ANTISTRIPPING ADDITIVES IN LIEU OF MINERAL FILLERS IN ASPHALTIC CONCRETE MIXTURES

Final Report

by

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RESEARCH REPORT NO. 88
RESEARCH PROJECT NO. 72-3B(B)
LOUISIANA HPR 1(12)

Conducted by
LOUISIANA DEPARTMENT OF HIGHWAYS
Research and Development Section
In Cooperation with
U. S. Department of Transportation
FEDERAL HIGHWAY ADMINISTRATION

April 1975

IMPLEMENTATION

The Department should consider specifying the use of antistripping additives for certain North Louisiana aggregate-asphalt mixtures. Although such a requirement may increase the cost of asphalt cement by 1.5 cents per gallon (0.4 cents per liter) the resulting mixtures would minimize certain pavement problems associated with stripping conditions. Table 4 can be used as guidelines for specifying the asphalt-aggregate combination that would require antistripping additives.

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INTRODUCTION

Mineral fillers in asphaltic concrete are used primarily to fill voids in the mineral aggregate and thereby create a dense mix. The filler also tends to increase the stability of the mix, and to some extent, act as an antistripping agent, depending on the quantity of filler used. On the other hand, the brittleness and tendency of the mix to dry out and crack in service can be attributed, to some degree, to the presence of filler. This coupled with the problem of stripping of asphalt from the aggregate, directed attention towards the use of antistripping additives in lieu of mineral fillers to provide the desired hot mix characteristics comparable to those obtained with mineral fillers. This report, then, is concerned with the laboratory evaluation of mixes with mineral fillers and those with antistripping additive in place of mineral fillers.

OBJECTIVES AND SCOPE

The major objective of the study was to determine the feasibility of specifying antistripping additives in lieu of mineral fillers in asphaltic concrete mixtures using Marshall Test and visual observation of stripping characteristics as criteria.

The scope of the study was confined to wearing course type sand-gravel mixtures with aggregate from two geographical sources and the asphalts from six major sources generally used in the State.

METHOD OF PROCEDURE

Mixes were prepared with zero-, two-percent and five percent mineral filler and with no filler and an antistripping additive. These mixes were prepared in the laboratory at predetermined optimum asphalt content according to the Marshall Method of Mix Design (LDH TR 303). Thus, for each aggregate-asphalt combination four mixes were prepared, making a total of 48 mixes for both aggregate sources. The antistripping additive was a commercial brand from the Department's Qualified Product's List. The percentage of additive was based on past experience and was added to the asphalt cement on weight basis. The various mixes were evaluated using the following criteria:

1. Marshall Stability and Flow (LDH TR 305)
2. Percent Voids in Total Mix (LDH TR 304)
3. Index of Retained Marshall Stability of Immersed Specimen (LDH TR 313)
4. Visual Stripping Characteristic

The stripping of asphalt from aggregate surfaces was evaluated by subjecting the various mixes to the action of boiling water for ten minutes. The extent of stripping was determined by visual observation of the stripped aggregate particles after the boiling period. A brief outline of this method of test appears in the Appendix.

DISCUSSION OF RESULTS

Marshall Test Properties

Tables 1 and 2 list the average test data for the two aggregate sources used in the study. Figures 1 through 6 show graphical relationships of these data for each asphalt source. Data averaged for each filler content is also indicated in these figures. Although the relationships are ill defined, the data in the tables and figures warrant the following comments:

1. In general, use of an antistripping additive and no mineral filler may result in loss of stability and density expressed as percent voids (Figures 1 through 4).

2. The index of retained strength does not seem to indicate any detrimental effect of water on the mixes without mineral filler (Figures 5 and 6). However, this index may be a function of aggregate source as is indicated by the higher magnitude of retained strength for one source over the other.

Visual Stripping Evaluation

The stripping test was performed according to the test outlined in the Appendix. The various mixes were then evaluated by a panel of raters. The criteria was the extent of asphalt stripped from aggregate particles. The average rating scale for each mix is indicated in the last column of Tables 1 and 2. The rating scale of 1 indicates none to very slight stripping and the scale of 5 indicates an extreme stripping condition. On the basis of this subjective rating scale, the following comments seem justified:

1. Presence of mineral fillers do tend to minimize stripping of asphalt from aggregate surface. Likewise, addition of antistripping additive minimizes this stripping for some asphalt aggregate mixtures. This is readily seen by reduction in a rating scale for mixes with additive from those with no filler and no additive.

2. In general, mixes containing North Louisiana aggregate exhibit a greater stripping condition than the corresponding mixes made with South Louisiana aggregate.

3. Regardless of the aggregate source, certain asphalts seem to contribute to the stripping characteristics of these mixtures. This is evident for mixes containing asphalt designated as "C" in the Tables.

Extended Stripping Evaluation

On the basis of the above findings, it was decided to broaden the scope of the stripping phase of the evaluation by including various sources of aggregates generally used in the State in asphaltic concrete construction. Samples from eleven sources of aggregates, five from South Louisiana and six from the North, were obtained for this evaluation. The fraction passing 3/8-inch sieve and retained on No. 4 was used in the test.

Asphalt cements generally used in North Louisiana were used with that area's aggregates and those used in South Louisiana were paired with the corresponding Southern sources. The grades were AC-40 and AC-20. The X's in Table 3 indicate the various asphalt-aggregate combinations described above. For each asphalt-aggregate combination two mixes were prepared, one without the additive and one with 0.5 percent additive. The asphalt content was four percent. The prepared mixes were immersed in a 60°C water bath for 10 minutes, after which time they were subjectively evaluated for stripping using a scale of 1 to 5 as defined previously.

Table 4 is a recapitulation of the stripping evaluation. In this table, the X's and the O's, for AC-40 and AC-20, respectively, indicate excessive stripping for that asphalt-aggregate combination. The blanks indicate no stripping to very slight stripping. The data in this table reinforces the trend observed in the previous section, namely that:

1. The North Louisiana aggregate are more prone to stripping than the corresponding South Louisiana aggregate.

2. Asphalt "C" seems to have an adverse effect on all North Louisiana aggregate with some aggregate in the group requiring as much as 1.0 percent additive to prevent stripping.

SUMMARY, CONCLUSIONS & RECOMMENDATIONS

In the previous sections an attempt was made to discuss the comparative evaluation of some major sources of sand-gravel-asphalt mixtures with and without mineral fillers, and with antistripping additives in place of mineral fillers, using Marshall Test and visual stripping characteristics as criteria for evaluation. On the basis of this evaluation, the following conclusions and recommendations seem warranted and are within the constraints of the materials and test procedures used in the study:

1. Absence of mineral fillers in asphaltic concrete mixtures may result in loss of stability and density (expressed as percent voids). Furthermore, since mineral fillers do tend to minimize stripping of asphalt from the aggregate surface, it does not seem feasible, at this time, to recommend replacement of mineral fillers with antistripping additives only.

2. In general, mixes made with North Louisiana aggregates exhibit a greater stripping condition than the corresponding mixes containing South Louisiana aggregates.

3. Regardless of the aggregate source, certain asphalts tend to contribute to the stripping characteristics of mixtures.

4. On the basis of (2) and (3) above, it is recommended that the Department specify the use of 0.5 percent antistripping additive by weight of asphalt cement for certain North Louisiana asphalt-aggregate combination in asphaltic concrete. Table 4 can be used as a guideline for determining the asphalt-aggregate-quantity of additive combination for specification purposes. Specifying such treatment will, however, add to the cost of asphalt cement by approximately 1.5 cents per gallon or 0.4 cents per liter.

5. It is also recommended that the stripping test described in the Appendix be used whenever questionable asphalt-aggregate mixtures (with regard to stripping characteristics) are encountered.

TABLE 1: Average Marshall Test Data for North Louisiana Aggregate

OBS	SRC	AC %	MF %	ADT %	SGC gm/cc	%THEOR	VDS %	SGI gm/cc	STBC lb	FLC	STBI lb	FLI	STBRTD %	SWL %	ABS %	RATE
1	E	4.5	0	.0	2.312	93.8	6.2	2.311	1455	7	1435	10	98.6	.2	.6	3
2	E	4.5	2	.0	2.326	94.4	5.6	2.329	1492	7	1472	13	98.6	.2	.6	1
3	E	4.5	5	.0	2.357	95.6	4.4	2.357	1814	7	1473	7	81.2	.1	.7	1
4	E	4.5	0	.5	2.321	94.1	5.9	2.321	1468	7	1286	7	87.6	.1	.7	2
5	M	4.5	0	.0	2.309	93.7	6.3	2.309	1742	11	1523	12	87.4	.1	.6	3
6	M	4.5	2	.0	2.325	94.3	5.7	2.327	1662	12	1565	12	94.2	.2	.8	2
7	M	4.5	5	.0	2.351	95.4	4.6	2.351	1582	7	1617	9	102.3	.0	.5	2
8	M	4.5	0	.5	2.310	93.7	6.3	2.311	1622	7	1482	8	91.3	.1	.6	2
9	L	4.5	0	.0	2.319	94.1	5.9	2.318	1633	6	1388	5	85.0	.0	.4	4
10	L	4.5	2	.0	2.330	94.5	5.5	2.329	1737	7	1388	9	79.9	.0	.6	2
11	L	4.5	5	.0	2.358	95.7	4.3	2.358	1869	7	1636	9	87.5	.0	.5	2
12	L	4.5	0	.5	2.320	94.1	5.9	2.322	1336	6	1735	8	129.8	.1	.5	1
13	T	4.5	0	.0	2.313	93.8	6.2	2.311	1752	6	1556	7	88.8	.0	.5	3
14	T	4.5	2	.0	2.331	94.6	5.4	2.331	1832	7	1482	8	80.9	.1	.5	3
15	T	4.5	5	.0	2.359	95.7	4.3	2.364	1666	8	1744	12	104.7	.2	.4	3
16	T	4.5	0	.5	2.317	94.0	6.0	2.318	1409	6	1446	11	102.6	.0	.5	1
17	C	4.5	0	.0	2.336	94.8	5.2	2.334	1524	7	1409	13	92.5	.3	.5	4
18	C	4.5	2	.0	2.351	95.4	4.6	2.351	1520	8	1431	14	94.2	.3	.5	2
19	C	4.5	5	.0	2.359	95.7	4.3	2.358	1560	13	1516	8	97.2	.0	.5	2
20	C	4.5	0	.5	2.330	94.5	5.5	2.328	1549	13	1487	8	96.0	.0	.6	2
21	S	4.5	0	.0	2.331	94.6	5.4	2.325	1674	8	1290	8	77.0	.6	.7	4
22	S	4.5	2	.0	2.345	95.1	4.9	2.343	1537	9	1461	10	95.1	.3	.6	2
23	S	4.5	5	.0	2.355	95.6	4.4	2.356	1642	8	1636	9	99.7	.4	.7	2
24	S	4.5	0	.5	2.318	94.0	6.0	2.321	1305	6	1305	10	100.0	.3	.7	1

SRC - ASPHALT SOURCE
MF - MINERAL FILLER
SGC - SPECIFIC GRAVITY OF CONTROL SPECIMEN
VDS - VOIDS
STBC - STABILITY OF CONTROL SPECIMEN
STBI - STABILITY OF IMMERSED SPECIMEN
STBRTD - STABILITY RETAINED
ABS - ABSORPTION

AC - ASPHALT CONTENT
ADT - ADDITIVE
THEOR - THEORETIC GRAVITY
SGI - SPECIFIC GRAVITY OF IMMERSED SPECIMEN
FLC - FLOW OF CONTROL SPECIMEN
FLI - FLOW OF IMMERSED SPECIMEN
SWL - SWELL

TABLE 2: Average Marshall Test Data for South Louisiana Aggregate

OBS	SRC	AC %	MF %	ADT %	SGC gm/cc	%THEOR	VDS %	SGI gm/cc	STBC lb	FLC	STBI lb	FLI	STBRTD %	SWL %	ABS %	RATE
1	E	5.5	0	.0	2.305	94.8	5.2	2.304	1378	7	1404	9	101.9	.3	.5	2
2	E	5.5	2	.0	2.306	95.2	4.8	2.537	1238	12	1149	13	92.9	.3	.4	1
3	E	5.5	5	.0	2.279	94.6	5.4	2.278	1625	13	1453	11	89.4	.1	.8	1
4	E	5.5	0	.5	2.307	94.9	5.1	2.308	1274	11	1300	9	102.1	.0	.3	1
5	M	5.5	0	.0	2.301	94.7	5.3	2.299	1435	8	1383	9	96.4	.0	.5	2
6	M	5.5	2	.0	2.306	95.2	4.8	2.306	1253	12	1373	13	109.5	.2	.5	1
7	M	5.5	5	.0	2.289	95.0	5.0	2.290	1460	12	1382	11	94.7	.0	.5	1
8	M	5.5	0	.5	2.304	94.8	5.2	2.305	1253	11	1321	7	105.4	.0	.4	1
9	L	5.5	0	.0	2.301	94.6	5.4	2.301	1331	8	1561	12	118.8	.1	.4	3
10	L	5.5	2	.0	2.308	95.3	4.7	2.309	1055	11	1446	14	137.0	.2	.4	2
11	L	5.5	5	.0	2.281	94.6	5.4	2.281	1522	9	1526	8	100.2	.0	.6	2
12	L	5.5	0	.5	2.301	94.6	5.4	2.299	1279	8	1321	7	103.2	.0	.4	2
13	T	5.5	0	.0	2.299	94.6	5.4	2.300	1367	8	1598	9	116.9	.1	.4	2
14	T	5.5	2	.0	2.310	95.4	4.6	2.309	1258	9	1336	12	106.2	.2	.5	2
15	T	5.5	5	.0	2.281	94.6	5.4	2.281	1575	10	1615	9	102.5	.3	.9	1
16	T	5.5	0	.5	2.301	94.7	5.3	2.300	1497	10	1503	9	100.4	.1	.4	1
17	C	5.5	0	.0	2.305	94.8	5.2	2.305	1331	9	1456	9	109.4	.2	.4	4
18	C	5.5	2	.0	2.306	95.2	4.8	2.305	1102	13	1316	12	119.4	.2	.4	3
19	C	5.5	5	.0	2.287	94.9	5.1	2.287	1253	12	1455	13	116.1	.0	.5	3
20	C	5.5	0	.5	2.293	94.3	5.7	2.294	1257	10	1335	7	106.2	.0	.4	2
21	S	5.5	0	.0	2.287	94.1	5.9	2.286	1339	8	1597	11	119.3	.0	.6	2
22	S	5.5	2	.0	2.308	95.3	4.7	2.308	1331	12	1520	14	114.2	.1	.5	2
23	S	5.5	5	.0	2.275	94.4	5.6	2.276	1513	9	1586	13	104.8	.0	.7	1
24	S	5.5	0	.5	2.301	94.7	5.3	2.299	1513	9	1586	13	104.8	.0	.5	1

SRC - ASPHALT SOURCE
MF - MINERAL FILLER
SGC - SPECIFIC GRAVITY OF CONTROL SPECIMEN
VDS - VOIDS
STBC - STABILITY OF CONTROL SPECIMEN
STBI - STABILITY OF IMMERSED SPECIMEN
STBRTD - STABILITY RETAINED
ABS - ABSORPTION

AC - ASPHALT CONTENT
ADT - ADDITIVE
THEOR - THEORETIC GRAVITY
SGI - SPECIFIC GRAVITY OF IMMERSED SPECIMEN
FLC - FLOW OF CONTROL SPECIMEN
FLI - FLOW OF IMMERSED SPECIMEN
SWL - SWELL

```
XXXXXXXXXXXXXXXXXXXXXXXXX
X                       X
X     GROUP MEANS:      X
X                       X
X 0   0% FILLER    1630 X
X 2   2% FILLER    1630 X
X 5   5% FILLER    1689 X
X A .5% ADDITIVE   1448 X
X                       X
XXXXXXXXXXXXXXXXXXXXXXXXX
```

```
1900+
    I                                55
    I                                55
    I      55                        55        22
1800+      55                        55        22
    I      55                        55        22
    I      55      00              2255      0022
    I      55      00              2255      0022
1700+      55      00              2255      0022
    I      55      00              2255      002255
    I      55      0022            2255      002255                  00  55
    I      55      0022  AA      002255      002255                  00  55
1600+      55      0022  AA      002255      002255                  00  55
    I      55      002255AA      002255      002255                  00  55
    I      55      002255AA      002255      002255        55        002255
    I      55      002255AA      002255      002255    002255AA      002255
1500+    2255      002255AA      002255      002255    002255AA      002255
    I    2255AA    002255AA      002255      002255    002255AA      002255
    I  002255AA    002255AA      002255      002255    002255AA      002255
    I  002255AA    002255AA      002255      002255    002255AA      002255
1400+  002255AA    002255AA      002255      002255AA  002255AA      002255
    I  002255AA    002255AA      002255      002255AA  002255AA      002255
    I  002255AA    002255AA      002255AA    002255AA  002255AA      002255
    I  002255AA    002255AA      002255AA    002255AA  002255AA      002255
1300+  002255AA    002255AA      002255AA    002255AA  002255AA      002255AA
    I  002255AA    002255AA      002255AA    002255AA  002255AA      002255AA
    I  002255AA    002255AA      002255AA    002255AA  002255AA      002255AA
    I  002255AA    002255AA      002255AA    002255AA  002255AA      002255AA
1200+  002255AA    002255AA      002255AA    002255AA  002255AA      002255AA
    I  002255AA    002255AA      002255AA    002255AA  002255AA      002255AA
    I  002255AA    002255AA      002255AA    002255AA  002255AA      002255AA
    I  002255AA    002255AA      002255AA    002255AA  002255AA      002255AA
    +----------------------------------------------------------------------------

          E           M             L           T          C             S

                               ASPHALT SOURCE
```

MARSHALL STABILITY, LB.

FIGURE 1: Marshall Stability at Different Filler Contents and Various Asphalt Sources Using North Louisiana Aggregate

```
XXXXXXXXXXXXXXXXXXXXXXXX
X                      X
X     GROUP MEANS:     X
X                      X
X 0  0% FILLER     1364 X
X 2  2% FILLER     1206 X
X 5  5% FILLER     1491 X
X A .5% ADDITIVE   1346 X
X                      X
XXXXXXXXXXXXXXXXXXXXXXXX
```

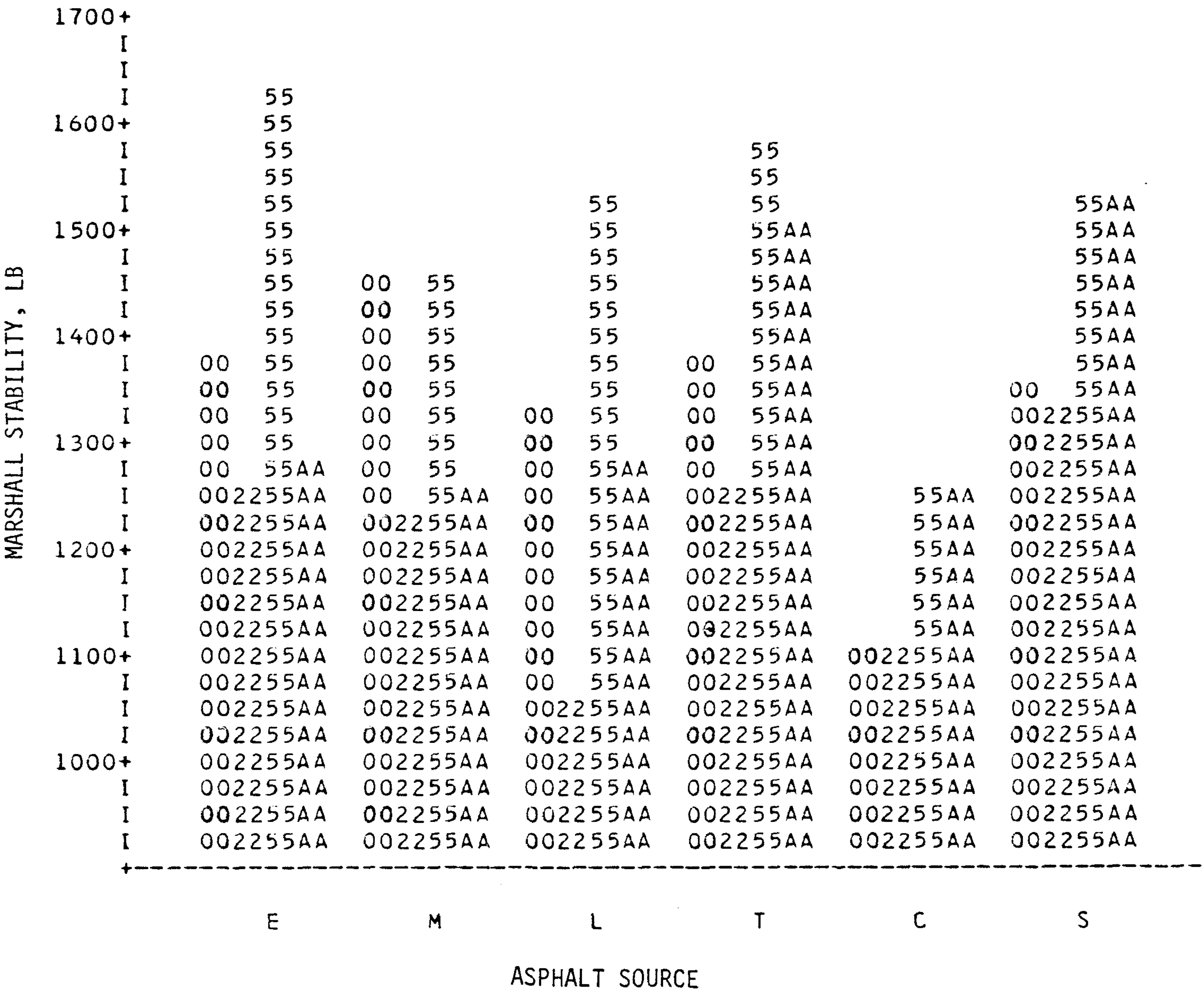

FIGURE 2: Marshall Stability at Different Filler Contents and Various Asphalt Sources Using South Louisiana Aggregate

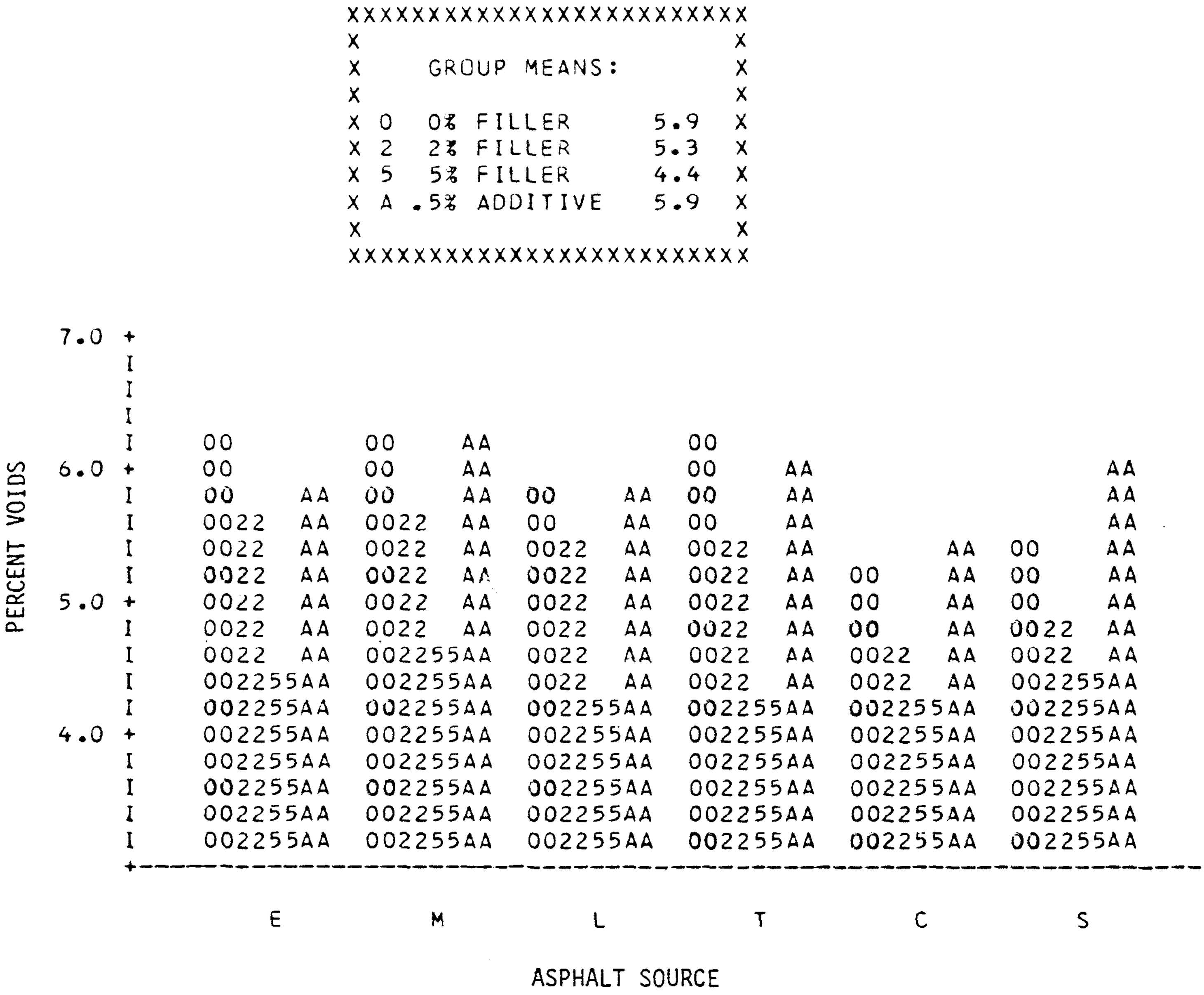

FIGURE 3: Percent Voids at Different Filler Contents and Various Asphalt Sources Using North Louisiana Aggregate

```
XXXXXXXXXXXXXXXXXXXXXXXXX
X                       X
X     GROUP MEANS:      X
X                       X
X 0   0% FILLER     5.4 X
X 2   2% FILLER     4.7 X
X 5   5% FILLER     5.3 X
X A .5% ADDITIVE    5.3 X
X                       X
XXXXXXXXXXXXXXXXXXXXXXXXX
```

```
6.0 +
    I                                                      00
    I                                                      00
    I                                                AA    00
    I                                                AA    00  55
5.5 +                                                AA    00  55
    I        55                  00  55AA  00  55          AA  00  55
    I        55    00            00  55AA  00  55AA        AA  00  55AA
    I    00  55    00    AA      00  55AA  00  55AA  00    AA  00  55AA
    I    00  55AA  00    AA      00  55AA  00  55AA  00  55AA  00  55AA
5.0 +    00  55AA  00  55AA      00  55AA  00  55AA  00  55AA  00  55AA
    I    00  55AA  00  55AA      00  55AA  00  55AA  00  55AA  00  55AA
    I    002255AA  002255AA      00  55AA  00  55AA  002255AA  00  55AA
    I    002255AA  002255AA      002255AA  00  55AA  002255AA  002255AA
    I    002255AA  002255AA      002255AA  002255AA  002255AA  002255AA
4.5 +    002255AA  002255AA      002255AA  002255AA  002255AA  002255AA
    I    002255AA  002255AA      002255AA  002255AA  002255AA  002255AA
    I    002255AA  002255AA      002255AA  002255AA  002255AA  002255AA
    I    002255AA  002255AA      002255AA  002255AA  002255AA  002255AA
    I    002255AA  002255AA      002255AA  002255AA  002255AA  002255AA
    +-------------------------------------------------------------------

             E         M             L         T         C         S

                               ASPHALT SOURCE
```

PERCENT VOIDS

FIGURE 4: Percent Voids at Different Filler Contents and Various Asphalt Sources Using South Louisiana Aggregate

GROUP MEANS:		% STABILITY RETAINED	% SWELL	% ABSORPTION
0% FILLER	0	88.2	0.20	0.55
2% FILLER	2	90.5	0.18	0.60
5% FILLER	5	95.4	0.12	0.55
.5% ADDITIVE	A	101.2	0.10	0.60

PERCENT STABILITY RETAINED

```
130 +                              AA
    I                              AA
    I                              AA
    I                              AA
120 +                              AA
    I                              AA
    I                              AA
    I                              AA
110 +                              AA
    I                              AA
    I                              AA      55
    I                  55          AA      55AA
100 +                  55          AA      55AA                55AA
    I    0022          55          AA      55AA      55        55AA
    I    0022        2255          AA      55AA    2255AA    2255AA
    I    0022        2255          AA      55AA  002255AA    2255AA
 90 +    0022        2255AA        AA  00  55AA  002255AA    2255AA
    I    0022  AA  002255AA      55AA  00  55AA  002255AA    2255AA
    I    0022  AA  002255AA  00  55AA  00  55AA  002255AA    2255AA
    I    0022  AA  002255AA  00  55AA  00  55AA  002255AA    2255AA
 80 +    002255AA  002255AA  002255AA  002255AA  002255AA    2255AA
    I    002255AA  002255AA  002255AA  002255AA  002255AA  002255AA
    I    002255AA  002255AA  002255AA  002255AA  002255AA  002255AA
    I    002255AA  002255AA  002255AA  002255AA  002255AA  002255AA
 70 +    002255AA  002255AA  002255AA  002255AA  002255AA  002255AA
    I    002255AA  002255AA  002255AA  002255AA  002255AA  002255AA
    I    002255AA  002255AA  002255AA  002255AA  002255AA  002255AA
    I    002255AA  002255AA  002255AA  002255AA  002255AA  002255AA
    +-------------------------------------------------------------------

             E         M         L         T         C         S
```

ASPHALT SOURCE

FIGURE 5: Index of Retained Strength for North Louisiana Aggregate

GROUP MEANS:		% STABILITY RETAINED	% SWELL	% ABSORPTION
0% FILLER	0	110.4	0.12	0.47
2% FILLER	2	113.2	0.20	0.45
5% FILLER	5	101.3	0.07	0.67
.5% ADDITIVE	A	103.7	0.02	0.40

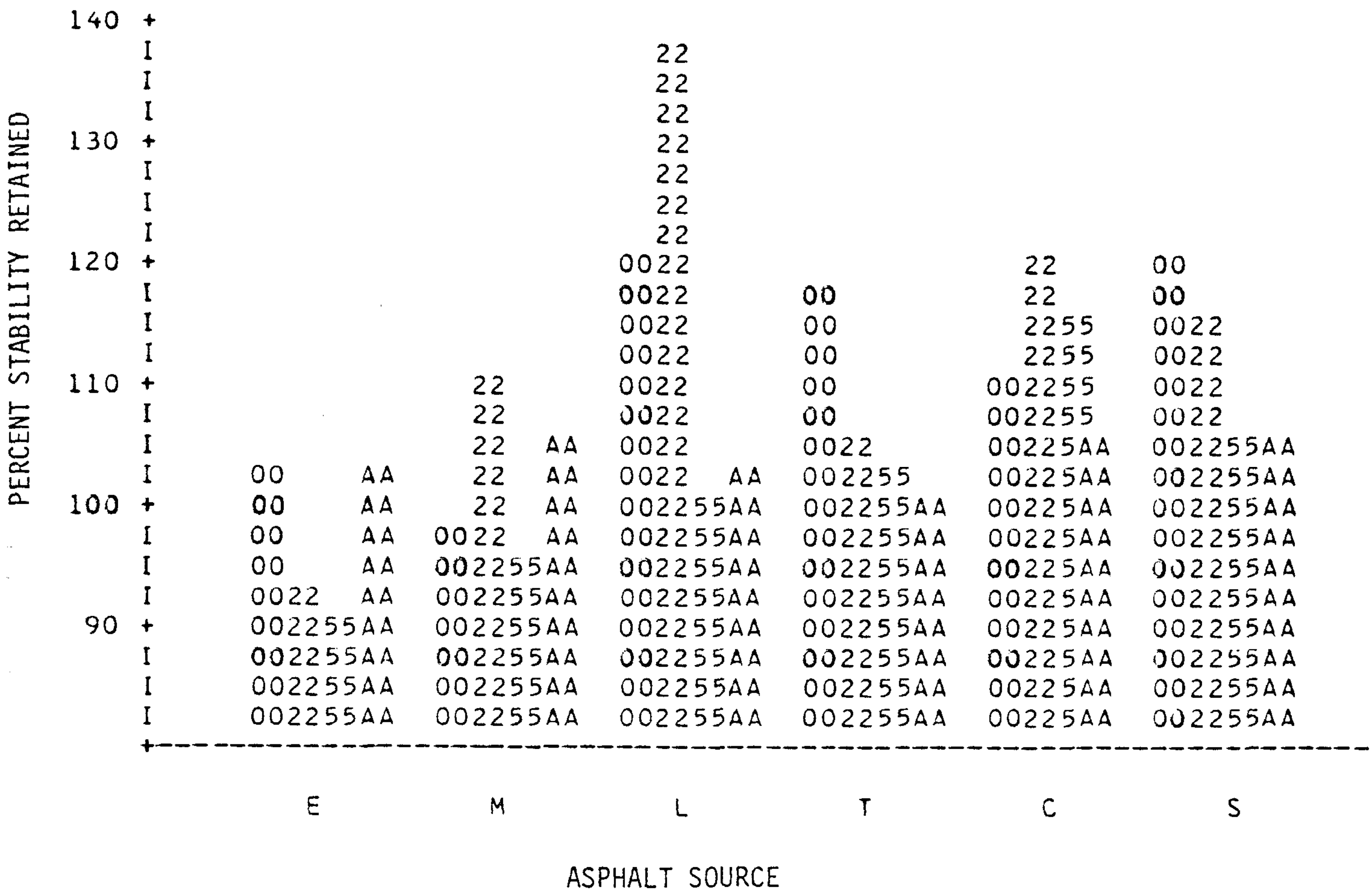

FIGURE 6: Index of Retained Strength for South Louisiana Aggregate

TABLE 3: Various Combinations of Asphalt-Aggregate Mixes Used in Stripping Evaluation

ASPHALT SOURCE / AGGREGATE SOURCE	E	M	L	T	C	S	SND
SOUTH LA							
ROGERS (62)	XX						XX
WA CORE(62)	XX						XX
PLANT3 (61)							
TRINITY(07)	XX			XX		XX	
GIFFORD(07)	XX			XX		XX	
NORTH LA							
LA INDUST(05)		XX	XX		XX		XX
LA INDUST(08)	XX	XX	XX	XX	XX	XX	
MID STATE(08)	XX	XX	XX	XX	XX	XX	
WINFORD (04)		XX	XX		XX		
MADDEN (04)		XX	XX		XX		
RUNYON (05)		XX	XX		XX		XX

TABLE 4: Combination of Asphalt-Aggregate-Additive Mixes Showing Excessive Stripping

ASPHALT SOURCE	E		M		L		T		C			S		SND	
ADDITIVE, %	NA	.5	NA	.5	NA	.5	NA	.5	NA	.5	1.	NA	.5	NA	.5
AGGREGATE SOURCE															
SOUTH LA															
ROGERS (62)	XX														
WA CORE(62)															
PLANT3 (61)															
TRINITY(07)															
GIFFORD(07)															
NORTH LA															
LA INDUST(05)			XX		XX				XX	XX				XX	
LA INDUST(05)			OO						OO	OO					
LA INDUST(08)									XX						
LA INDUST(08)									OO						
MID STATE(08)			XX		XX				XX						
MID STATE(08)									OO						
WINFORD (04)			XX						XX	XX					
WINFORD (04)			OO						OO						
MADDEN (04)									XX						
MADDEN (04)									OO						
RUNYON (05)									XX	XX				XX	
RUNYON (05)			OO						OO	OO				OO	

NOTE: XX=AC-40, OO=AC-20, NA=NO ADDITIVE
NUMBERS IN PARENTHESES REPRESENT DISTRICT NUMBERS

APPENDIX

BRIEF OUTLINE OF METHOD OF TEST FOR DETERMINATION OR LOSS OF ADHESION (STRIPPING) OF ASPHALT-AGGREGATE MIXTURES

1. SCOPE:

This method is intended for the determination of Loss of Adhesion between asphalt and aggregate due to water. The asphalt-aggregate mixtures may be either plant mixed or laboratory mixed. The method is also applicable for evaluation of anti-strip additives in the asphalt-aggregate mixtures. The Loss of Adhesion, if any, is determined subjectively by visually observing the proportion of stripped aggregate particles.

2. APPARATUS:

a. Constant temperature electric oven, capable of maintaining temperatures within ± 5° F.
b. Balance - having a capacity of approximately 2 kilograms or more and sensitive to 1 gram or less.
c. Sufficient number of pots, pans, etc.
d. Other appurtenant equipment such as a dial thermometer, gloves, etc.

3. PROCEDURE:

I. Evaluation of Asphalt-Aggregate Mixtures.

a. Preparation of Mix

In the Laboratory, prepare the mix at the desired asphalt content according to LDH Test Method-TR 303-71, (through Section 6(d)). After the introduction of the asphalt, mix the components thoroughly either with a spoon or a mechanical mixer.

b. Strip Test

Transfer the loose mixture prepared above in a pot or beaker of boiling water. Boil the mixture for 10 minutes. Drain the water and empty the contents on a white paper towel.

c. Determination of Stripping

The extent of stripping is indicated by visually observing the proportion of stripped aggregate particles. The stripping is rated subjectively and should be no more than five percent.

II. Evaluation of Anti-Strip Additives

The same procedure as described under 3(a) is followed except that an anti-strip additive, 0.5% by weight of the asphalt cement, is added to the asphalt cement during heating and prior to adding to the aggregate. The strip test 3(b) is then performed on this mixture.

The test as described above is applicable when the asphalt aggregate mixture indicates stripping characteristics. In such cases anti-strip additive may be used to determine if the additive tends to alleviate the problem.