appropriate design, within limits of the particular master grading, in order to operate the plant more efficiently provided that the quality of the mixture is not jeopardized. The paving mixture produced shall not vary from the designated grading and asphalt content by more than the tolerances allowed herein. The respective tolerances, based on the percent by weight of the mixture, are listed as follows:

	Percent by Weight
Passing 1-3/4" sieve retained on 7/8" sieve	plus or minus 5
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
Asphalt Material	plus or minus 0.5

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.

The type and amount of the mixture used shall be as specified on the plans.

Article 340.3. Paving Mixtures Subarticle (3) Extraction Test is voided and replaced by the following:

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 the asphalt content designated by the Engineer by more than the respective tolerances specified above.

Article 340.3. Paving Mixtures is supplemented by the following:

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 methods outlined in THD Bulletin C-14, will have the following laboratory density and stability, unless otherwise shown on the plans:

Density, Percent			Stability, Percent
Min	Max	Optimum	
95	99	97	Not less than 30 unless otherwise shown on the plans

Stability and density tests are control tests. If the laboratory stability and/or density of the mixture produced has a value lower than that specified, and in the opinion of the Engineer is not due to change in source or quality of materials, production may proceed, and the mix shall be changed until the laboratory stability and density falls within the specified limits and as near the optimum value as is practicable. If there is, in the opinion of the Engineer, a fundamental change in any material from that used in the design mixtures, production will be discontinued until a new design mixture is determined by trial mixes.

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

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 "A", Type "B", Type "C", and Type "G" mixtures, at least three bins when producing Type "D" and Type "H" 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.

Type "A" (Coarse Graded Base Course):

Bin No. 1 - will contain aggregates of which 85 to 100 percent by weight will pass the No. 10 sieve.
Bin No. 2 - will contain aggregates of which at least 70 percent by weight will be of such size as to pass the 3/8" sieve and be retained on the No. 10 sieve.
Bin No. 3 - will contain aggregates of which at least 75 percent by weight will be of such size as to pass the 7/8" sieve and be retained on the 3/8" sieve.

Bin No. 4 - will contain aggregates of which at least 75 percent by weight will be of such size as to pass the 2" sieve and be retained on the 7/8" sieve.

Type "B" (Fine Graded Base or Leveling-Up Course):
Bin No. 1 - will contain aggregates of which 85 to 100 percent by weight will pass the No. 10 sieve.
Bin No. 2 - will contain aggregates of which at least 70 percent by weight 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 by weight will be of such size as to pass the 3/8" sieve and be retained on the No. 4 sieve.
Bin No. 4 - will contain aggregates of which at least 75 percent by weight will be of such size as to pass the 1" sieve and be retained on the 3/8" sieve.

Type "C" (Coarse Graded Surface Course):
Bin No. 1 - will contain aggregates of which 85 to 100 percent by weight will pass the No. 10 sieve.
Bin No. 2 - will contain aggregates of which at least 80 percent by weight will be of such size as to pass the 3/8" sieve and be retained on the No. 10 sieve.
Bin No. 3 - will contain aggregates of which at least 80 percent by weight will be of such size as to pass the 1/2" sieve and be retained on the No. 4 sieve.
Bin No. 4 - will contain aggregates of which at least 80 percent by weight will be of such size as to pass the 1" sieve and be retained on the 3/8" sieve.

Type "D" (Fine Graded Surface Course):
Bin No. 1 - will contain aggregates of which 85 to 100 percent by weight will pass the No. 10 sieve.
Bin No. 2 - will contain aggregates of which at least 80 percent by weight will be of such size as to pass the 3/8" sieve and be retained on the No. 10 sieve.
Bin No. 3 - will contain aggregates of which at least 75 percent by weight will be of such size as to pass the 1/2" sieve and be retained on the No. 4 sieve.

Type "E" (Sheet Asphalt Surface Course):
Bin No. 1 - will contain aggregates of which 85 to 100 percent by weight will pass the No. 10 sieve.
Bin No. 2 - will contain aggregates of which at least 70 percent by weight will be of such size as to pass the No. 4 sieve and be retained on the No. 10 sieve.

Type "F" (Non-Skid Surface Course):
Bin No. 1 - will contain aggregates of which 85 to 100 percent by weight will pass the No. 10 sieve.
Bin No. 2 - will contain aggregates of which at least 75 percent by weight will be of such size as to pass the 3/8" sieve and be retained on the No. 10 sieve.

Type "G" (Coarse Graded Surface Course):

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

Bin No. 2 - will contain aggregates of which at least 80 percent by weight will be of such size as to pass the 3/8" sieve and be retained on the No. 10 sieve.

Bin No. 3 - will contain aggregates of which at least 80 percent by weight will be of such size as to pass the 1/2" sieve and be retained on the No. 4 sieve.

Bin No. 4 - will contain aggregates of which at least 80 percent by weight will be of such size as to pass the 1" sieve and be retained on the 3/8" sieve.

Type "H" (Fine Graded Surface Course):

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

Bin No. 2 - will contain aggregates of which at least 80 percent by weight will be of such size as to pass the 3/8" sieve and be retained on the No. 10 sieve.

Bin No. 3 - will contain aggregates of which at least 75 percent by weight will be of such size as to pass the 1/2" sieve and be retained on the No. 4 sieve.

Article 340.4. Equipment Subarticle (1) Mixing Plants Section (a) Weight-Batching Type: The subsection Cold Aggregate Bin and Proportioning Device is supplemented by the following:

Unless otherwise indicated on the plans, this device will not be required if the mineral aggregate is composed entirely of iron ore topsoil.

Article 340.4. Equipment Subarticle (1) Mixing Plants Section (a) Weight-Batching Type: The second paragraph of the subsection Aggregate Material Bucket and Scales is voided and replaced by the following:

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

Article 340.4. Equipment Subarticle (1) Mixing Plants Section (b) Continuous Mixing Type: The subsection Asphaltic Material Meter is voided and not replaced.

Article 340.4. Equipment Subarticle (3) Spreading and Finishing Machine is voided and replaced by the following:

The spreading and finishing machine shall be of a type approved by the Engineer, shall be capable of producing a surface that will meet the requirements of the typical cross section and the surface test, when required, and shall have adequate power to propel the delivery vehicles in a satisfactory manner when the mixture is dumped into the finishing machine. The finishing machine shall be equipped with a flexible spring and/or hydraulic type hitch sufficient in design and capacity to maintain contact between the rear wheels of the hauling equipment and the pusher roller of the finishing machine while the mixture is being unloaded.

Any vehicle which the finishing machine cannot push or propel in such a manner as to obtain the desired lines and grade without resorting to hand finishing will not be allowed to dump directly into the finishing machine. Vehicles of the semi-trailer type are specifically prohibited from dumping directly into the finishing machine. Vehicles dumping into the finishing machine shall be so designed and equipped that unloading into the finishing machine can be mechanically and/or automatically operated in such a manner that overloading the finishing machine being used cannot occur and the required line and grade will be obtained without resorting to hand finishing.

Dumping of the asphaltic mixture in a windrow and then placing the mixture in the finishing machine with loading equipment will be permitted provided that the loading equipment is constructed and operated in such manner that substantially all of the mixture deposited on the roadbed is picked up and placed in the finishing machine without contamination by foreign material of the mixture. The loading equipment will be so designed and operated that the finishing machine being loaded will obtain the required line, grade and surface without resorting to hand finishing. Any operation of the loading equipment resulting in the accumulation and subsequent shedding of this accumulated material into the asphaltic mixture will not be permitted.

Article 340.4. Equipment Subarticle (11) Straightedges and Templates is voided and replaced by the following:

When directed by the Engineer, the Contractor shall provide acceptable 10-foot straightedges for surface testing. Satisfactory templates shall be provided as required by the Engineer.

Article 340.4. Equipment Subarticle (5) Motor Grader is supplemented by the following:

On courses applied with a blade, a motor grader shall be provided. A windrow evener box may be required for quantity control on level up courses when directed by the engineer in writing.

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

If the aggregates are stored or stockpiled, they shall be handled in such a manner to prevent segregation, the mixing of the various materials or sizes, and contamination with foreign materials.

Slight variations in grading from that of the preliminary design in each aggregate can be expected to occur during stockpiling, which will affect the grading of the plant produced mixture. A departure from the preliminary grading of the aggregates for stockpiled material may be accepted provided that a mixture can be produced which will be within the applicable requirements of the specifications. Fluctuation from preliminary grading of any aggregate proposed or stockpiled may be cause for rejection of material if in the opinion of the Engineer undue changes would be required to be made to any designated grading of mineral aggregate and/or asphalt content of the mixture.

Article 340.6. Construction Methods. The first paragraph is supplemented 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(5) of this specification after being dumped from the mixer and prior to placing all or any part of the load may be rejected and payment will not be made for the rejected material.

Article 340.6. Construction Methods. Subarticle (2) Tack Coat is voided and replaced by the following:

Before the asphaltic mixture is laid, the surface upon which the tack coat is to be placed shall be cleaned thoroughly to the satisfaction of the Engineer. The surface shall be given a uniform application of tack coat using ashpeltic materials of this specification. This tack coat shall be applied, as directed by the Engineer, with an approved sprayer at a rate of not to exceed 0.10 gallon per square yard of surface. Where the mixture will adhere to the surface on which it is to be placed without the use of a tack coat, the tack coat may be eliminated by the Engineer. All contact surfaces of curbs and structures and all joints shall be painted with a thin uniform coat of the asphaltic material meeting the requirements for tack coat. The tack coat shall be rolled with a pneumatic tire roller as directed by the Engineer.

Article 340.6. Construction Methods Subarticle (5) Compacting. Section (b) is voided and replaced by the following:

Rolling with the three wheel and tandem rollers shall start longitudinally at the sides and proceed toward the center of the pavement, overlapping on successive trips by at least half the width of the rear wheels unless otherwise directed by the Engineer. Alternate trips of the roller shall be slightly different in length. On super-elevated curves, rolling shall begin at the low side and progress toward the high side unless otherwise directed by the Engineer. Rolling with pneumatic tire roller shall be done as directed by the Engineer. Rolling shall be continued until no further compression can be obtained and all roller marks are eliminated. One tandem roller, one pneumatic tire roller, and at least one three-wheel roller, as specified above shall be provided for each job. If the Contractor elects he may substitute the three axle tandem roller for the two axle tandem roller and/or the three wheel roller; but in no case shall less than three rollers be in use on each job. Additional rollers shall be provided if needed. The motion of the roller shall be slow enough at all times to avoid displacement of the mixture. If any displacement occurs, it shall be corrected at once by the use of rakes and of fresh mixture where required. The roller shall not be allowed to stand on pavement which has not been fully compacted. To prevent adhesion of the surface mixture to the roller, the wheels shall be kept thoroughly moistened with water, but an excess of water will not be permitted. All rollers must be in good mechanical condition. Necessary precautions shall be taken to prevent the dropping of gasoline, oil, grease, or other foreign matter on the pavement, either when the rollers are in operation or when standing.

The thickness of each course of asphaltic concrete shall not exceed the depth beyond which thorough compaction can be obtained with the rolling equipment in use. The Engineer will be the judge of the results obtained in the compaction of the asphaltic mixture, and may require the depth of compacted material to be reduced to the extent required to obtain thorough compaction. However, the depth of the

compacted material shall not be less than one inch except where the existing imperfections in grade line and/or traverse slope of the short sections of the roadbed can be improved by reducing the specified minimum thickness of a course or where courses of lesser thickness are indicated on the plans.

Article 340.6. Construction Methods Subarticle (6) Surface Tests is voided and replaced by the following:

The surface of the pavement, after compression, shall be smooth and true to the established line, grade, and cross section, and when tested with a 10-foot straightedge placed parallel to the center line of the roadway or tested by other equivalent and acceptable means, except as provided herein, the maximum deviation shall not exceed 1/8 inch in 10 feet, and any point in the surface not meeting this requirement shall be corrected as directed by the Engineer. When placed on existing surfaces, the 1/8 inch deviation in 10 feet requirement may be waived by the Engineer.

If, in the opinion of the Engineer, after application of the level up course or courses shown on the plans, an acceptable profile and/or section is not accomplished over short sections due to existing extreme irregularity of pavement surface, the Contractor will be required to apply an additional level up course or courses with compensation to be made under the provisions for payment of this item.

Article 340.6. Construction Methods Subarticle (7) Opening to Traffic is supplemented by the following:

If the surface ravels, it will be the Contractor's responsibility to correct this condition at his expense.

Article 340.7. Measurement. Subarticle (1) is voided and replaced by the following:

(1) 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 shall 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 in pounds
G_a = Average specific gravity of three molded specimen as prepared by Test Method Tex-206-F and determined in accordance with Test Metohd Tex-207-F.

The weight "W", if mixing is done by a continuous mixer, will be determined by truck scales. 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.