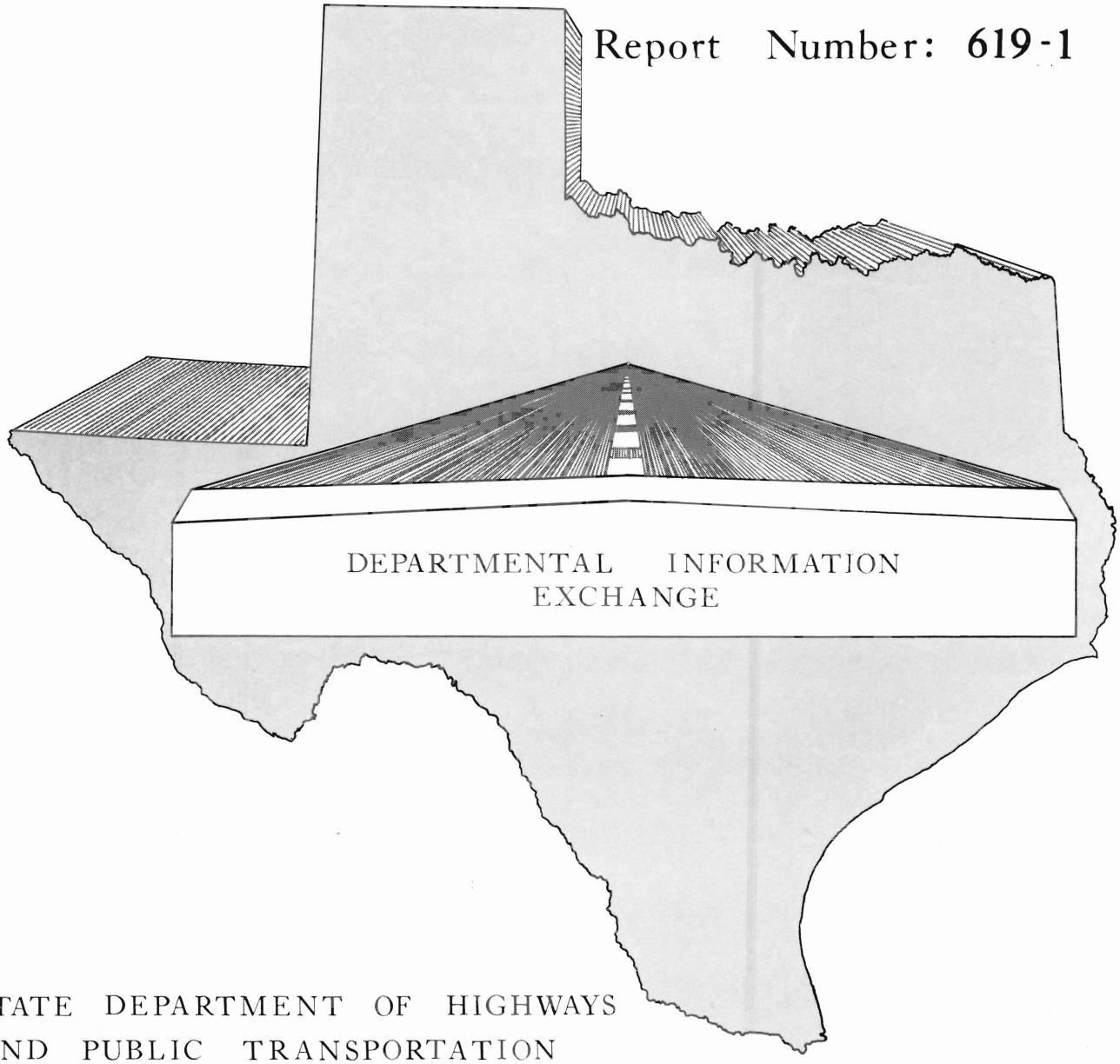
EXPERIMENTAL PROJECTS

EXPERIMENTAL PAVEMENT OVERLAYS

Report Number: 619-1



STATE DEPARTMENT OF HIGHWAYS
AND PUBLIC TRANSPORTATION

EXPERIMENTAL PAVEMENT OVERLAYS

consisting of

ITEM 340, "Type D" Sandstone Mix

ITEM 340, "Type D", Sandstone-Limestone Blend Mix

placed on

IH 410, Control 521, Section 4

Bexar County, Texas

A NARRATIVE REPORT

Report 619-1

Prepared by District 15 Laboratory

Donald J. Frye, Supv. Lab. Engineer

May, 1976

DISCLAIMER STATEMENT

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

A NARRATIVE REPORT

In District 15 we have felt for some time that Hot Mix Pavements, of good skid resistant surface qualities, could be constructed by blending a polish resistant aggregate with locally produced limestone aggregates.

Our initial effort along these lines was in December, 1974, and January, 1975 when we placed varicus Lightweight-Limestone Blend Mixes on F.M. 1604, Project C 73-5-38, Bexar County. We have monitored these mixes with the Skid Trailer and at this date find that we still have acceptable skid values on these experimental pavement sections.

Still seeking a more economical skid resistant surface, we have recently become interested in a sandstone aggregate which is now potentially available to our District. Through a cooperative effort involving the Department, Cloud Paving Co., Inc., and Vulcan Materials Co., we placed Experimental Pavement Overlays on two bridges in San Antonio, Texas, on February 25, 1976. The purpose of this work was to compare a Sandstone Hot Mix and a Sandstone-Limestone Blend Hot Mix.

The bridges selected for the overlay treatment were those spanning the Leon Creek, on IH 410, between W. Commerce St. and Culebra Rd. Approximately $2\frac{1}{2}$ months before they were overlayed, both bridges received a double seal coat using EA-HVRS Emulsion (0.2 Gal/SY) and Limestone Rock Asphalt Aggregate PB-4 was used as the cover aggregate.

The Westbound Structure, Str. No. 521-4-19-52, received a 3/4" overlay of

Item 340, "Ty.D", Sandstone Mix, and the Eastbound Structure, Str. No. 521-4-66-52, received a 3/4" overlay of Item 340, "Ty.D", Sandstone-Limestone Blend Mix.

Using sandstone aggregates, both coarse and fine, as produced by the Cloud Co., we then ran a series of mixes with varying percentages of AC-10 Asphalt. We selected 6.75% AC-10 as the optimum asphalt content which gave a Density of 93.8% and a Hveem Stability of 44%. We noted that all of these batches were tender and indicated a need for some limestone dust which would make for a tougher mixture.

We then proceeded to develop the specifications by which these asphalt mixtures would be produced. In doing so, we gave consideration to the special sizing of aggregate used in the Polish Value Test, namely material passing the 1/2" sieve and retained on the No. 4 sieve. This size material apparently imparts the majority of the skid resistance value to a completed pavement surface. These specifications are included herein as Attachments No. 1 & 2.

The Cloud Co then hauled sandstone material to the Vulcan Plant where it was crushed, screened and sized. Vulcan Co. later produced the mixes.

Additional testing and design work then followed. The sandstone aggregate had a Polish Value of 41. Due to being crushed and screened through a different plant, both the plus No. 10 Mesh and minus No. 10 Mesh sizes of sandstone aggregate had a slightly different screen analysis than the original samples. The Asphalt vs. Density Curve also showed higher densities at lower asphalt contents than the original design data. Design

Data for both mixes are included herein as Attachments No. 3 & 4.

We had anticipated placing 125 tons of each mixture. However, due to crushing and handling operations, by the time we got to production, it was estimated that we had enough sandstone aggregate for only 100 Tons of each mixture. This limited quantity of materials kept us from running trial batches through the Vulcan Plant. We ran hot bin screen analyses, made corrections in bin weights and proceeded to produce the mixtures.

The Sandstone Mix was placed on the Westbound Structure and the Sandstone-Limestone Blend Mix was placed on the Eastbound Structure. The day was cool and windy with the temperature at about 65° F. throughout the paving operations. Compaction operations were done with a double-drum vibratory roller (rolling static at all times due to rolling on the bridge decks) and a pneumatic roller. Both mixes were tougher than anticipated. Placed at 310°F, they did not shove or crawl during compaction operations. Screen Analysis data of both mixes is included herein as Attachments 5 & 6. The Density and Stability data from the production runs is included herein as Attachment No. 7.

The Materials and Tests Laboratory, File D-9, currently has a Research Project underway entitled, "Polishing Characteristics of Laboratory Molded and Field Placed Bituminous Mixes". To assist them in this work we submitted 9 extra Hveem Stability Molded Specimens of each of the two mixtures. Coupons were obtained from these specimens and the Polish Values were then obtained. These results are included as Attachment No. 8.

The method of determining Polish Value of Hveem Stability Specimens and Pavement Core Specimens is contained in D-9 Research Report No. 3-20-75-068(1), "Preliminary Study In The Development Of A Method For Evaluating The Relative Polishing Characteristics of Bituminous Paving Mixtures", dated September, 1975.

To further assist D-9 Laboratory in this on-going study, on March 17, 1976, we obtained 4" diameter cores of each of the pavement mixtures f the overlay sections on the bridges. These cores were taken from the right wheel path of the outside lane of each structure, thus leaving t left wheel path available for skid testing without the probability of the surface of that left wheel path being contaminated by tack coat fro patching the core holes. Coupons were taken from these cores, tested for Polish Value, and the results are shown on Attachment No. 9.

Specifications and Plan Notes currently used in District 15 require a Polish Value of not less than 35 for the coarse aggregate of an asphalt surface course; however, if the coarse aggregate is a blended aggregate, a Polish Value of not less than 37 is required. We had more than met this requirement on the Sandstone-Limestone Blend Mix, having obtained a Polish Value of 41 with a blend of No. 4 Sandstone and # 6 Limestone. Could a more economical blend be obtained by using No. 4 Sandstone and # 5 Limestone? There was a possibility of some producers wanting to go this direction, if possible; therefore, we decided to find the answer. We had Polish Values run on various blends of Cloud Co. Grade 4 Sandstone

and Vulcan Co. Grade 5 Limestone. These results are shown as Attachment No. 10.

In evaluating the data shown on Attachment No. 10, it must be recognized that the various blends were of the minus 1/2", plus #4 sizes only. Applying this to our Blend Mix: We had a total of 39.3% (say 40%) minus 1/2", plus #4 material in the mix. Therefore, 70% of 40% = 28% of this size Sandstone in the total batch that would result in a passing Polish Value of 38. This may, or may not, be a more economical design. It would probably depend upon how a producer wanted to handle his materials. While it would conform to the required Polish Value, whether or not such a blend would give as high Skid Values as did our own blend would only be conjecture on our part at this time.

The Skid History of this work, along with the Traffic Analysis of Loop 410 at this work site is presented on Attachment No. 11.

We had been concerned over the decrease in Skid Values until we analyzed the traffic, type of traffic and another factor, namely, road film. A large number of tractor-trailer hauling units cross these structures carrying sand, gravel, and base materials from nearby sources. These could very well contribute to the deposit of road film on the pavements. On May 25, 1976 a hard rain fell in this area and apparently washed the pavements clean because the Skid Values that we obtained on the morning of May 26, 1976 came back up.

We believe that we have accomplished the intent of these two experimental pavement sections. We feel that we have proven that a Sandstone-Limestone

Blend Mix will be skid resistant, economical in today's market, and of a long life. We recognize that we could probably improve the surface texture by a more open graded mix design and will attempt to accomplish that on future work in our area.

The Skid Values of these pavements will continue to be monitored and reported by means of an updated Attachment No. 11.

Suggested Specifications for Experimental Limestone and Sandstone Blended Hot Mix, Item 340, Type "D"

Article 340.2 Materials, (a) Coarse Aggregate, par. 1:

For this experimental work, subject paragraph 1 is deleted and replaced with the following: "Coarse Aggregate" shall be that part of the aggregate retained on the No. 10 sieve and shall consist only of a mixture of crushed limestone rock and crushed particles of hard, fine grained sandstone. It is the intent that the Coarse Aggregate shall contain not more than 50% (by wt.) of crushed sandstone. The crushed sandstone shall have a "Polish Value" of not less than 40 and shall conform to the following grading requirements.

Passing 1/2" Sieve, Retained 3/8" Sieve 0-15%
Passing 3/8" Sieve, Retained No. 4 Sieve 85-100%

Article 340.2 Materials (b) Fine Aggregate, par. 1:

For this experimental work, subject paragraph 1 is deleted and replaced with the following: "Fine Aggregate" shall be that part of the aggregate passing the No. 10 sieve and shall consist of sandstone screenings, silica sand, and/or limestone rock screenings.

Article 340.3 Paving Mixtures, (4) Sampling and Testing Density:

For this experimental work, Density requirements are changed to read as follows: "Minimum Density 93%, Maximum Density 98%, Optimum Density 95.5%.

Attachment No. 1

Suggested Specifications for Experimental Sandstone Hot Mix, Item 340, Type "D".

Article 340.2 Materials, (a) Coarse Aggregate, par. 1:

For this experimental work, subject paragraph 1 is deleted and replaced with the following: "Coarse Aggregate"shall be that part of the aggregate retained on the No. 10 sieve and shall consist only of crushed particles of hard, fine grained sandstone. The coarse aggregate shall have a "Polish Value" of not less than 40."

Article 340.2 Materials, (b) Fine Aggregate, par. 1:

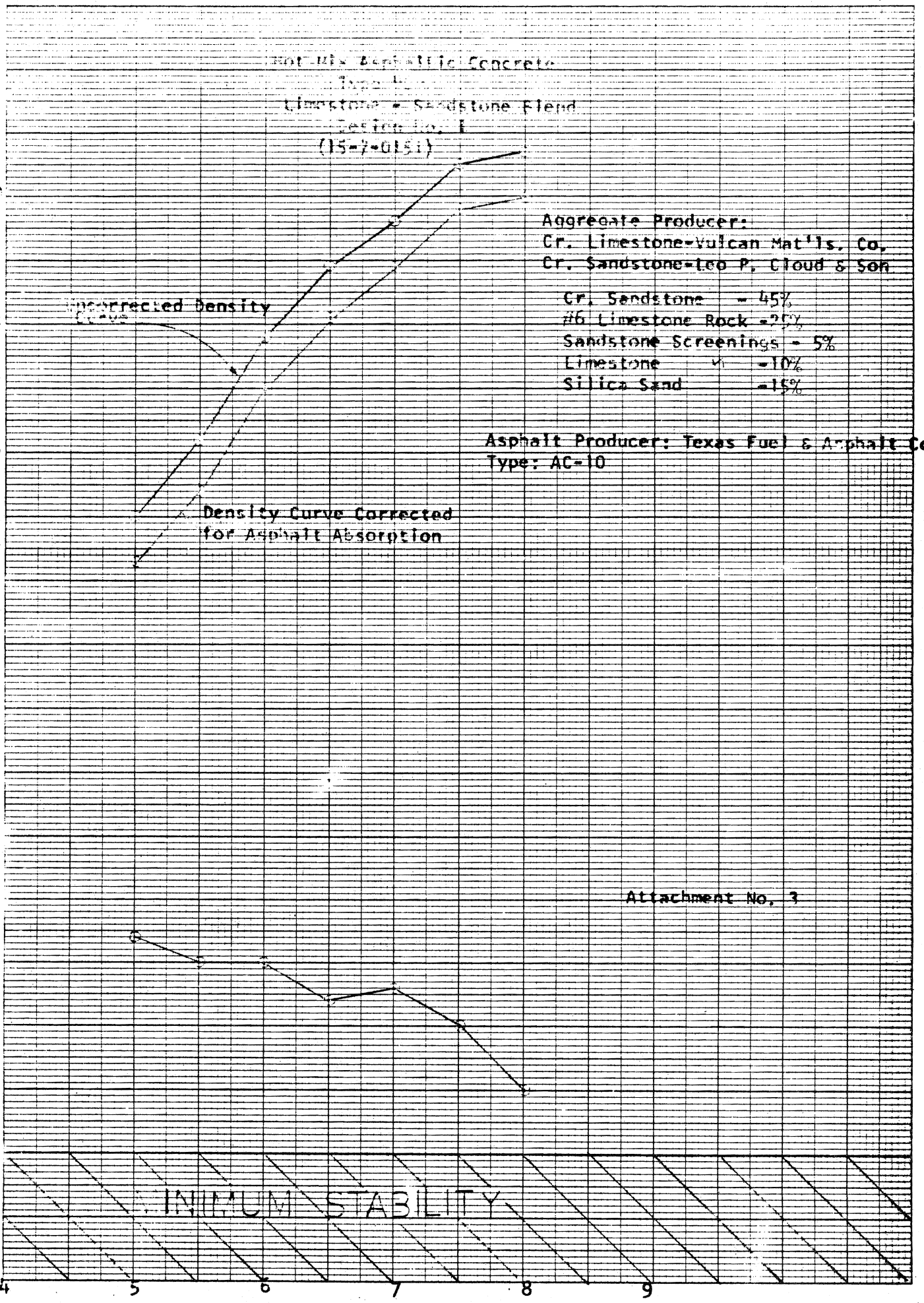
For this experimental work, subject paragraph 1 is deleted and replaced with the following: "Fine Aggregate" shall be that part of the aggregate passing the No. 10 sieve and shall consist of sandstone screenings, silica sand, and/or limestone rock screenings."

Article 340.3 Paving Mixtures (4) Sampling and Testing Density

For this experimental work, density requirements are changed to read as follows: Minimum Density 92%, Maximum Density 96%, Optimum Density 94%.

Attachment No. 2

Hot Mix Asphaltic Concrete
Type C
Limestone - Sandstone Blend
Design No. 1
(15-7-015)



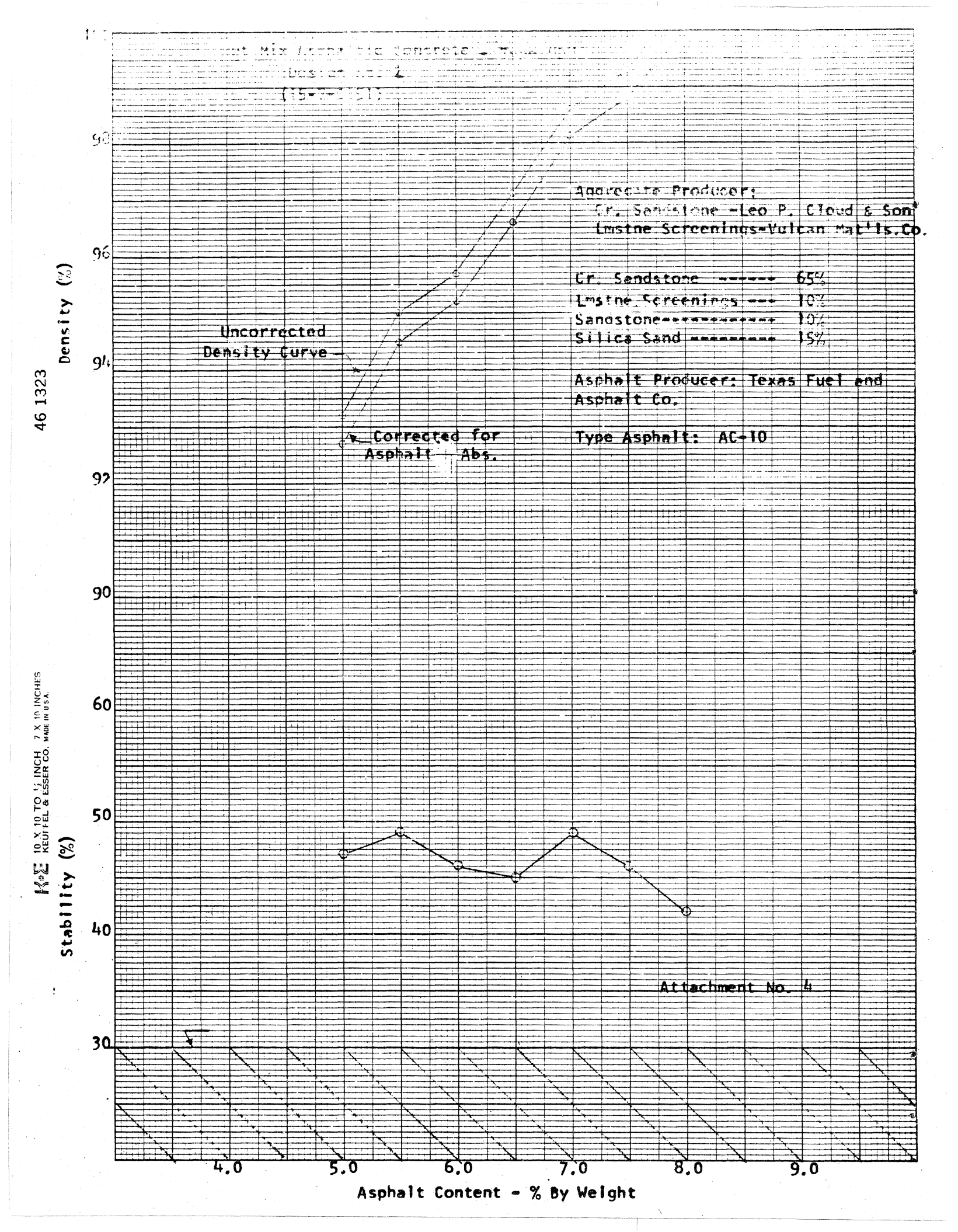
Aggregate Producer:
Cr. Limestone-Vulcan Mat'ls. Co.
Cr. Sandstone-Leo P. Cloud & Son

Cr. Sandstone - 45%
#6 Limestone Rock - 25%
Sandstone Screenings - 5%
Limestone " - 10%
Silica Sand - 15%

Asphalt Producer: Texas Fuel & Asphalt Co.
Type: AC-10

Attachment No. 3

INIMUM STABILITY


Density (%)
Stability (%)
Asphalt Content - % By Weight
4.0
5.0
6.0
7.0
8.0
9.0
90
92
94
96
30
40
50
60
Uncorrected Density Curve
Corrected for Asphalt Abs.
Aggregate Producer:
Cr. Sandstone -Leo P. Cloud & Son
Lmstne Screenings-Vulcan Mat'ls.Co.
Cr. Sandstone ------ 65%
Lmstne Screenings --- 10%
Sandstone---------- 10%
Silica Sand -------- 15%
Asphalt Producer: Texas Fuel and Asphalt Co.
Type Asphalt: AC-10
Attachment No. 4
46 1323
10 X 10 TO ½ INCH 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

MATERIALS AND TESTS DIVISION
BITUMINOUS SECTION
SIEVE ANALYSIS

Date	District No. 15
Time	Req. No.
Spec. Item No. 340	Project No. I 410-012-13-200
Type "D"	Design No. "D" Sandstone Blend Mix

Bin #1 = 34.6 % ; Bin #2 = 20.4 % ; Bin #3 = 39.4 %

SIEVE ANALYSIS, % BY WEIGHT											
Sieve Size	Car No.	Car No.	Car No.	Car No.	~~Car No.~~ Actual Grading Analysis	Car No.	Car No.	~~Car No.~~ Design Grading	Car No.	Car No.	T.H.D. Specs. 340 Ty "D"
Pass											
Pass 1/2"					100 %			100 %			100 %
~~3/4" — 7/8"~~											
1/2 ~~3/8~~" — 3/8"					0.4			2.6			0-5
~~5/8" — 3/8"~~											
3/8" — No.4					33.4			36.7			20-50
~~1/4" — No.4~~											
~~1/4" — No.10~~											
No.4 — No.10					30.3			25.3			10-30
Ret. No.10					64.1			64.5			50-70
No.10 — No.40					9.0			12.6			0-30
No.40 — No.80					15.8			11.0			4-25
No.80 — No.200					4.8			3.2			3-25
Pass No.200					0.7			3.0			0-6
Total					94.4			94.4			
Asphalt Added					5.6			5.6			4-8

Attachment No. 5

Inspector

Form No. D-9-F23

MATERIALS AND TESTS DIVISION
BITUMINOUS SECTION
SIEVE ANALYSIS

Date	District No. 15
Time	Req. No.
Spec. Item No. 340	Project No. I 410-012-13-200
Type "D"	Design No. "D" Sandstone Mix

Bin #1 = 33.0% ; Bin #2 = 21.5 % ; Bin #3 = 39.3%

SIEVE ANALYSIS, % BY WEIGHT											
Sieve Size	Car No.	Car No.	Car No.	Car No.	~~Car No.~~ Schaal Grading, Sandstone	Car No.	Car No.	~~Car No.~~ Design Grading	Car No.	Car No.	T.H.D. Specs. 340 Ty "D"
Pass											
Pass 1/2"					100%			100%			100 %
~~1 1/4" – 1/2"~~											
1/2" – 3/8"					0.8			4.1			0-5
~~5/8" – 3/8"~~											
3/8" – No.4					35.7			36.1			20-50
~~1/4" – No.4~~											
~~1/4" – No.10~~											
No.4 – No.10					26.7			23.4			10-30
Ret. No.10					63.2			63.6			50-70
No.10 – No.40					9.9			13.1			0-30
No.40 – No.80					14.5			11.6			4-25
No.80 – No.200					5.5			3.3			3-25
Pass No.200					0.7			2.2			0-6
Total					93.8			93.8			
Asphalt Added					6.2			6.2			4-8

Attachment No. 6

Inspector

Form No. D-9-F23

STATE DEPARTMENT OF
HIGHWAYS AND PUBLIC TRANSPORTATION
DIVISION OF MATERIALS AND TESTS
AUSTIN, TEXAS 78703

ASPHALTIC CONCRETE STABILITY REPORT

Attachment No. 7

PAGE 1 OF 1 D-9 CHARGES $18.00

LABORATORY NO.-H76400837 & H76400838 CONTRACT NO.-AUTHACCT ( )
DATE RECEIVED-03/01/76 REPORTED-03/01/76- 2.43 PM SAMPLED-2-25-76
DIST. OR RES. ENGR.-W.B. COLLIER
ADDRESS-SAN ANTONIO CONT.- PD-
CONTRACTOR-LEO P. CLOUD, JR. & SONS
SAMPLER-M. HAGG CO.-BEXAR HWY-I-410
SAMPLED FROM-TRUCK
ASPH PRODUCER-SEE NOTE 1 PROJ. NO.-15-7-015I-0410-12-13
TYPE-AC-10 & -200
AGGR PRODUCER-VULCAN MATLS, DIST.-15 REQ. NO.-
SAN ANTONIO SPEC. ITEM NO.-340
TYPE-D

LABORATORY NUMBER	SPEC. NO.	IDENT. MARKS	COHESIOMETER VALUE (AVG.)	ASPHALT (% BY WT.)	SPEC. HT. (IN.)	SPEC. DENS. FIELD (AVG. %)	HVEEM STABILITY (%)	HVEEM STABILITY (AVG. %)	
						LAB. DENSITY			
H76400837	1	V-1			2.01		45		
	2	V-2		5.3	2.01	96.8	46	46	SANOSTONE BLEND MIX
	3	V-3			2.02		46		
H76400838	1	V-2			2.01		43		
	2	V-3		6.1	2.02	95.4	43	43	SANOSTONE MIX
	3	V-4			2.02		43		

NOTE 1 ASPHALT PRODUCER-TEXAS FUEL & ASPHALT CO., INC.

FIG. 2

DISTRICT 15 SANDSTONE AND SANDSTONE/LIMESTONE BLENDS
HMAC RATE-OF-POLISH STUDY

Project 15-7-015, PD0410, C12-13-200
IH 410 Leon Crk. Bridge Overlay
(Hveem Samples)

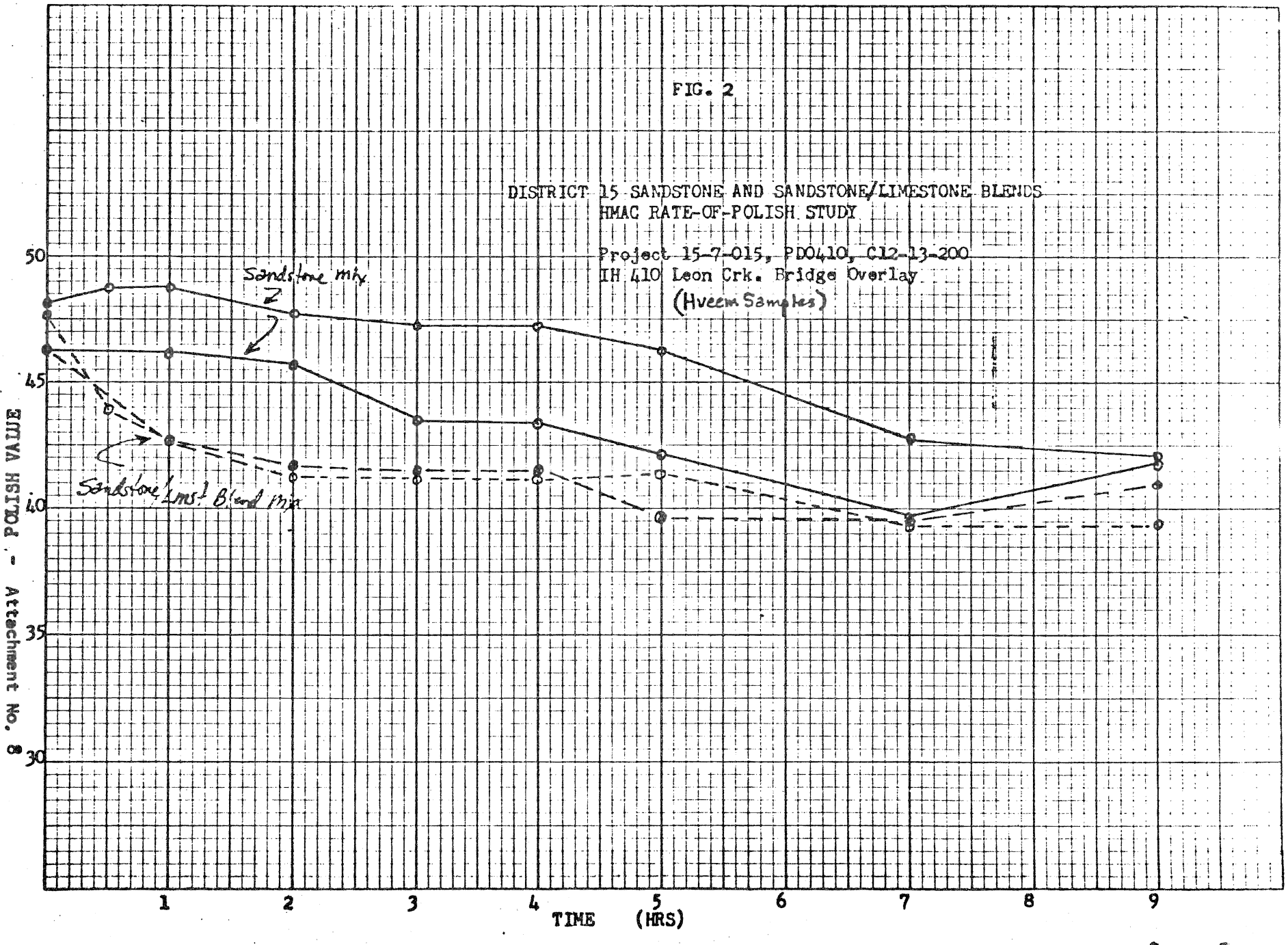
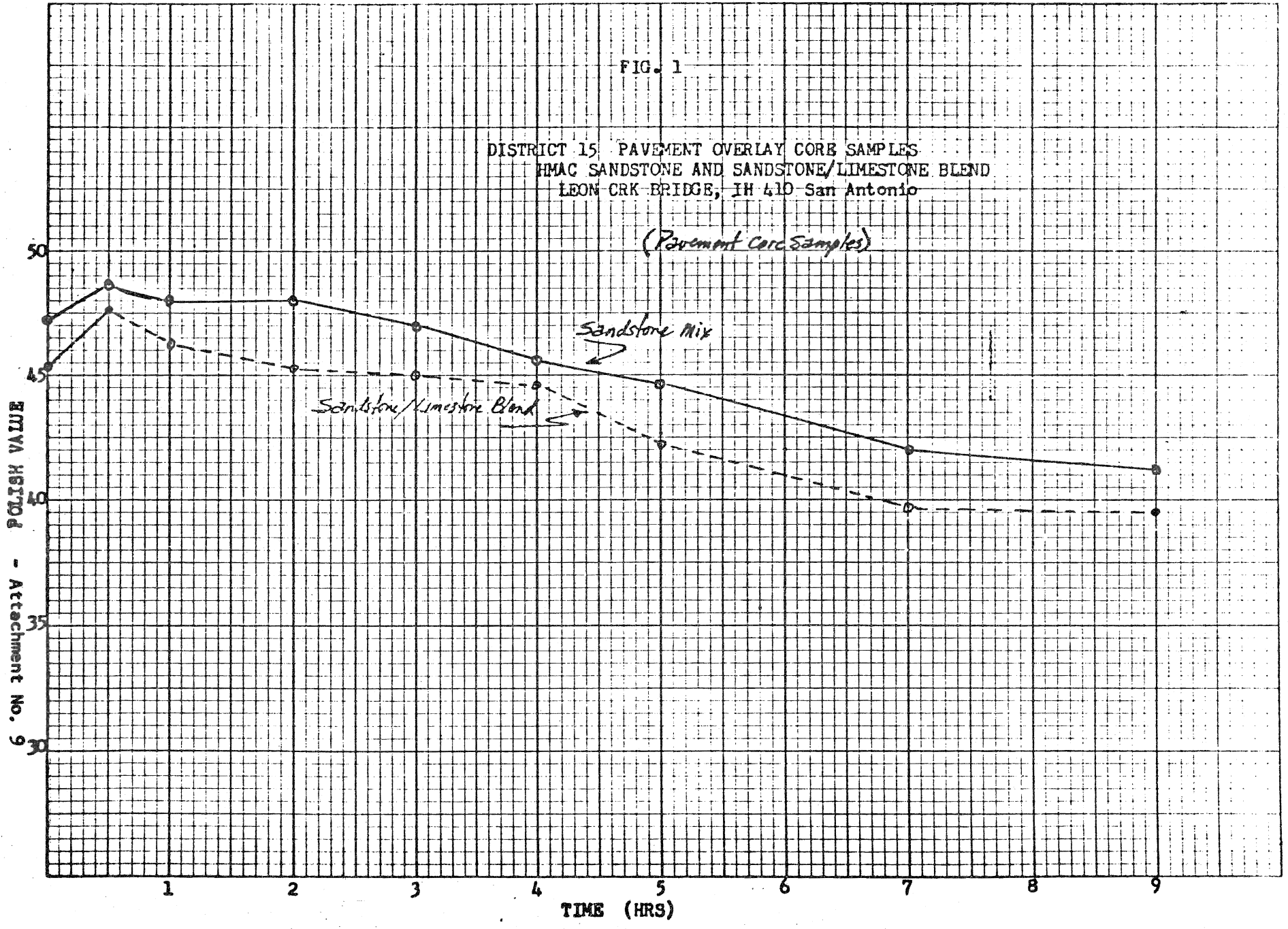


FIG. 1

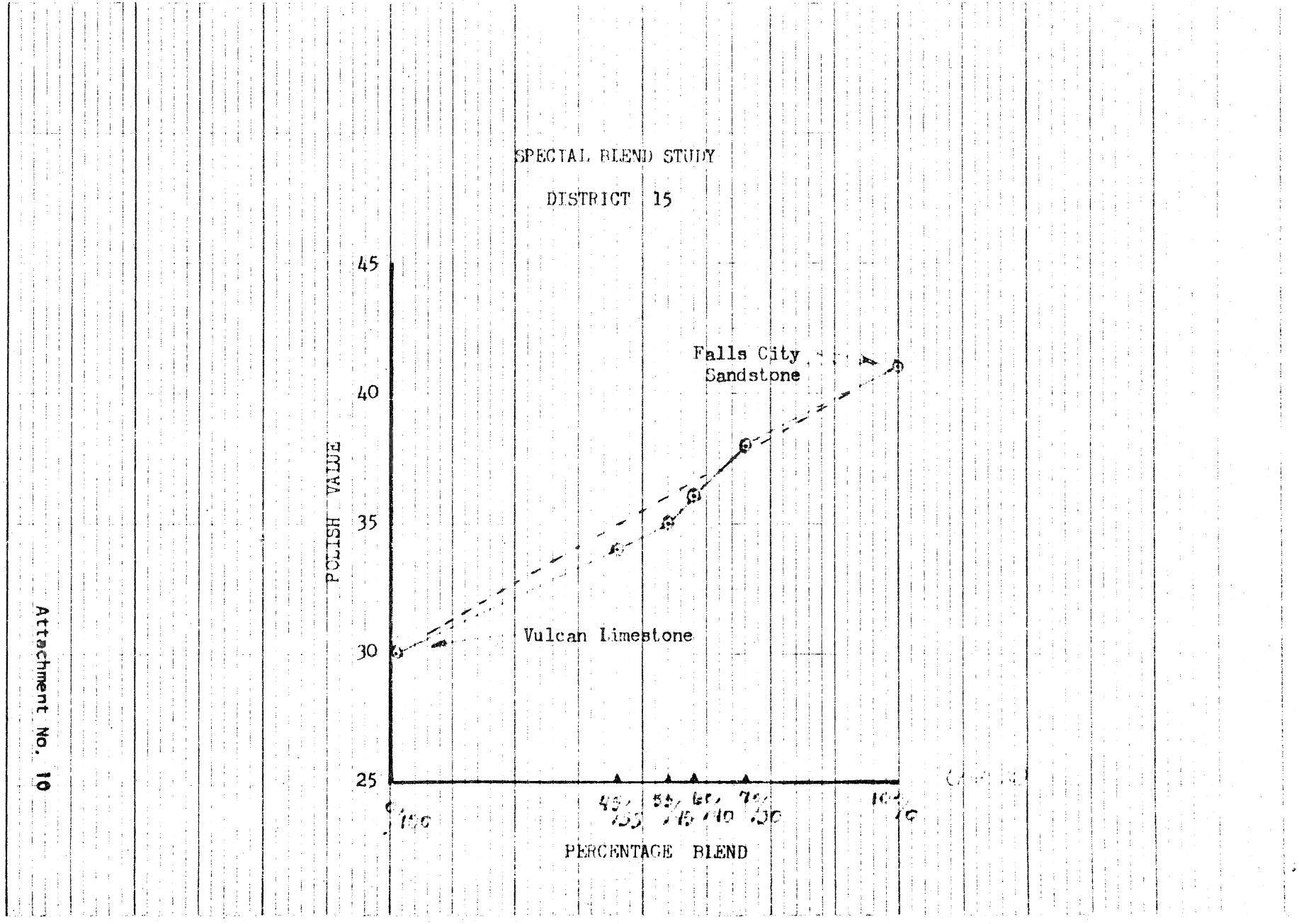
DISTRICT 15 PAVEMENT OVERLAY CORE SAMPLES
HMAC SANDSTONE AND SANDSTONE/LIMESTONE BLEND
LEON CRK BRIDGE, IH 410 San Antonio

(Pavement Core Samples)



Attachment No. 9

Attachment No. 10



SKID HISTORY

Sandstone Mix: Westbound Structure, 2-25-76

	Date Skidded				
	3-3-76	4-9-76	4-27-76	5-10-76	5-26-76
Lane 'A Average	51	47	44	50	50
Lane 'B' Average	51	47	43	46	50

Sandstone-Limestone Blend Mix: Eastbound Structure, 2-25-76

	Date Skidded				
	3-3-76	4-9-76	4-27-76	5-10-76	5-26-76
Lane 'A Average	51	45	42	45	46
Lane 'B' Average	48	42	37	39	42

Average Daily Traffic - 34,290 (1974)

Westbound Daily Traffic = 17,145 (est.)
Westbound Lane 'A' = 7,040 (est.)
Westbound Lane 'B' = 10,105 (actual count 5-76)

Eastbound Daily Traffic = 17,145 (est.)
Eastbound Lane 'A' = 6,065 (est.)
Eastbound Lane 'B' = 11,080 (actual count 5-76)

Attachment No. 11