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JANUARY 1973

FINAL REPORT
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EVALUATION OF GAP-GRADED ASPHALT CONCRETE MIXTURES PART III: APPENDIX

Iowa Highway Research Board
Project HR-157

ERI Project 900-S

Prepared in cooperation with the
Iowa State Highway Commission
and the U. S. Department of Transportation
Federal Highway Administration

ENGINEERING RESEARCH INSTITUTE
IOWA STATE UNIVERSITY
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III: APPENDIX

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The opinions, findings, and conclusions expressed in this publication are those of the author, and not necessarily those of the Iowa State Highway Commission or of the United States Department of Transportation, Federal Highway Administration.

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16. Abstract

This report presents the results of a comparative laboratory study between well- and gap-graded aggregates used in asphalt concrete paving mixtures. A total of 424 batches of asphalt concrete mixtures and 3,960 Marshall and Hveem specimens were examined.

There is strong evidence from this investigation that, with proper combinations of aggregates and asphalts, both continuous- and gap-graded aggregates can produce mixtures of high density and of qualities meeting current design criteria. There is also reason to believe that the unqualified acceptance of some supposedly desirable, constant, mathematical relationship between adjacent particle sizes of the form such as Fuller's curve $p = 100\ (d/D)^n$ is not justified. It is recommended that the aggregate grading limits be relaxed or eliminated and that the acceptance or rejection of an aggregate for use in asphalt pavement be based on individual mixture evaluation.

Furthermore, because of the potential attractiveness of gap-graded asphalt concrete in cost, quality, and skid and wear resistance, selected gap-graded mixtures are recommended for further tests both in the laboratory and in the field, especially in regard to ease of compaction and skid and wear resistance.

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asphalt concrete, gap-graded aggregate	

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Appendix A. Aggregate Sources and Petrography

Lithographic limestone. Moscow quarry; NW¼ Sec. 8, T78N, R2W, Muscatine County; operated by Wendling Quarries, Inc., — Devonian age stone from the Davenport member of the Wapsipinicon Formation; brown, microcrystalline limestone. Dominant grain size is less than 0.004 mm.

Dolomitic limestone. Ferguson quarry; SW¼ Sec. 5, T82N, R17W, Marshall County; operated by Concrete Materials Division, Martin-Marietta Corporation — Mississippian age stone from the Eagle City member of the Hampton Formation; interbedded clastic limestones and calcareous dolomites; grain size range is 0.01 mm to 0.15 mm.

Crushed and pit-run gravels. Akron pit; NW¼ Sec. 1, T92N, R49W, Plymouth County; operated by Higman Sand and Gravel Co. — Terrace deposit on the Big Sioux River; approximately 65% igneous and quartzite particles and 35% fine-grained limestone particles.

Concrete sand. Ames pit; SE¼ Sec. 22, T84N, R24W, Story County; operated by Hallett Construction Co. — Pleistocene gravel deposit in the Skunk River Valley; the 3/8" × #16 sieve-size material is over 40% limestone particles and nearly 60% igneous particles, the #16 × #100 sieve-size material is approximately 90% quartz and igneous particles with less than 10% carbonate particles.

Appendix B. Method For Compacting Marshall Specimens (Iowa Test Method 502-A, October 1969)

Scope

This method of test covers the procedures to be used in compacting asphaltic concrete utilizing the Marshall apparatus.

Procedure

A. Apparatus

1. Specimen mold assembly consisting of a base plate, forming mold and collar extension. The forming mold shall have an inside diameter of 4.0 ± 0.005 in., and a height of approximately 3 in.; the base plate and collar extension are designed to be interchangeable with either end of the forming mold.

2. A specimen extractor for extracting the compacted specimen from the specimen mold.

3. A mechanical compaction apparatus designed to drop a 10-lb. weight a distance of 18 in. and strike a 3-15/16 in. diameter compaction plate 50 times in a period of 55 ± 10 sec.

4. A compaction pedestal.

5. An oven capable of maintaining a constant temperature of 275 ± 5°F.

6. Thermometers (100 - 400°F range).

7. Balance having a capacity of at least 1500 g and accurate to at least 1 g.

8. Funnel with protuding prongs which fit inside the mold and are long enough to reach the bottom of the mold.

9. Suitable pans for heating the mixture.

10. Specimen height indicator.

11. Wax paper discs (4-in. diameter).

B. Procedure

1. Weigh into separate pans for each specimen the amount of asphaltic concrete required which will result in a compacted specimen 2.5 $\pm$ 0.05 in. in height. This will normally be about 1200 g. It is generally desirable to prepare a trial specimen prior to weighing additional specimens. If the trial specimen height falls outside the limits, the amount of mixture used for the specimen may be adjusted as follows:

Adjusted weight of mixture =

$$\frac{2.5 \text{ (weight of mixture used)}}{\text{specimen height obtained}}$$

2. Heat the pans of mix in the oven to a temperature of 275 $\pm$ 5°F as checked by a thermometer with the bulb in the center of the mix sample.

(a) When molding is in progress check the temperature at least once for each three pans of mix.

(b) Heat the mold, base, funnel and compaction plate in the oven for each specimen compacted.

3. Place a wax-paper disc in the bottom of the mold.

4. Place all of the mix that has been weighed out, in one pan, into the mold at one time by quickly inverting the pan into the funnel which is placed in the mold.

5. Remove the funnel with a combination forward and backward rocking motion in an upward direction only.

6. Spade the mixture with a spatula in an effort to embed any excess of coarse particles lying on the surface.

7. Place wax-paper disc on the mixture.

8. Place the compaction plate in the mold and position the hammer guide rod on the compaction plate.

9. Apply 50 (or 75) blows of the compaction hammer. Remove the collar and compaction plate, invert the mold, and reassemble.

10. Apply the same number of blows of the compaction hammer to the face of the reversed specimen.

11. Place the mold in the specimen extractor and press out the finished specimen. Check specimen height.

12. Allow the specimens to cool before further testing.

Appendix C. Method For Determining The Bulk Specific Gravity of Compacted Bituminous Mixtures (Iowa Test Method 503-A, Nov. 1969)

Scope

This method of test describes the procedure for determining the density (bulk specific gravity) of compacted bituminous mixtures.

Procedure

A. Apparatus

1. Balance with a capacity of at least 2000 g and accurate to at least 0.1 g.

2. Basket for holding submerged specimen in water.

3. Water container large enough to conveniently place specimen in basket and completely submerge it without touching sides or bottom of container.

4. Damp towel.

B. Procedure

1. If the specimens were recently molded in the laboratory, allow them to cool for at least two hours at room temperature after molding.

2. Determine the dry weight of each laboratory specimen to the nearest 0.1 g and record this weight.

3. Use the same balance and carefully tare the weight of the basket suspended and completely submerged in water which is at 77°F (25°C).

4. Obtain the weight of each specimen while completely immersed in water and record to the nearest 0.1 g. Make certain that neither the specimen nor basket touches the sides or bottom of the water container.

5. Surface dry the specimen by blotting quickly with a damp towel and determine and record this surface dry weight.

C. Calculations

$$\text{Bulk Specific Gravity} = \frac{A}{B - C}$$

A = weight in grams of dry specimen in air.

B = weight in grams of surface dry specimen in air.

C = weight in grams of specimen while immersed in water.

Appendix D. Mixing, Compaction and Testing Procedures for Part I, HR-157

1. Separate the aggregates by dry sieving into the following fractions and label properly: + 3/4 in., + 1/2 in., + 3/8 in., + No. 4, + No. 8, + No. 30, + No. 50, + No. 100, + No. 200 and - No. 200 (on pan).

2. Combine fractions according to weight schedule (Form 157-2) into pans and insert thermometers in the blends. Place the pans in ovens or on hot plates the night before mixing and heat to a temperature of 350 - 370°F. When hot plate is used, a 1/4-in. asbestos board will be used beneath the pan to prevent local over-heating and the aggregates will be covered.

3. Transfer asphalt from 5-gal cans into 1-gal cans by heating in oven at 275°F to just fluid enough to pour. Place enough asphalt (check weight schedule) in oven at 250-275°F the night before mixing.

4. Turn on the pug-mill mixer heaters the day before mixing.

5. Prior to mixing, check aggregate temperatures and record. (Form 157-1) Transfer asphalt from 1-gal can to a large pour can and heat to 290-310°F on a hot plate. When asphalt reaches desired mixing temperature, transfer desired weight of asphalt into a tared pour can and maintain the temperature at 290-310°F (record exact temperature).

6. Start the mixer. Pour aggregates at 350-370°F into the mixer and dry mix for 10 sec. Add weighed asphalt and wet mix for 30-45 sec or until the asphalt is uniformly distributed.

7. Discharge and measure the temperature of the mix and record.

8. Immediately weigh out 1200 g from each mix for trial specimens while maintaining the mixes at 275° ± 5°F.

9. Compact the trial specimens according to procedure in Appendix B.

10. If the trial specimen heights fall outside the limits of 2.5 ± 0.05 in., the amount of mixture used for next 13 specimens-per-mix will be adjusted as follows:

$$\text{Adjusted wt of mixture (g)} = \frac{2.5 \times 1200}{\text{Specimen height obtained (in.)}}$$

$$= \frac{3{,}000}{\text{Specimen height obtained (in.)}}$$

11. Immediately weigh out 13 (8) more batches from each mix into labelled small sample pans and place in oven at 275 ± 5°F for compaction.

12. Weigh out another 1000 g from each mix and label for Rice specific gravity determination. Discard the rest of mixtures.

13. Compact a total of seven specimens by Marshall 50 blows and seven specimens by Marshall 75 blows per mix following procedure in Appendix B, except specimen height will be measured after air cooled for at least 24 hours and prior to bulk specific gravity determination.

14. Part I specimens will be designated by 5-digit code number:

A-XX-X-X

First digit: Part I, (A)

Second and third digits: Batch No. (01-36)

Fourth digit: Compactive effort = 1 (50 blows); 2 (75 blows)

Fifth digit: Specimen No. (1-7).

Appendix E. Indirect Tensile Test — Procedure

1. Turn on Marshall Tester, switch box, and recorder.

2. Place specimen in mount and push horizontal transducer cores against the specimen. Be sure specimen is seated properly.

3. Adjust the strain recorder (Brush) using the pen bias so that the pens are at the right edge of the chart paper on both channels (zero).

4. Adjust the recorder on Marshall tester to zero.

5. Set recorder speed to 25 mm/sec.; range on the recorder should be set at 0.01 volts/division on both channels.

6. Set Marshall tester range at 10,000 lbs. and apply load.

7. If strain recorder pens jump over before any load is applied to the specimen, quickly adjust the pen back to its proper place on the chart and make sure transducer cores are still in contact with the specimen.

8. Turn strain recorder (Brush) off when both vertical and horizontal pens reach the left edge of the charts.

9. When Marshall tester shuts off (automatically) push the down button. This releases the load on the specimen.

10. Record the specimen number on all the charts used.

11. Remove specimen and clean the apparatus for the next specimens. (A light coat of oil on the tensile tester will make it easier to keep clean.)

$$\text{Tensile strength} = \frac{2P}{\pi dt}\,\frac{\text{lbs.}}{\text{in.}^2}$$

$$\text{Resilient modulus} = \frac{P(\nu + 0.2732)}{tH}$$

P = maximum load (lbs.)
d = diameter of specimen (inches)
t = thickness of specimen (inches)
ν = Poisson's ratio:

$$\frac{\text{horizontal deformation}}{\text{vertical deformation}}$$

H = total horizontal deflection

Appendix F.

Table F-1. Laboratory Compaction Correlation.

			Lab. A				Lab. B				
Spec. No.	Specimen Height-in. Hot	Specimen Height-in. Cool	Wt in Air Dry (g)	Wt in Water (g)	Wt in Air Surf. Dry (g)	Bulk Sp. Gr.	Wt in Air Dry (g)	Wt in Water (g)	Wt in Air Surf. Dry (g)	Bulk Sp. Gr.	Date Compacted
A1A	2.50	2.49+	1188.5	681.5	1189.0	2.34	1189.8	683.1	1190.2	2.346	4-29-71
A1B	2.51	2.50+	1186.5	678.0	1187.5	2.33	1187.8	679.4	1188.3	2.333	4-29-71
A1C	2.50	2.49+	1188.0	680.0	1188.5	2.34	1189.0	681.2	1189.8	2.338	4-29-71
A1D	2.51	2.50+	1187.5	678.5	1188.0	2.33	1188.5	679.8	1189.0	2.334	4-29-71
A2A	2.50	2.49+	1206.5	701.5	1208.0	2.38	1206.1	701.8	1207.8	2.384	4-29-71
A2B	2.52	2.51+	1204.5	698.5	1206.5	2.37	1204.1	699.5	1206.2	2.376	4-29-71
A2C	2.50	2.49	1205.0	699.5	1206.0	2.38	1205.0	700.5	1206.0	2.384	4-29-71
A2D	2.54	2.54	1207.5	699.5	1210.5	2.36	1207.4	701.5	1211.2	2.369	4-29-71
A3A	2.50	2.50	1155.5	648.0	1156.5	2.27	1156.4	648.6	1157.0	2.275	4-29-71
A3B	2.51	2.51	1159.0	648.0	1159.0	2.27	1159.8	649.3	1160.2	2.270	4-29-71
A3C	2.50	2.50	1156.5	648.5	1157.5	2.27	1157.5	649.6	1158.0	2.277	4-29-71
A3D	2.52	2.52	1155.5	643.0	1156.0	2.25	1156.4	643.9	1156.9	2.254	4-29-71
A4A	2.50	2.50	1178.5	670.0	1179.0	2.32	1178.2	670.0	1179.0	2.319	4-29-71
A4B	2.51	2.51	1179.5	670.5	1180.0	2.32	1179.1	671.4	1179.9	2.319	4-29-71
A4C	2.50	2.50	1178.5	668.5	1179.5	2.31	1178.8	669.7	1179.5	2.312	4-29-71
A4D	2.52	2.52	1179.0	668.0	1179.5	2.30	1179.0	668.8	1179.5	2.308	4-29-71

Table F-1. Continued.

			Lab. A				Lab. B				
Spec. No.	Specimen Height-in. Hot	Specimen Height-in. Cool	Wt in Air Dry (g)	Wt in Water (g)	Wt in Air Surf. Dry (g)	Bulk Sp. Gr.	Wt in Air Dry (g)	Wt in Water (g)	Wt in Air Surf. Dry (g)	Bulk Sp. Gr.	Date Compacted
A5A	2.49	2.49	1195.0	690.0	1195.5	2.36	1194.9	691.5	1195.5	2.371	4-29-71
A5B	2.50	2.50	1196.5	690.5	1197.0	2.36	1196.8	691.5	1197.2	2.367	4-29-71
A5C	2.51	2.51	1199.0	689.5	1199.5	2.35	1199.0	691.1	1200.0	2.356	4-29-71
A5D	2.51	2.51	1198.5	688.5	1198.5	2.35	1198.4	689.6	1198.9	2.353	4-29-71
A6A	2.51	2.51	1105.0	595.0	1105.5	2.16	1107.5	597.6	1108.5	2.168	4-29-71
A6B	2.52	2.52	1107.0	595.5	1107.5	2.16	1109.8	598.0	1110.4	2.166	4-29-71
A6C	2.52	2.52	1107.0	596.5	1107.5	2.17	1109.8	598.7	1110.4	2.169	4-29-71
A6D	2.52	2.52	1108.5	597.0	1109.0	2.16	1111.2	599.4	1111.8	2.169	4-29-71
A7A	2.49	2.49	1137.5	631.5	1138.5	2.24	1138.9	633.0	1139.5	2.249	4-29-71
A7B	2.51	2.51	1140.5	633.0	1141.5	2.24	1141.8	634.4	1142.7	2.246	4-29-71
A7C	2.48	2.47	1137.0	633.0	1137.5	2.25	1138.0	634.6	1139.0	2.256	4-29-71
A7D	2.49	2.48	1137.0	632.5	1137.5	2.25	1138.0	634.0	1139.0	2.253	4-29-71
A8A	2.51	2.51	114.0	604.5	1115.0	2.18	1114.5	605.8	1115.7	2.186	4-29-71
A8B	2.47	2.46	1113.5	614.0	1114.5	2.22	1114.0	615.4	1114.7	2.231	4-29-71
A8C	2.49	2.49	1113.0	606.5	1113.5	2.20	1113.5	608.3	1114.2	2.201	4-29-71
A8D	2.48	2.48	1113.5	611.0	1114.0	2.21	1113.9	612.4	1114.9	2.217	4-29-71

Table F-1. Continued.

			Lab. A				Lab. B				
Spec. No.	Specimen Height-in. Hot	Specimen Height-in. Cool	Wt in Air Dry (g)	Wt in Water (g)	Wt in Air Surf. Dry (g)	Bulk Sp. Gr.	Wt in Air Dry (g)	Wt in Water (g)	Wt in Air Surf. Dry (g)	Bulk Sp. Gr.	Date Compacted
B1A	2.509	2.507	1192.5	680.0	1193.0	2.325	1191.2	679.5	1191.9	2.325	5-11-71
B1B	2.513	2.519	1193.0	681.0	1194.0	2.326	1192.0	680.0	1192.8	2.324	5-11-71
B1C	2.508	2.505	1185.5	673.5	1180.5	2.311	1184.5	672.8	1185.2	2.312	5-11-71
B1D	2.528	2.530	1192.5	678.5	1193.5	2.316	1191.5	677.8	1192.1	2.317	5-11-71
B2A	2.446	2.447	1168.0	675.0	1170.5	2.357	1167.4	675.0	1170.7	2.355	5-11-71
B2B	2.476	2.477	1166.5	671.5	1169.5	2.342	1165.9	670.9	1169.9	2.336	5-11-71
B2C[3]	2.410	2.410	1164.0	675.0	1166.0	2.371	1163.5	674.8	1165.6	2.370	5-11-71
B2D	2.502	2.500	1164.0	664.5	1168.0	2.312	1163.5	664.1	1168.0	2.309	5-11-71
B3A	2.514	2.523	1159.5	645.0	1159.0	2.254	1157.9	644.2	1158.5	2.251	5-11-71
B3B	2.517	2.515	1159.5	646.0	1160.0	2.256	1158.8	644.9	1159.1	2.254	5-11-71
B3D	2.521	2.520	1159.0	642.5	1159.5	2.242	1158.0	641.8	1158.2	2.242	5-11-71
B3DD[4]	-	2.540	1159.5	642.0	1160.5	2.236	1162.0	644.8	1162.6	2.244	5-11-71
B4A	2.541	2.540	1185.0	667.5	1185.5	2.288	1184.2	667.6	1185.1	2.288	5-11-71
B4B	2.534	2.535	1185.5	670.0	1186.5	2.295	1185.0	669.8	1187.0	2.291	5-11-71
B4C	2.528	2.528	1186.0	669.5	1187.0	2.292	1185.4	669.1	1186.4	2.292	5-11-71
B4D	2.536	2.536	1184.0	666.5	1185.0	2.284	1183.3	666.0	1184.4	2.283	5-11-71

Table F-1. Continued.

			Lab. A				Lab. B				
Spec. No.	Specimen Height-in. Hot	Specimen Height-in. Cool	Wt in Air Dry (g)	Wt in Water (g)	Wt in Air Surf. Dry (g)	Bulk Sp. Gr.	Wt in Air Dry (g)	Wt in Water (g)	Wt in Air Surf. Dry (g)	Bulk Sp. Gr.	Date Compacted
B4AA[4]	-	2.530	1188.0	673.5	1189.0	2.305	1189.2	674.8	1190.0	2.308	5-11-71
B4BB[4]	-	2.550	1187.5	669.5	1188.5	2.288	1188.0	669.8	1189.0	2.288	5-11-71
B4CC[4]	-	2.522	1187.0	670.0	1187.5	2.294	1187.5	170.6	1188.3	2.294	5-11-71
B4DD[4]	-	2.547	1185.0	670.0	1185.5	2.299	1185.7	670.3	1186.2	2.298	5-11-71
B5A	2.534	2.534	1207.0	690.5	1207.5	2.335	1206.3	690.0	1207.0	2.333	5-11-71
B5B	2.369	2.361	1117.5	637.5	1118.0	2.326	1117.0	637.7	1117.3	2.329	5-11-71
B5C	2.495	2.493	1199.5	689.0	1200.0	2.347	1199.0	689.1	1199.6	2.349	5-11-71
B5D	2.513	2.513	1198.0	685.5	1198.5	2.335	1197.2	685.3	1198.0	2.335	5-11-71
B6A	2.557	2.550	1106.0	587.5	1106.5	2.131	1103.9	586.3	1104.5	2.130	5-11-71
B6B	2.528	2.528	1101.5	590.5	1101.5	2.156	1099.9	590.2	1100.8	2.154	5-11-71
B6C	2.505	2.505	1109.5	597.5	1110.0	2.165	1107.3	596.6	1107.9	2.166	5-11-71
B6D	2.561	2.557	1107.0	587.5	1107.5	2.129	1106.1	587.2	1106.6	2.130	5-11-71
B7A	2.517	2.519	1142.0	630.0	1143.0	2.226	1140.9	629.8	1142.2	2.227	5-11-71
B7B	2.512	2.512	1139.0	627.5	1140.0	2.222	1138.4	627.2	1139.8	2.221	5-11-71
B7C	2.477	2.482	1140.5	633.5	1141.5	2.245	1139.7	632.8	1140.5	2.245	5-11-71
B7D	2.512	2.512	1142.0	631.5	1143.0	2.233	1140.9	631.0	1142.2	2.232	5-11-71

Table F-1. Continued.

			Lab. A				Lab. B				
Spec. No.	Specimen Height-in. Hot	Specimen Height-in. Cool	Wt in Air Dry (g)	Wt in Water (g)	Wt in Air Surf. Dry (g)	Bulk Sp. Gr.	Wt in Air Dry (g)	Wt in Water (g)	Wt in Air Surf. Dry (g)	Bulk Sp. Gr.	Date Compacted
B8A[5]	-	-					-	-	-	-	5-11-71
B8B	2.503	2.511	1119.0	607.5	1119.5	2.186	1118.3	607.1	1119.7	2.182	5-11-71
B8C[5]	-	-					-	-	-	-	5-11-71
B8DD[4]	-	2.481	1119.0	612.0	1119.5	2.205	1118.3	611.8	1119.2	2.204	5-11-71
B8AA[4,6]	-	2.483	1134.5	627.5	1135.0	2.235	1149.0	642.4	1149.2	2.267	5-11-71

Note: 1). First digit in specimen No. indicates laboratory where compacted:

A = I.S.H.C., B = I.S.U.

Second digit indicates mix No.

Third digit indicates mold used.

2). All I.S.H.C. compactions done on west Marshall compactor.

3). Final 16 blows by hand.

4). Cold extrusion.

5). Sample crumbled when removed from specimen extractor.

6). Overnight cooling in water may be attributed to difference in weight in air between laboratories.

Appendix G-1. Bituminous mix design data by Marshall method — Series B.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb, Meas.	Stability, lb, Adj.	Flow, in. (x 0.01)	Gradation
B01	1	5.80	5.49	2.403	2.423	0.83	11.84	149.9		1924	21	B-8
	2			2.413		0.41	11.47	150.6		2131	19	
	3			2.422		0.04	11.14	151.1		2227	19	
	4			2.403		0.83	11.84	149.9		1944	17	
	5			2.408		0.62	11.65	150.3		1944	17	
	6			2.403		0.00	11.84	149.9		209.1[a]		
B02	1	3.00	3.03	2.302	2.583	10.86	15.44	143.6		3408	9	
	2			2.235		13.45	15.87	139.5		2544	9	
	3			2.232		13.57	15.98	139.3		2474	9	
	4			2.247		13.10	15.41	140.2		2167	10	
	5			2.245		13.18	15.60	139.9		2225	10	
	6			2.230		13.65	16.06	139.2		175.3		
B03	1	4.00	3.86	2.380	2.537	6.18	11.18	148.5		3450	9	
	2			2.284		9.96	14.76	142.5		2314	10	
	3			2.297		9.45	14.27	143.3		2730	10	
	4			2.289		9.77	14.57	142.8		2241	12	
	5			2.287		9.85	14.64	142.7		2198	11	
	6			2.431		7.22	12.63	144.8		289.0		
B04	1	4.69	4.48	2.409	2.495	3.44	10.67	150.3		3130	10	
	2			2.362		5.33	12.42	147.4		3542	9	
	3			2.359		5.45	12.53	147.2		3357	10	
	4			2.358		5.49	12.56	147.1		3720	12	
	5			2.354		5.65	12.71	146.9		3227	12	
	6			2.422		2.93	10.19	146.1		290.3		
B05	1	7.00	6.47	2.394	2.495	4.04	13.08	149.4		1580	27	
	2			2.415		3.20	12.32	150.7		2050	16	
	3			2.423		2.88	12.03	151.2		2140	18	
	4			2.421		2.96	12.10	151.1		2112	18	
	5			2.418		3.08	12.21	150.9		2402	17	
	6			2.427		2.76	11.88	151.1		184.3		
B06	1	6.00	5.68	2.412	2.414	0.08	11.31	150.5		1580	26	A-30H
	2			2.428		0.00	10.72	151.5		1930	22	
	3			2.430		0.00	10.64	151.6		1750	23	
	4			2.432		0.00	10.57	151.8		1910	28	
	5			2.423		0.00	10.90	151.2		1646	24	
	6			2.410		0.17	11.38	151.4		158.9		
B07	1	4.00	3.86	2.418	2.502	3.35	9.37	150.9		2969	14	
	2			2.427		2.99	9.03	151.4		4032	13	
	3			2.422		3.19	9.22	151.1		4080	12	
	4			2.421		3.23	6.97	151.1		4075	13	
	5			2.368		5.35	9.01	147.8		3044	16	
	6			2.410		3.68	9.67	150.4		304.4		
B08	1	2.90	2.82	2.331	2.583	9.75	11.68	145.5		3200	10	
	2			2.312		10.49	12.41	144.3		3078	10	
	3			2.290		11.34	13.24	142.8		2744	10	
	4			2.304		10.80	12.71	143.8		2558	13	
	5			2.290		11.30	13.24	142.9		2651	13	
	6			2.316		10.34	12.25	144.5		343.3		
B09	1	7.00	6.47	2.392	2.407	0.62	12.78	149.3		1488	35	
	2			2.415		0.00	11.94	150.7		-	22	
	3			2.410		0.00	12.12	150.4		-	27	
	4			2.417		0.00	11.86	150.8		1392	26	
	5			2.420		0.00	11.76	151.0		1555	25	
	6			2.424		0.00	11.61	151.3		139.2		
B10	1	5.13	4.88	2.416	2.444	1.15	10.41	150.8		1800	23	
	2			2.423		0.86	10.15	151.2		2064	18	
	3			2.422		0.86		151.1		2381	20	
	4			2.419		1.02	10.29	150.9		1997	18	
	5			2.427		0.70	9.99	151.4		2145	18	
	6			2.414		0.00	10.48	150.6		227.6		
B11	1	3.00	3.03	2.302	2.562	10.14	13.38	143.6		2957	8	B-P
	2			2.295		10.42	13.64	143.2		2924	8	
	3			2.290		10.61	13.83	142.9		3227	8	
	4			2.293		10.49	13.72	143.1		3187	10	
	5			2.252		12.09	15.26	140.5		2353	10	
	6			2.297		10.34	13.57	143.9		238.7		
B12	1	5.00	4.68	2.432	2.499	2.68	10.04	151.8		2584	13	
	2			2.381		4.72	11.93	148.6		2976	10	
	3			2.402		3.88	11.15	149.9		3106	12	
	4			2.396		4.12	11.38	149.5		3050	12	
	5			2.401		3.92	11.19	149.8		3082	12	
	6			2.401		3.92	11.19	149.8		296.0		

[a] Indirect tensile strength, psi, for specimen No. 6 in each batch.

Bituminous mix design data by Marshall method — Series B, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb. Meas.	Stability, lb. Adj.	Flow, in. (x 0.01)	Gradation
B13	1	6.00	5.68	2.431	2.446	0.61	11.02	151.7		1851	19	B-P
	2			2.431		0.61	11.02	151.7		2280	16	
	3			2.432		0.57	10.99	151.8		2304	16	
	4			2.432		0.57	10.99	151.8		2424	17	
	5			2.433		0.53	10.95	151.8		2400	17	
	6			2.434		0.49	10.91	151.9		201.2		
B14	1	7.00	6.47	2.405	2.420	0.45	12.71	150.1		1500	26	
	2			2.427		0.00	11.91	151.4		1750	19	
	3			2.428		0.00	11.88	151.5		1830	19	
	4			2.431		0.00	11.76	151.7		1970	21	
	5			2.431		0.00	11.76	151.7		2020	20	
	6			2.432		0.00	11.73	151.8		155.3		
B15	1	3.79	3.66	2.433	2.517	3.33	9.04	151.8		2808	12	
	2			2.380		5.44	11.02	148.5		3534	10	
	3			2.385		5.24	10.84	148.8		3953	10	
	4			2.399		4.68	10.31	149.7		3539	12	
	5			2.396		4.80	10.43	149.5		3539	12	
	6			2.386		5.20	10.80	148.9		307.6		
B16	1	4.24	4.07	2.418	2.527	4.30	11.20	150.9		4035	9	C-100
	2			2.363		6.47	13.22	147.5		3794	10	
	3			2.367		6.32	13.07	147.7		4219	9	
	4			2.349		7.03	13.73	146.6		3395	11	
	5			2.342		7.30	13.99	146.1		3325	11	
	6			2.358		6.68	13.40	147.1		271.4		
B17	1	5.00	4.68	2.434	2.527	3.68	11.18	151.9		3000	12	
	2			2.393		5.30	12.67	149.3		3534	11	
	3			2.407		4.74	12.16	150.2		3624	10	
	4			2.404		4.86	12.27	150.0		3515	12	
	5			2.400		5.02	12.42	149.8		3504	12	
	6			2.371		4.85	12.25	148.0		279.4		
B18	1	8.26	7.63	2.376	2.382	0.25	15.98	148.3		440	35	
B19	1	6.00	5.68	2.436	2.465	1.17	12.04	152.0		1872	20	
	2			2.439		1.05	11.93	152.2		2304	17	
	3			2.442		0.93	11.82	152.4		2550	16	
	4			2.443		0.89	12.14	152.4		2400	17	
	5			2.443		0.89	12.14	152.4		2360	17	
	6			2.441		2.19	12.94	152.3		200.0		
B20	1	7.00	6.47	2.417	2.424	0.28	13.45	150.8		1400	33	
	2			2.437		0.00	12.74	152.1		1805	25	
	3			2.436		0.00	12.77	152.0		1558	26	
	4			2.435		0.00	12.81	151.9		1656	26	
	5			2.436		0.00	12.77	152.0		1725	25	
	6			2.438		0.00	12.70	152.1		169.1		
B21	1	6.00	5.68	2.411	2.439	1.14	11.89	150.4		2370	11	C-100L
	2			2.403		1.47	12.18	149.9		2544	10	
	3			2.405		1.39	12.11	150.1		2712	10	
	4			2.406		1.35	12.08	150.1		2540	11	
	5			2.397		1.72	12.40	149.6		2650	11	
	6			2.397		1.72	12.40	149.6		284.5		
B22	1	7.00	6.47	2.389	2.427	1.56	13.43	149.1		1850	12	
	2			2.378		2.01	13.83	148.4		2218	9	
	3			2.373		2.22	14.01	148.1		2179	8	
	4			2.370		2.34	14.12	147.9		2131	11	
	5			2.377		2.06	13.86	148.3		2064	11	
	6			2.376		2.10	13.86	148.3		268.1		
B23	1	4.24	4.07	2.362	2.504	5.67	12.21	147.4		2400	12	
	2			2.307		7.86	14.25	144.0		2655	9	
	3			2.314		7.58	13.96	144.4		3060	9	
	4			2.309		7.78	14.17	144.1		2381	12	
	5			2.305		7.94	14.33	143.8		2720	11	
	6			2.291		8.51	14.85	139.8		277.3		
B24	1	2.90	2.82	2.257	2.567	12.07	15.02	140.8		2539	8	
	2			2.261		11.92	14.87	141.1		3168	10	
	3			2.250		12.34	15.28	140.4		2981	9	
	4			2.246		12.50	15.43	140.2		2592	9	
	5			2.239		12.77	15.70	139.7		2256	10	
	6			2.240		12.74	15.66	147.8		221.7		
B25	1	5.13	4.88	2.368	2.475	4.32	12.73	147.8		2170	10	
	2			2.370		4.24	12.66	147.9		2675	8	
	3			2.390		3.43	11.93	149.1		2861	9	
	4			2.377		3.95	12.40	148.3		2851	10	
	5			2.373		4.12	12.54	148.1		2500	11	
	6			2.368		4.32	12.73	147.8		283.3		

Bituminous mix design data by Marshall method — Series B, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb, Meas.	Stability, lb, Adj.	Flow, in. (x 0.01)	Gradation
B26	1	7.37	6.86	2.406	2.419	0.53	13.14	150.1		1430	24	B-30
	2			2.430		0.00	12.28	151.6		1860	22	
	3			2.439		0.00	11.95	152.2		2050	21	
	4			2.433		0.00	12.17	151.8		1980	20	
	5			2.432		0.00	12.20	151.8		1900	21	
	6			2.435		0.00	12.09	151.9		180.8		
B27	1	5.13	4.88	2.426	2.467	1.66	10.56	151.4		1930	17	
	2			2.441		1.05	10.00	152.3		2805	17	
	3			2.444		0.93	9.89	152.5		2755	18	
	4			2.445		0.89	9.85	152.6		2955	18	
	5			2.441		1.05	10.00	152.3		2600	17	
	6			2.441		1.05	10.00	152.3		226.2		
B28	1	6.25	5.88	2.411	2.440	1.18	12.05	150.4		1500	19	
	2			2.436		0.16	11.13	152.0		2400	19	
	3			2.439		0.04	11.02	152.2		2415	18	
	4			2.440		0.00	10.99	152.3		2750	18	
	5			2.442		0.00	10.91	152.4		2605	18	
	6			2.437		0.12	11.10	152.1		214.8		
B29	1	4.00	3.86	2.416	2.536	4.73	9.97	150.8		3335	10	
	2			2.403		5.24	10.55	149.9		4579	11	
	3			2.405		5.16	10.38	150.1		4695	11	
	4			2.389		5.79	10.98	149.1		4334	12	
	5			2.403		5.24	10.46	149.9		4286	12	
	6			2.390		5.76	10.94	149.1		—		
B30	1	3.00	3.03	2.359	2.697	12.53	11.34	147.2		3800	9	
	2			2.320		13.97	12.80	144.8		3994	10	
	3			2.319		14.01	12.84	144.7		3984	10	
	4			2.305		14.53	13.37	143.8		3221	12	
	5			2.320		13.97	12.86	144.8		3883	12	
	6			2.308		13.25	14.42	144.0		255.8		
B31	1	5.00	4.68	2.405	2.476	2.86	10.59	150.1		2250	16	A-30L
	2			2.368		4.36	11.97	147.8		2774	12	
	3			2.397		3.19	10.89	149.6		2678	11	
	4			2.411		2.62	10.37	150.4		2440	14	
	5			2.385		3.67	11.34	148.8		2263	8	
	6			2.381		3.84	11.48	148.6		269.5		
B32	1	3.35	3.24	2.321	2.535	8.44	12.41	144.8		2088	14	
	2			2.316		8.63	12.60	144.5		2448	9	
	3			2.328		8.16	12.15	145.3		2722	10	
	4			2.321		8.44	12.41	144.8		2300	12	
	5			2.323		8.36	12.33	145.0		2198	13	
	6			2.308		8.96	12.90	144.0		241.6		
B33	1	7.00	6.47	2.385	2.421	1.48	13.00	148.8		1425	25	
	2			2.380		1.69	13.18	148.5		1805	10	
	3			2.381		1.65	13.04	148.6		1848	12	
	4			2.393		1.15	12.71	149.3		1622	16	
	5			2.392		1.19	12.74	149.3		1715	12	
	6			2.401		0.83	12.42	149.8		190.2		
B34	1	6.00	5.68	2.379	2.434	2.25	12.48	148.4		1735	13	
	2			2.375		2.42	12.63	148.2		2352	11	
	3			2.386		1.97	12.23	148.9		2947	11	
	4			2.383		2.09	12.34	148.7		2640	14	
	5			2.344		3.69	13.77	146.3		2060	12	
	6			2.344		3.70	13.77	146.3		235.2		
B35	1	4.00	3.86	2.405	2.520	4.57	9.82	150.1		3115	11	
	2			2.364		6.19	11.36	147.5		2976	12	
	3			2.340		7.15	12.26	146.0		3092	12	
	4			2.364		6.19	11.36	147.5		2669	11	
	5			2.340		7.15	12.26	149.1		3041	12	
	6			2.338		7.23	12.33	145.9		254.0		
B36	1	5.00	4.68	2.423	2.418	0.00	9.89	151.2		2855	15	A-8
	2			2.406		0.49	10.52	150.1		3370	12	
	3			2.428		0.00	9.70	151.5		3581	12	
	4			2.413		0.20	10.26	150.6		3470	13	
	5			2.420		0.00	9.99	151.0		3509	12	
	6			2.403		0.62	10.63	149.9		321.7		
B37	1	4.24	4.07	2.398	2.454	2.28	10.25	149.6		3240	11	
	2			2.359		3.87	11.71	147.2		3322	9	
	3			2.350		4.23	12.04	146.6		3297	10	
	4			2.337		4.77	12.69	145.8		2837	11	
	5			2.345		4.44	12.39	146.3		3232	13	
	6			2.403		4.03	10.06	146.4		263.4		

Bituminous mix design data by Marshall method — Series B, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb, Meas.	Stability, lb, Adj.	Flow, in. (X 0.01)	Gradation
B38	1	6.00	5.68	2.405	2.425	0.80	11.50	150.1		2030	16	A-8
	2			2.406		0.76	11.46	150.1		2900	13	
	3			2.422		0.10	10.87	151.1		3000	13	
	4			2.415		0.80	11.13	150.7		2850	15	
	5			2.411		0.55	11.27	150.4		2592	15	
	6			2.412		0.52	11.24	150.5		244.0		
B39	1	3.35	3.24	2.393	2.521	5.06	9.66	149.3		4035	10	
	2			2.307		8.47	12.90	144.0		3655	10	
	3			2.330		7.56	12.04	145.4		3748	10	
	4			2.306		8.51	12.94	143.9		3802	13	
	5			2.314		8.19	12.64	144.4		3528	11	
	6			2.310		8.36	12.79	144.1		262.0		
B40	1	2.00	1.97	2.275	2.601	12.50	12.99	142.0		3325	8	
	2			2.227		14.34	14.82	139.0		3072	8	
	3			2.235		14.04	14.52	139.5		3000	8	
	4			2.227		14.34	14.82	139.0		2765	10	
	5			2.238		13.92	14.40	139.7		2544	10	
	6			2.232		14.15	14.63	139.3		150.6		
B41	1	7.14	6.67	2.385	2.398	0.16	13.39	148.8		1950	16	A-I
	2			2.406		0.00	12.63	150.1		2600	14	
	3			2.397		0.00	12.95	149.6		2600	15	
	4			2.413		0.00	12.37	150.6		2985	13	
	5			2.406		0.00	12.63	150.1		2735	14	
	6			2.401		0.00	12.81	149.8		209.2		
B42	1	5.80	5.47	2.381	2.426	1.85	12.42	148.6		1960	17	
	2			2.397		1.19	11.83	149.6		2918	13	
	3			2.395		1.28	11.91	149.4		3302	12	
	4			2.398		1.15	11.80	149.6		3384	12	
	5			2.389		1.52	12.13	149.1		2770	13	
	6			2.394		1.32	12.04	149.4		254.1		
B43	1	3.00	3.03	2.298	2.529	9.11	13.29	143.4		2919	9	
	2			2.295		9.23	13.41	143.2		3870	8	
	3			2.291		9.39	13.56	143.0		3820	9	
	4			2.288		9.51	13.67	142.8		2785	10	
	5			2.280		9.83	13.97	142.3		2450	10	
	6			2.289		9.49	13.63	142.8		235.6		
B44	1	4.24	4.07	2.365	2.552	7.33	11.72	147.6		3720	9	
	2			2.304		9.72	14.00	143.8		3385	9	
	3			2.280		10.66	14.89	142.3		3266	10	
	4			2.274		10.90	15.81	141.9		3125	11	
	5			2.297		10.00	14.96	143.3		3218	10	
	6			2.274		10.89	15.12	143.3		269.6		
B45	1	5.00	4.68	2.393	2.450	2.33	11.24	149.3		3275	13	
	2			2.365		3.48	12.28	147.6		4560	11	
	3			2.381		2.82	11.69	148.6		4363	11	
	4			2.371		3.23	12.10	148.0		4278	11	
	5			2.331		4.86	13.54	145.5		3950	11	
	6			2.342		4.32	13.14	146.1		286.9		
B46	1	5.00	4.68	2.390	2.455	2.53	11.15	149.1		3105	11	A-30LH
	2			2.338		4.75	13.08	145.9		3395	11	
	3			2.345		4.46	12.82	146.3		3259	10	
	4			2.329		5.11	13.42	145.3		2957	11	
	5			2.335		4.07	13.19	145.7		2957	10	
	6			2.320		5.48	13.74	144.8		2904		
B47	1	4.00	3.86	2.329	2.547	8.56	12.67	145.3		3149	10	
	2			2.376		6.72	10.91	148.3		2864	10	
	3			2.278		10.56	14.58	142.1		2904	10	
	4			2.279		10.52	14.55	142.2		2558	11	
	5			2.263		11.15	15.15	141.2		3492	11	
	6			2.276		7.00	14.66	142.0		289.3		
B48	1	7.00	6.47	2.384	2.427	1.78	13.04	148.8		1730	21	
	2			2.393		1.41	12.71	149.3		2405	16	
	3			2.382		1.87	13.11	148.6		2021	12	
	4			2.385		1.74	13.00	148.8		2045	17	
	5			2.396		1.29	15.60	149.5		2208	16	
	6			2.374		2.02	14.20	148.1		271.1		
B49	1	3.00	3.03	2.280	2.538	10.17	13.77	142.3		2716	9	
	2			2.238		11.82	15.36	139.7		2558	9	
	3			2.245		11.55	15.09	140.1		2604	8	
	4			2.200		13.32	16.86	137.3		1976	9	
	5			2.193		13.60	17.06	136.8		2046	9	
	6			2.220		12.54	16.04	138.5		176.2		

Bituminous mix design data by Marshall method — Series B, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb, Meas.	Stability, lb, Adj.	Flow, in. (x 0.01)	Gradation
B50	1	6.00	5.68	2.394	2.418	0.99	11.93	149.4		2055	15	A-30LH
	2			2.346		2.98	13.70	146.4		2260	10	
	3			2.341		3.18	13.88	146.1		2553	12	
	4			2.344		3.06	13.77	146.3		2883	12	
	5			2.315		4.26	14.84	144.5		2395	9	
	6			2.342		3.14	13.85	146.1		247.3		
B51	1	4.00	3.86	2.284	2.493	8.39	14.12	142.5		1816	10	A-F
	2			2.280		8.55	14.27	142.3		3162	10	
	3			2.291		8.11	13.86	143.0		3195	10	
	4			2.286		8.31	14.05	142.6		3181	10	
	5			2.267		9.07	14.76	141.5		2866	10	
	6			2.268		9.02	14.73	141.3		233.4		
B52	1	4.69	4.48	2.374	2.443	2.80	11.32	148.1		2155	12	
	2			2.311		5.38	13.70	144.2		2550	10	
	3			2.297		5.96	14.19	143.3		2581	9	
	4			2.319		5.06	13.37	144.7		2799	12	
	5			2.313		5.30	13.60	144.3		2790	11	
	6			2.306		5.61	13.86	143.9		248.1		
B53	1	6.00	5.68	2.383	2.416	1.34	12.78	148.7		1820	13	
	2			2.351		2.67	13.95	146.7		2506	11	
	3			2.360		2.29	13.62	147.3		2568	11	
	4			2.368		1.96	12.65	147.8		2832	12	
	5			2.370		1.88	12.58	147.9		2803	12	
	6			2.368		1.95	12.65	146.8		263.0		
B54	1	3.00	3.03	2.264	2.543	10.97	14.14	141.3		2375	10	
	2			2.244		11.76	14.90	140.0		3240	9	
	3			2.252		11.45	14.60	140.5		3509	10	
	4			2.263		11.01	14.18	141.2		3600	9	
	5			2.235		12.11	15.24	139.5		3283	10	
	6			2.233		12.19	15.32	141.3		174.0		
B55	1	7.00	6.47	2.377	2.3992	0.92	13.05	148.3		1990	13	
	2			2.331		2.84	14.74	145.5		2325	13	
	3			2.326		3.05	14.92	145.1		2306	11	
	4			2.336		2.63	14.55	145.8		2568	11	
	5			2.335		2.67	11.02	145.7		2501	14	
	6			2.311		3.67	15.47	144.2		247.6		
B56	1	3.00	3.03	2.259	2.679	12.00	15.34	141.6		3055	8	C-I
	2			2.236		13.28	16.57	139.5		3312	8	
	3			2.257		12.47	15.79	140.8		3715	10	
	4			2.245		12.93	16.23	140.1		3640	9	
	5			2.208		14.37	17.62	137.8		2976	9	
	6			2.226		13.69	16.95	138.9		162.3		
B57	1	7.00	6.47	2.405	2.441	1.46	13.45	150.1		2450	15	
	2			2.379		2.53	14.39	148.4		3811	12	
	3			2.398		1.75	13.70	148.6		3590	12	
	4			2.373		2.77	14.60	148.1		3667	12	
	5			2.372		2.78	16.26	148.0		3088	13	
	6			2.369		2.95	14.75	147.8		312.6		
B58	1	4.00	3.86	2.305	2.558	9.90	14.74	143.8		2698	8	
	2			2.252		11.97	16.70	140.5		3134	9	
	3			2.256		11.81	16.55	140.8		3302	9	
	4			2.232		12.75	17.44	139.3		2720	9	
	5			2.218		13.30	17.95	138.4		2360	9	
	6			2.240		12.43	17.14	139.8		203.7		
B59	1	6.00	5.68	2.393	2.464	2.89	13.16	149.3		3100	11	
	2			2.350		4.63	14.72	146.6		2890	10	
	3			2.352		4.55	14.64	146.8		3010	9	
	4			2.357		4.35	14.46	147.1		3240	10	
	5			2.360		4.23	14.35	147.3		3178	11	
	6			2.366		3.98	14.14	147.6		297.2		
B60	1	5.00	4.68	2.388	2.506	4.69	12.42	149.0		3697	10	
	2			2.327		7.13	14.66	145.2		3232	9	
	3			2.328		7.09	14.62	145.3		3091	11	
	4			2.320		7.41	14.91	144.8		3023	11	
	5			2.334		6.85	14.44	145.6		3218	11	
	6			2.331		6.98	14.51	145.5		279.7		
B61	1	5.13	4.88	2.390	2.413	0.93	11.23	149.1		2620	17	A-8LH
	2			2.386		1.10	11.38	148.9		3202	12	
	3			2.389		0.97	11.27	149.1		3312	13	
	4			2.375		1.55	11.79	148.2		2722	13	
	5			2.369		1.80	12.01	147.8		3082	12	
	6			2.375		1.58	11.79	150.3		260.2		

Bituminous mix design data by Marshall method — Series B, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb, Meas.	Stability, lb, Adj.	Flow, in. (x 0.01)	Gradation
B62	1	7.14	6.67	2.385	2.390	0.18	13.08	148.8		1615	25	A-81R
	2			2.395		0.00	12.72	149.4		1838	22	
	3			2.388		0.06	12.97	149.0		1772	21	
	4			2.397		0.00	12.65	149.6		2131	17	
	5			2.394		0.00	12.76	149.4		1850	20	
	6			2.387		0.11	13.01	148.9		252.5		
B63	1	4.00	3.86	2.387	0.450	2.88	10.39	148.9		2640	13	
	2			2.326		5.07	12.68	145.1		2688	8	
	3			2.345		4.30	11.97	146.3		3329	11	
	4			2.341		4.46	12.12	146.1		2804	12	
	5			2.336		4.66	12.31	145.8		2953	12	
	6			2.331		4.86	12.49	145.5		177.6		
B64	1	6.00	5.68	2.399	2.397	0.74	12.38	148.4		1420	21	
	2			2.399		0.00	11.65	149.7		2606	13	
	3			2.395		0.07	11.79	149.4		1939	18	
	4			2.395		0.07	11.79	149.4		2246	19	
	5			2.395		0.07	11.79	149.4		2016	17	
	6			2.396		0.04	11.78	149.5		188.4		
B65	1	2.90	2.82	2.335	2.524	7.48	11.40	145.7		3038	10	
	2			2.307		8.59	12.46	144.0		2981	11	
	3			2.305		8.67	12.53	143.8		2971	10	
	4			2.293		9.14	12.99	143.1		2674	12	
	5			2.271		10.02	13.82	141.7		2413	11	
	6			2.277		9.79	13.60	142.1		202.6		
B66	1	6.25	5.88	2.394	2.414	0.84	12.19	149.4		2590	16	A-30
	2			2.392		0.92	12.26	149.3		3235	12	
	3			1.290		1.01	12.34	149.1		3182	13	
	4			2.397		0.72	12.08	149.6		3062	13	
	5			2.392		0.92	13.26	149.3		3274	13	
	6			2.392		0.91	12.26	149.3		260.2		
B67	1	5.00	4.68	2.382	2.469	3.50	11.52	148.6		3615	11	
	2			2.360		4.39	12.33	147.3		4387	11	
	3			2.393		3.05	11.11	149.3		4580	10	
	4			2.374		3.82	11.81	148.1		4368	12	
	5			2.358		4.15	12.11	147.6		4111	12	
	6			2.376		3.73	11.74	147.0		318.7		
B68	1	3.79	3.66	2.363	2.511	5.90	11.28	147.5		3078	10	
	2			2.338		6.90	12.22	145.9		4094	9	
	3			2.338		6.90	12.22	145.9		3892	10	
	4			2.364		5.86	11.24	147.1		3086	11	
	5			2.358		6.10	11.47	146.0		3696	11	
	6			2.340		6.81	12.14	146.0		275.0		
B69	1	3.00	3.03	2.316	2.601	10.95	12.48	144.5		3264	9	
	2			2.269		12.75	14.25	141.5		3390	10	
	3			2.272		12.64	14.14	141.8		3213	10	
	4			2.250		13.48	14.97	140.4		2804	9	
	5			2.260		13.10	14.59	141.0		3209	10	
	6			2.269		12.76	14.25	141.6		204.5		
B70	1	7.00	6.47	2.370	2.419	2.02	12.89	147.9		1570	23	
	2			2.397		0.90	12.63	149.6		2145	15	
	3			2.401		0.74	12.48	149.8		2141	21	
	4			2.409		0.41	12.19	150.3		2180	21	
	5			2.395		0.99	12.70	149.4		2030	17	
	6			2.394		1.03	12.74	149.4		204.5		
B71	1	7.14	6.67	2.378	2.379	0.02	13.14	148.4		1395	35	A-4L
	2			2.409		0.00	12.00	150.3		1985	19	
	3			2.394		0.00	12.55	149.4		1900	23	
	4			2.394		0.00	12.55	149.4		1910	23	
	5			2.397		0.00	12.44	149.6		1622	27	
	6			—		—	—	—		—		
B72	1	5.00	4.68	2.370	2.439	2.82	11.58	147.9		2580	12	
	2			2.350		3.64	12.33	146.6		3075	12	
	3			2.357		3.36	12.07	147.1		2311	13	
	4			2.372		2.74	11.51	148.0		3024	12	
	5			2.354		3.48	12.17	146.9		2808	12	
	6			2.341		4.02	12.66	146.1		239.7		
B73	1	4.24	4.07	2.395	2.447	2.13	10.08	149.4		2570	17	
	2			2.336		4.54	12.29	145.8		3226	11	
	3			2.392		2.25	10.19	149.3		3365	11	
	4			2.370		3.15	11.01	147.9		3134	13	
	5			2.373		3.03	10.90	148.1		3086	16	
	6			2.356		3.72	11.54	147.0		257.0		

Bituminous mix design data by Marshall method — Series B, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb, Meas.	Stability, lb, Adj.	Flow, in. (X 0.01)	Gradation
B74	1	3.00	3.03	2.299	2.583	11.00	12.75	143.5		2784	10	A-4L
	2			2.293		11.23	12.98	143.1		3120	10	
	3			2.312		10.50	12.25	144.3		3139	12	
	4			2.288		11.43	13.16	142.8		2316	13	
	5			2.303		10.85	12.59	143.7		3254	12	
	6			2.296		11.12	12.86	143.3		259.3		
B75	1	5.80	5.49	2.406	2.417	0.43	11.00	150.1		1805	18	
	2			2.384		1.34	11.82	148.8		2448	17	
	3			2.392		1.01	11.52	149.3		3024	15	
	4			2.388		1.18	11.67	149.0		2136	15	
	5			2.388		1.18	11.67	149.0		2222	16	
	6			2.411		0.25	10.82	150.4		242.3		
B76	1	7.00	6.47	2.395	2.392	0.00	12.50	149.4		1725	23	A-4LH
	2			2.407		0.00	12.06	150.2		1968	18	
	3			2.395		0.00	12.50	149.4		2064	20	
	4			2.402		0.00	12.24	149.9		1886	18	
	5			2.407		0.00	12.06	150.2		2136	17	
	6			2.407		0.00	12.06	150.2		184.3		
B77	1	2.90	2.82	2.299	2.565	10.36	12.73	143.5		2883	9	
	2			2.289		10.75	13.11	142.8		3515	11	
	3			2.304		10.17	12.54	143.8		3221	10	
	4			2.280		11.10	13.45	142.3		3298	10	
	5			2.281		11.06	13.41	142.3		2976	10	
	6			2.242		12.59	14.89	139.9		186.2		
B78	1	5.00	4.68	2.394	2.443	1.98	10.86	149.4		2245	14	
	2			2.391		2.11	10.97	149.2		2897	12	
	3			2.379		2.60	11.42	148.4		3336	12	
	4			2.364		3.21	11.98	147.5		3069	12	
	5			2.363		3.25	12.02	147.5		2906	14	
	6			2.391		2.11	10.97	147.5		330.6		
B79	1	6.00	5.68	2.398	2.399	0.05	11.65	149.6		1730	19	
	2			2.391		0.34	11.91	149.2		2813	11	
	3			2.391		0.34	11.91	149.2		3427	14	
	4			2.394		0.21	11.80	149.4		2975	13	
	5			2.385		0.59	12.13	148.8		3000	12	
	6			2.377		0.92	12.42	148.3		332.7		
B80	1	4.00	3.86	2.390	2.452	2.52	10.24	149.1		3150	11	
	2			2.307		5.91	13.36	144.0		2884	10	
	3			2.322		5.30	12.80	144.9		3050	9	
	4			2.317		5.50	12.99	144.6		2943	11	
	5			2.344		4.40	11.97	146.3		2995	11	
	6			2.347		4.28	11.86	146.5		320.6		
B81	1	3.13	3.03	2.241	2.590	13.47	15.21	139.8		3506	9	A-8H
	2			2.241		13.47	15.21	139.8		3840	8	
	3			2.223		14.17	15.89	138.7		3581	9	
	4			2.224		14.13	15.86	138.8		2988	10	
	5			2.226		14.05	15.78	138.9		3212	12	
	6			2.229		13.94	15.67	139.1		219.0		
B82	1	6.03	5.67	2.389	2.414	1.02	12.07	149.1		2264	19	
	2			2.391		0.94	12.00	149.2		3307	12	
	3			2.373		1.68	12.66	148.1		2960	13	
	4			2.385		1.18	12.22	148.8		2703	16	
	5			2.394		0.81	11.89	149.4		2562	17	
	6			2.389		1.04	12.07	149.1		350.1		
B83	1	6.90	6.46	2.378	2.399	0.85	13.21	148.4		1798	27	
	2			2.398		0.02	12.48	149.6		2220	17	
	3			2.385		0.56	12.96	148.8		2125	17	
	4			2.398		0.02	12.48	149.6		2213	21	
	5			2.396		0.10	12.55	149.5		2161	18	
	6			2.397		0.07	12.52	149.6		219.1		
B84	1	4.68	4.47	2.377	2.453	3.11	11.40	148.3		2305	15	
	2			2.340		4.62	12.78	146.0		3592	11	
	3			2.337		4.74	12.89	145.8		3744	13	
	4			2.349		4.25	12.45	146.6		3705	14	
	5			2.329		5.07	13.19	145.3		3235	13	
	6			2.347		4.32	12.52	146.5		358.1		
B85	1	4.01	3.85	2.317	2.551	9.17	13.08	144.6		2925	11	
	2			2.271		10.97	14.80	141.7		3264	11	
	3			2.258		11.48	15.29	140.9		3185	10	
	4			2.221		12.93	16.68	138.6		2392	14	
	5			2.236		12.34	16.12	139.5		2609	15	
	6			2.224		12.62	16.57	140.7		234.6		

Bituminous mix design data by Marshall method — Series B, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb, Meas.	Stability, lb, Adj.	Flow, in. (X 0.01)	Gradation
B86	1	4.00	3.85	2.354	2.541	7.37	11.97	146.9		3525	11	B-8L
	2			2.289		9.93	14.40	142.8		3883	12	
	3			2.310		9.10	13.61	144.1		4176	13	
	4			2.306		9.26	13.76	143.9		3593	13	
	5			2.278		10.36	14.81	142.1		2855	13	
	6			2.264		10.90	15.33	141.3		261.4		
B87	1	3.33	3.23	2.268	2.602	12.83	14.63	141.5		3278	10	
	2			2.268		12.83	14.63	141.5		4074	11	
	3			2.254		13.37	15.16	140.6		4092	12	
	4			2.219		14.72	16.48	138.5		2675	12	
	5			2.247		13.64	15.43	140.2		2907	12	
	6			2.247		13.64	15.42	140.2		229.6		
B88	1	6.67	6.25	2.371	2.409	1.55	13.54	148.0		–	–	
	2			2.387		0.89	12.96	149.0		2412	17	
	3			2.393		0.64	12.74	149.3		2355	23	
	4			2.389		0.80	12.89	149.0		2380	22	
	5			2.390		0.76	12.85	149.1		2710	22	
	6			2.394		0.60	12.70	149.4		289.3		
B89	1	4.67	4.46	2.362	2.484	4.92	12.23	147.4		2758	14	
	2			2.333		6.09	13.30	145.6		4196	12	
	3			2.328		6.29	13.49	145.3		3747	13	
	4			2.318		6.69	13.86	144.6		3125	13	
	5			2.321		6.57	13.75	144.8		3059	14	
	6			2.301		7.37	14.49	143.6		263.7		
B90	1	6.00	5.66		2.397					1711	26	
	2			2.370		1.12	13.04	147.9		1546	25	
	3			2.380		0.70	12.67	148.5		3636	10	
	4			2.367		1.24	13.15	147.7		2653	19	
	5			2.380		0.70	12.66	148.5		2838	19	
	6			2.386		0.46	12.47	148.9		320.7		
B91	1	4.91	4.68	2.336	2.486	6.02	13.63	145.8		3499	10	B-30L
	2			2.278		8.35	15.77	143.1		3302	12	
	3			2.295		7.67	15.14	143.2		3676	11	
	4			2.277		8.39	15.81	142.1		3121	13	
	5			2.274		8.51	15.92	141.9		2736	12	
	6			2.259		9.13	16.48	141.0		264.2		
B92	1	6.92	6.47	2.350	2.388	1.58	14.74	146.6		1948	19	
	2			2.360		1.16	14.38	147.3		2209	17	
	3			2.378		0.41	13.73	148.4		2390	17	
	4			2.357		1.28	14.49	147.1		2075	17	
	5			2.349		1.62	14.78	146.0		1974	19	
	6			2.355		1.38	14.56	147.0		298.9		
B93	1	3.35	3.24	2.187	2.560	14.55	17.92	136.5		2305	11	
	2			2.175		15.02	18.37	135.7		2371	10	
	3			2.177		14.94	18.29	135.8		2631	13	
	4			2.195		14.24	17.62	137.0		2218	11	
	5			2.183		14.70	18.06	136.2		2171	12	
	6			2.179		14.88	18.22	136.0		168.8		
B94	1	6.25	5.88	2.363	2.432	2.83	13.73	147.5		2253	14	
	2			2.326		4.35	15.08	145.1		3068	13	
	3			2.325		4.39	15.12	145.1		3736	11	
	4			2.331		4.14	14.89	145.5		3907	14	
	5			2.326		4.35	15.08	145.1		3557	13	
	6			2.326		4.35	15.08	145.1		312.1		
B95	1	3.79	3.66	2.248	2.526	11.00	15.99	140.3		2197	12	
	2			2.232		11.63	16.59	139.3		3353	11	
	3			2.209		12.54	17.45	137.8		2803	13	
	4			2.217		12.22	17.15	138.3		2443	12	
	5			2.207		12.62	17.52	137.7		2579	13	
	6			2.197		13.02	17.90	137.1		285.3		
B96	1	6.25	5.88	2.399	2.470	2.88	12.92	149.7		2808	16	C-P
	2			2.374		3.89	13.83	148.1		3360	15	
	4			2.365		4.26	14.16	147.6		3344	13	
	5			2.362		4.38	14.26	147.4		3736	12	
	6			2.382		3.56	13.54	148.6		–		
B97	1	3.13	3.03	2.253	2.601	13.34	15.74	140.6		3183	8	
	2			2.215		14.81	17.17	138.2		2890	8	
	3			2.231		14.19	16.57	139.2		3077	9	
	4			2.237		13.96	16.34	139.6		2708	9	
	5			2.238		13.92	16.31	139.7		2757	9	
	6			2.207		15.11	17.46	137.7		180.0		

Bituminous mix design data by Marshall method — Series B, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb, Meas.	Stability, lb, Adj.	Flow, in. (x 0.01)	Gradation
B98	1	4.02	3.86	2.299	2.573	10.63	14.76	143.5		3552	10	C-P
	2			2.271		11.72	15.80	141.7		3812	9	
	3			2.268		11.84	15.91	141.5		3764	10	
	4			2.261		12.11	16.17	141.1		3239	11	
	5			2.260		12.15	16.21	141.0		2971	11	
	6			2.246		12.71	16.73	140.2		275.8		
B99	1	4.91	4.68	2.363	2.538	6.89	13.14	147.5		3747	10	
	2			2.242		11.66	17.58	139.9		2520	13	
	3			2.256		11.11	17.07	140.8		3015	12	
	4			2.236		11.89	17.80	139.5		2345	13	
	5			2.279		10.20	16.22	142.2		3342	13	
	6			2.279		10.20	16.22	142.2		315.1		
B100	1	6.70	6.28	2.393	2.430	1.52	13.51	149.3		1646	26	
	2			2.405		1.03	13.07	150.1		2247	21	
	3			2.401		1.19	13.22	149.8		2173	19	
	4			2.406		0.99	13.04	150.1		2369	21	
	5			2.406		0.99	13.04	150.1		2418	21	
	6			2.408		0.90	12.97	150.3		265.2		
B101	1	2.91	2.83	2.260	2.590	12.74	16.21	141.0		2850	7	B-B
	2			2.260		–	16.21	141.0		2800	9	
	3			2.260		–	16.21	141.0		2820	9	
	4			2.260		–	16.21	141.0		2600	9	
	5			2.240		–	16.95	139.8		2522	9	
	6			–		–	–	–		–		
B102	1	4.03	3.87	2.290	2.472	7.36	16.01	142.9		2820	10	
	2			2.250		8.98	17.48	140.4		2400	9	
	3			2.260		8.58	17.11	141.0		3234	7	
	4			2.270		8.17	16.74	141.6		2350	9	
	5			2.270		8.17	16.74	141.6		2300	10	
	6			2.290		7.36	16.01	142.9		191.3		
B103	1	6.93	6.48	2.380	2.458	3.17	15.01	148.5		2475	15	
	2			2.380		–	–	148.5		3050	13	
	3			–		–	–	148.5		3200	13	
	4			2.380		–	–	148.5		3168	14	
	5			–		–	–	148.5		3267	14	
	6			2.380		–	–	142.9		229.5		
B104	1	6.04	5.70	2.390	2.463	2.96	14.01	149.1		2800	12	
	2			2.396		2.96	14.01	149.5		4050	11	
	3			2.399		2.60	13.69	149.7		4700	12	
	4			2.399		2.60	13.69	149.7		4100	13	
	5			2.393		2.84	13.90	149.3		4090	13	
	6			2.386		3.13	14.15	148.9		274.5		
B105	1	5.15	4.89	2.312	2.494	7.30	16.10	144.3		2328	10	
	2			2.331		6.53	15.41	145.5		3960	11	
	3			2.332		6.52	15.38	145.5		3969	11	
	4			2.430		2.57	11.82	151.6		4100	12	
	5			2.307		7.67	16.28	144.0		3332	12	
	6			2.329		7.36	15.49	145.3		247.2		
B106	1	3.80	3.66	2.334	2.518	7.31	15.85	145.6		3068	11	A-8L
	2			2.320		7.87	16.36	144.8		3437	12	
	3			2.350		6.68	15.28	146.6		3709	13	
	4			2.329		9.77	12.28	145.3		3466	12	
	5			2.298		8.74	13.45	143.4		2989	18	
	6			2.321		7.84	12.59	144.8		300.2		
B107	1	3.36	3.25	2.320	2.600	10.77	18.31	144.8		3405	11	
	2			2.309		11.19	18.69	144.1		4342	12	
	3			2.314		11.00	18.52	144.4		4699	11	
	4			2.304		11.38	12.86	143.8		4197	12	
	5			2.297		11.65	13.12	143.3		3302	12	
	6			2.290		11.92	13.39	142.9		241.9		
B108	1	6.04	5.70	2.395	2.443	1.94	15.59	149.5		1804	31	
	2			2.382		2.47	16.05	148.6		1931	20	
	3			2.395		1.94	15.59	149.5		1909	15	
	4			2.395		1.94	15.59	149.5		1920	22	
	5			2.389		2.19	15.81	149.0		1692	33	
	6			2.398		1.80	11.60	149.6		258.8		
B109	1	6.94	6.49	2.377	2.392	0.61	16.04	148.3		1581	33	
	2			2.419		0.00	14.57	150.9		1824	23	
	3			2.379		0.53	15.97	148.5		1847	24	
	4			2.392		0.00	15.52	149.3		1733	23	
	5			2.390		0.07	15.38	149.1		1594	28	
	6			2.398		0.00	12.34	149.6		265.9		

Bituminous mix design data by Marshall method — Series B, continued.

Specimen No.	% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb, Meas.	Stability, lb, Adj.	Flow, in. (× 0.01)	Gradation
B110 1	4.92	4.69	2.398	2.443	1.85	13.10	149.6		1871	27	A-8L
2			2.397		1.89	13.13	149.6		2195	18	
3			2.402		1.68	12.95	149.9		2278	22	
4			2.403		1.64	12.91	149.9		2181	22	
5			2.407		1.48	12.77	150.2		2039	23	
6			2.401		1.72	10.54	149.8		289.3		
B111 1	4.00	3.85	2.290	2.557	10.43	19.25	142.9		3271	9	B-100L
2			2.271		11.18	19.92	141.7		3373	10	
3			2.247		12.12	20.77	140.2		3140	9	
4			2.255		11.80	20.48	140.7		2535	11	
5			2.241		12.35	20.97	139.8		2519	13	
6			2.235		12.59	16.32	139.5		259.5		
B112 1	3.33	3.23	2.226	2.618	14.96	22.15	138.9		3202	8	
2			2.189		16.38	23.45	136.6		2604	8	
3			2.190		16.34	23.41	136.7		2705	9	
4			2.210		15.57	22.71	137.9		2315	10	
5			2.194		16.18	23.26	136.9		1856	11	
6			2.201		15.93	17.06	137.3		186.0		
B113 1	6.89	6.44	2.376	2.426	2.06	17.36	148.3		2129	12	
2			2.369		2.34	17.60	147.8		2639	10	
3			2.373		2.18	17.46	148.1		2757	9	
4			2.378		1.97	17.28	148.4		2558	12	
5			2.370		2.30	17.56	147.9			10	
6			2.365		2.51	13.84	147.6		315.1		
B114 1	6.00	5.66	2.380	2.434	2.22	15.69	148.5		2222	12	
2			2.334		4.11	17.32	145.6		2385	11	
3			2.344		3.70	16.97	146.3		2512	10	
4			2.346		3.62	16.90	146.4		2381	13	
5			2.350		3.45	16.75	146.6		2894	12	
6			2.342		3.78	13.96	146.1		297.7		
B115 1	4.89	4.66	2.375	2.456	3.31	14.38	148.2		2404	10	
2			2.325		5.34	16.17	145.1		3007	10	
3			2.350		4.33	15.28	146.6		3371	10	
4			2.334		4.98	10.85	145.6		2759	12	
5			2.334		4.98	10.85	145.6		2824	13	
6			2.324		5.38	13.72	145.0		308.1		
B116 1	3.36	3.25	2.351	2.604	9.72	17.36	146.7		4242	8	C-8L
2			2.305		11.48	18.97	143.8		4011	9	
3			2.289		12.10	19.54	143.8		3899	9	
4			2.299		11.71	19.18	143.5		3351	9	
5			2.282		12.37	19.78	142.4		3007	10	
6			2.258		13.29	14.93	140.9		203.4		
B117 1	6.71	6.29	2.423	2.433	0.39	15.63	151.2		1682	29	
2			2.439		0.00	15.08	152.2		2288	20	
3			2.442		0.00	14.97	152.4		2376	20	
4			2.447		0.00	14.80	152.7		2580	17	
5			2.439		0.00	11.62	152.2		2548	19	
6			2.432		0.00	11.25	151.8		230.0		
B118 1	4.03	3.87	2.357	2.578	8.57	17.69	147.1		3636	9	
2			2.313		10.27	19.22	144.3		3736	10	
3			2.583		10.62	19.55	143.8		3562	10	
4			2.331		9.58	18.60	145.5		3936	12	
5			2.302		10.70	19.61	143.6		3109	12	
6			2.359		8.50	11.69	147.2		277.9		
B119 1	6.04	5.70	2.412	2.445	1.34	15.09	150.5		1529	25	
2			2.431		0.56	14.42	151.7		—	—	
3			2.431		0.56	14.42	151.7		2382	19	
4			2.432		0.52	14.38	151.8		2952	19	
5			2.431		0.56	14.42	151.7		2524	19	
6			2.419		1.06	11.17	150.9		255.7		
B120 1	4.70	4.49	2.421	2.555	5.23	16.10	151.0		2788	13	
2			2.407		5.78	16.59	150.2		3681	12	
3			2.399		6.09	16.86	149.7		3533	13	
4			2.405		5.85	16.65	150.1		3611	13	
5			2.395		6.25	17.00	149.4		3172	14	
6			2.372		7.16	11.78	148.0		318.5		
B121 1	3.13	3.04	2.329	2.609	10.72	17.80	145.3		3667	11	A-4H
2			2.271		12.75	19.85	141.7		3153	8	
3			2.265		13.18	20.07	141.3		3234	8	
4			2.278		12.68	19.61	142.1		2853	12	
5			2.276		12.76	19.68	142.0		2772	13	
6			2.268		13.07	14.33	141.5		212.9		

Bituminous mix design data by Marshall method — Series B, continued.

Specimen No.	% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb, Meas.	Stability, lb, Adj.	Flow, in. (x 0.01)	Gradation
B122 1	4.92	4.69	2.409	2.478	2.79	14.09	150.3		2872	12	A-4H
2			2.369		4.41	15.52	147.8		3216	11	
3			2.358		4.85	15.91	147.1		3122	10	
4			2.364		4.61	15.70	147.5		3010	10	
5			–		4.77	15.84	147.3		3253	11	
6			2.339		5.61	13.16	146.0		280.5		
B123 1	6.04	5.70	2.397	2.421	0.97	15.63	149.6		1839	17	
2			2.419		0.07	13.86	150.9		2294	16	
3			2.415		0.23	14.00	150.7		2308	16	
4			2.399		0.89	14.56	149.7		2249	16	
5			2.404		0.68	14.38	150.0		1989	17	
6			2.404		0.70	11.69	150.0		228.6		
B124 1	4.03	3.87	2.355	2.506	6.01	15.12	147.0		2253	11	
2			2.324		7.25	16.24	145.0		3526	11	
3			2.346		6.37	15.45	146.4		3255	10	
4			2.337		6.73	15.77	145.8		2980	11	
5			2.331		6.97	15.99	145.5		3478	11	
6			2.326		7.18	12.90	145.1		282.1		
B125 1	6.71	6.29	2.391	2.401	0.39	15.43	149.2		1729	20	
2			2.396		0.19	15.26	149.5		2185	15	
3			2.403		0.00	15.02	159.9		2209	14	
4			2.396		0.19	15.26	149.5		1962	15	
5			2.396		0.19	15.26	149.5		1885	15	
6			2.394		0.29	12.60	149.4		226.0		
B126 1	4.90	4.50	2.405	2.497	3.68	14.50	150.1		3136	13	B-100
2			2.375		4.88	15.57	148.2		3480	12	
3			2.378		4.76	15.46	148.4		3736	12	
4			2.365		5.28	15.92	147.6		3429	12	
5			2.361		5.44	16.06	147.3		3250	14	
6			2.335		6.49	14.04	145.7		285.8		
B127 1	6.01	5.50	2.388	2.433	1.85	14.98	149.0		2051	18	
2			2.388		1.85	14.98	149.0		3030	12	
3			2.391		1.73	14.88	149.2		3059	14	
4			2.386		1.93	15.05	148.9		3433	14	
5			2.394		1.60	14.77	149.4		3101	13	
6			2.381		2.14	13.26	148.6		279.2		
B128 1	3.12	2.90	2.306	2.578	10.55	17.24	143.9		3390	8	
2			2.259		12.37	18.92	141.0		3496	8	
3			2.279		11.59	18.20	142.2		3729	9	
4			2.287		11.28	17.91	142.7		3410	11	
5			2.251		12.68	19.21	140.5		2513	10	
6			2.263		12.22	15.29	141.2		187.0		
B129 1	6.90	6.30	2.373	2.426	2.16	17.11	148.1		1280	32	
2			2.401		1.01	16.14	149.8		2193	20	
3			2.399		1.09	16.20	149.7		2141	20	
4			2.401		1.01	16.14	149.8		2460	21	
5			2.396		1.21	16.30	149.5		2136	22	
6			2.389		1.50	13.70	149.1		211.9		
B130 1	4.01	3.70	2.305	2.560	9.94	18.47	143.8		3038	10	
2			2.260		11.70	20.06	141.0		3369	10	
3			2.267		11.42	19.81	141.5		3144	10	
4			2.251		12.05	20.38	140.5		2802	10	
5			2.259		11.74	20.10	141.0		2636	11	
6			2.253		11.98	16.36	140.6		216.5		
B131 1	6.03	5.70	2.418	2.458	1.61	15.39	150.9		2612	14	C-8
2			2.399		2.39	16.06	149.7		3171	11	
3			2.391		2.71	16.34	149.2		3203	11	
4			2.411		1.90	15.64	150.4		3386	12	
5			2.406		2.10	15.81	150.1		3272	12	
6			2.405		2.16	12.50	150.1		307.5		
B132 1	6.92	6.50	2.407	2.433	1.07	16.72	150.2		1708	20	
2			2.417		0.66	16.37	150.8		2320	12	
3			2.423		0.41	16.16	151.2		2445	11	
4			2.427		0.25	16.03	151.4		2684	16	
5			2.422		0.45	16.19	151.1		2399	16	
6			2.415		0.74	12.88	150.7		211.9		
B133 1	4.02	3.90	2.274	2.566	11.38	20.45	141.9		2841	8	
2			2.251		12.28	20.06	140.5		3185	9	
3			2.260		11.93	20.74	141.0		3527	8	
4			2.271		11.50	20.36	141.7		3579	10	
5			2.256		12.08	20.88	140.8		3143	10	
6			2.256		12.08	16.36	140.4		214.1		

Bituminous mix design data by Marshall method — Series B, continued.

Specimen No.	% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb, Meas.	Stability, lb, Adj.	Flow, in. (x 0.01)	Gradation
B134 1	4.91	4.70	2.367	2.527	6.33	17.45	147.7		2993	9	C-8
2			2.325		8.00	18.93	145.1		3981	10	
3			2.314		8.43	19.31	144.4		3868	11	
4			2.333		7.68	18.65	145.6		4114	12	
5			2.319		8.23	19.13	144.7		3663	12	
6			2.311		8.55	15.03	144.2		289.9		
B135 1	3.13	3.00	2.241	2.586	13.35	20.07	139.8		2558	7	
2			2.230		13.77	20.46	139.2		3021	8	
3			2.230		13.77	20.46	139.2		3006	9	
4			2.243		13.27	19.99	140.0		2751	13	
5			2.220		14.16	20.82	138.5		2483	14	
6			2.226		13.92	16.70	138.9		177.7		
B136 1	6.90	6.46	2.391	2.422	1.27	16.71	149.2		1976	17	A-100L
2			2.401		0.86	16.37	149.8		2568	12	
3			2.406		0.65	16.19	150.1		2492	12	
4			2.406		0.65	16.19	150.1		2858	13	
5			2.391		1.27	16.71	149.2		2443	13	
6			2.383		1.61	12.79	148.7		253.9		
B137 1	4.01	3.85	2.373	2.481	4.36	13.50	148.1		2877	10	
2			2.318		6.58	15.50	144.6		2960	9	
3			2.309		6.94	13.83	144.1		2849	10	
4			2.307		7.02	15.90	144.0		2914	11	
5			2.310		6.90	15.79	144.1		2712	11	
6			2.291		7.66	13.82	143.0		261.1		
B138 1	6.01	5.67	2.390	2.427	1.53	15.08	149.1		1989	13	
2			2.387		1.65	15.18	148.9		2341	11	
3			2.371		2.31	15.75	148.0		2215	11	
4			2.387		1.65	15.18	148.9		2291	11	
5			2.368		2.43	15.86	147.8		2228	11	
6			2.368		2.43	12.61	147.8		252.6		
B139 1	4.68	4.47	2.374	2.455	3.30	13.91	148.1		2168	9	
2			2.345		4.48	14.96	146.3		2803	10	
3			2.352		4.20	14.71	146.8		2720	9	
4			2.350		4.28	14.78	146.6		2770	10	
5			2.346		4.44	14.93	146.4		2682	12	
6			2.340		4.68	12.54	146.0		290.7		
B140 1	3.12	3.02	2.315	2.534	8.64	15.63	144.5		2338	10	
2			2.271		10.38	17.24	141.7		2955	10	
3			2.293		9.51	16.43	143.1		3298	9	
4			2.274		10.26	17.13	141.9		2537	12	
5			2.278		10.10	16.98	142.1		2253	12	
6			2.272		10.34	14.80	141.8		257.9		
B141 1	6.94	6.49	2.396	2.428	1.32	18.05	149.5		2442	11	A-4
2			2.354		3.05	19.49	146.9		2563	12	
3			2.383		1.85	18.50	148.7		2872	10	
4			2.362		2.72	19.21	147.4		2555	11	
5			2.356		2.97	19.42	147.0		217.4	11	
6			—		—	—	—		—	—	
B142 1	4.25	4.08	2.392	2.501	4.51	14.27	149.3		2716	9	
2			2.338		6.66	16.20	145.9		2862	10	
3			2.332		6.90	16.41	145.5		2908	12	
4			2.336		6.74	16.27	145.8		2964	11	
5			2.358		5.86	15.48	147.1		3686	11	
6			2.320		7.38	13.41	144.8		282.7		
B143 1	6.04	5.70	2.412	2.440	1.13	14.88	150.5		1959	16	
2			2.415		1.00	14.77	150.7		2621	11	
3			2.419		0.86	14.63	150.9		2502	14	
4			2.405		1.41	15.12	150.1		2335	12	
6			2.405		1.42	11.75	150.1		269.2		
B144 1	3.36	3.25	2.323	2.562	9.32	16.87	145.0		2605	9	
2			2.290		10.60	18.04	142.9		3315	8	
3			2.283		10.88	18.30	142.5		3243	9	
4			2.286		10.76	18.19	142.6		3176	10	
5			2.295		10.41	17.87	143.2		3228	11	
6			2.226		13.12	16.20	138.9		162.4		
B145 1	4.92	4.69	2.409	2.493	3.37	14.67	150.3		2795	12	
2			2.354		5.57	16.61	146.9		3087	10	
3			2.350		5.73	16.75	146.6		2696	9	
4			2.325		6.74	17.64	145.1		2292	11	
5			2.347		5.86	16.87	146.5		2710	11	
6			2.338		6.22	13.29	145.9		283.3		

Bituminous mix design data by Marshall method — Series B, continued.

Specimen No.	% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb, Meas.	Stability, lb, Adj.	Flow, in. (× 0.01)	Gradation
B146 1	6.00	5.70	2.405	2.469	2.57	16.28	150.1		2163	14	C-30L
2			2.403		2.65	16.35	149.9		2650	13	
3			2.414		2.21	15.97	150.6		2750	13	
4			2.397		2.90	16.56	149.6		2410	12	
5			2.403		2.65	16.35	149.9		2426	13	
6			2.407		2.51	12.50	150.2		252.1		
B147 1	4.00	4.10	2.229	2.561	12.97	22.11	139.0		2498	8	
2			2.219		13.36	22.46	138.5		2805	8	
3			2.209		13.75	22.81	137.8		3519	8	
4			2.230		12.93	22.07	139.2		2835	9	
5			2.210		13.71	22.77	137.9		–	–	
6			2.213		13.55	18.19	138.1		196.5		
B148 1	3.00	3.20	2.223	2.632	15.55	20.66	138.7		2160	8	
2			2.209		16.08	23.15	137.8		2376	8	
3			2.201		16.38	23.42	137.3		2499	8	
4			2.231		15.24	22.38	139.2		2100	8	
5			2.241		14.86	22.03	139.8		2172	8	
6			2.213		15.92	17.42	138.1		158.8		
B149 1	7.00	6.50	2.383	2.447	2.63	18.12	148.7		1691	18	
2			2.386		2.50	20.76	148.9		1642	13	
3			2.381		2.71	18.19	148.6		2861	13	
4			2.398		2.01	17.60	149.6		2454	14	
5			2.383		2.63	18.12	148.7		2352	14	
6			2.392		2.25	13.78	149.3		271.0		
B150 1	5.00	4.68	2.302	2.552	9.80	20.57	143.6		2432	10	
2			2.258		11.53	20.10	140.9		2612	9	
3			2.290		10.27	20.99	142.9		3152	9	
4			2.277		10.78	21.44	142.1		2667	11	
5			2.279		10.70	21.36	142.2		2638	11	
6			2.263		11.32	16.84	141.2		274.4		
B151 1	6.00	5.88	2.393	2.442	2.01	16.08	149.3		2065	14	A-P
2			2.393		2.01	16.08	149.3		3036	11	
3			2.395		1.93	16.01	149.5		3094	11	
4			2.369		2.99	16.91	147.8		2406	12	
5			2.373		–	–	148.1		2525	12	
6			2.393		2.01	12.12	149.3		292.0		
B152 1	5.00	4.07	2.407	2.488	3.26	13.06	150.2		2525	12	
2			2.355		5.35	14.93	147.0		3420	10	
3			2.332		6.27	15.76	145.5		3337	11	
4			2.319		6.80	16.24	144.7		2808	13	
5			2.349		5.59	15.15	146.6		2907	12	
6			2.327		4.66	11.22	145.2		327.0		
B153 1	7.00	6.47	2.385	2.401	0.66	16.09	148.8		1479	28	
2			2.406		0.00	15.36	150.1		2029	17	
3			2.403		0.00	15.47	149.9		1850	16	
4			2.409		0.00	15.26	150.3		2141	21	
5			2.408		0.00	15.29	150.3		1848	18	
6			2.400		0.04	12.42	149.8		–		
B154 1	4.00	3.86	2.375	2.525	5.94	15.11	148.2		2222	11	
2			2.321		8.08	17.04	144.8		2928	9	
3			2.312		8.44	17.36	144.3		3102	11	
4			2.344		7.17	16.22	146.3		3306	12	
5			2.311		8.48	17.40	144.2		2565	12	
6			2.317		8.60	13.09	144.6		285.5		
B155 1	3.00	3.03	2.220	2.625	15.41	22.14	138.5		1672	8	
2			2.219		15.45	22.17	138.5		2676	8	
3			2.214		15.64	22.35	138.2		2623	8	
4			2.211		15.76	22.46	138.0		2171	10	
5			2.200		16.18	22.85	137.3		1881	10	
6			2.219		15.47	16.04	138.5		166.9		
B156 1	3.00	3.03	2.241	2.616	14.34	21.13	139.8		2679	8	C-30
2			2.245		14.19	20.99	140.1		2850	8	
3			2.250		14.00	20.82	140.4		2828	8	
4			2.246		14.15	22.95	140.2		2480	9	
5			2.249		14.04	20.85	140.3		2560	9	
6			2.242		14.30	16.25	139.9		177.8		
B157 1	5.00	4.68	2.317	2.564	9.63	20.47	144.6		2871	9	
2			2.303		10.18	20.96	143.7		2339	9	
3			2.307		10.02	20.82	143.9		3571	9	
4			2.308		9.98	20.78	144.0		3822	10	
5			2.280		11.07	21.74	142.3		3049	10	
6			2.263		11.74	16.91	141.2		249.9		

Bituminous mix design data by Marshall method — Series B, continued.

Specimen No.	% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb. Meas.	Stability, lb. Adj.	Flow, in. (x 0.01)	Gradation
B158 1	7.00	6.47	2.388	2.461	2.97	18.42	149.0		2550	14	C-30
2			2.385		3.09	18.52	148.8		3346	11	
3			2.394		2.73	18.22	149.4		3683	12	
4			2.395		2.68	18.18	149.4		3683	12	
5			2.391		2.85	18.34	149.2		3445	11	
6			2.387		3.01	14.00	148.9		319.4		
B159 1	6.00	5.68	2.383	2.474	3.67	17.03	148.7		2550	12	
2			2.374		4.04	17.52	148.1		3361	10	
3			2.369		4.04	17.70	147.8		3485	10	
4			2.383		3.67	17.21	148.7		3920	11	
5			2.370		4.20	17.66	147.9		3430	11	
6			2.366		4.36	14.04	147.6		318.8		
B160 1	4.00	3.86	2.293	2.564	10.58	19.43	143.1		2977	8	
2			2.268		11.55	20.30	141.5		3214	8	
3			2.266		11.63	20.38	141.4		3104	8	
4			2.277		11.20	19.99	142.1		3381	9	
5			2.269		11.51	20.27	141.6		3201	9	
6			2.261		11.86	16.30	141.1		266.7		
B161 1	4.00	3.87	2.339	2.536	7.77	12.75	145.9		—	—	A-100
2			2.296		9.46	14.35	143.3		1880	10	
3			2.321		8.48	13.42	144.8		2548	9	
4			2.350		7.33	12.34	146.6		2496	12	
5			2.306		9.07	13.98	143.9		1757	13	
6			2.290		11.10	14.78	142.9		163.9		
B162 1	6.00	5.70	2.405	2.454	2.00	11.99	150.1		1212	35	
2			2.418		1.47	11.52	150.9		1400	27	
3			2.426		1.14	11.23	151.4		1313	27	
4			2.413		1.67	11.70	150.6		1421	27	
5			2.422		1.30	11.37	151.1		1415	28	
6			2.410		1.79	11.81	150.1		163.1		
B163 1	5.15	4.89	2.410	2.487	3.10	11.05	150.4		1323	23	
2			2.408		3.18	11.13	150.3		1632	22	
3			2.416		2.86	10.83	150.8		1850	19	
4			2.404		3.34	11.28	150.1		1683	20	
5			2.427		2.41	10.43	151.4		1565	21	
6			2.422		2.61	10.61	151.1		170.5		
B164 1	7.00	6.49	2.389	2.440	2.09	13.31	149.1		1336	32	
2			2.414		1.07	12.41	150.6		1680	20	
3			2.417		0.94	12.30	150.8		1377	19	
4			2.417		0.94	12.30	150.8		1479	32	
5			2.399		1.68	12.95	149.7		1300	30	
6			2.399		2.87	12.95	149.7		134.0		
B165 1	3.13	3.04	2.304	2.575	10.52	13.31	143.8		1729	10	
2			2.292		10.99	13.76	143.0		2525	11	
3			2.319		9.94	12.75	144.7		2600	9	
4			2.331		9.48	12.30	145.5		2184	10	
5			2.294		10.91	13.69	143.1		2020	11	
6			2.300		10.67	13.46	143.5		200.7		

Appendix G-2. Bituminous mix design data by Hveem method — Series B.

Specimen No.	% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Hveem stability	Cohesiometer value	Gradation
B001 7	5.80	5.49	2.428	2.403	0.00	10.92	151.5	0	157	B-8
8			2.424		0.00	11.07	151.3	0	166	
9			2.430		0.00	10.85	151.6	0	159	
B002 7	3.00	3.03	2.319	2.583	10.22	12.70	144.7	57.5	92	
8			2.328		9.87	12.37	145.3	55.6	130	
9			2.296		11.11	13.57	143.3	55.4	166	
B003 7	4.00	3.86	2.375	2.537	6.39	11.36	148.2	47.8	138	
8			2.392		5.72	10.73	149.3	48.4	148	
9			2.390		5.79	10.80	149.1	47.6	259	
B004 7	4.69	4.48	2.400	2.495	3.81	11.01	149.8	48.8	284	
8			2.404		3.65	10.86	150.0	47.9	250	
9			2.402		3.73	10.93	149.9	46.5	236	
B005 7	7.00	6.47	2.421	2.495	2.97	12.10	151.1	0	90	
8			2.419		3.05	12.17	150.9	0	108	
9			2.413		3.29	12.39	150.6	0	104	
B006 7	6.00	5.68	2.427	2.414	0.00	10.75	151.4	0	148	A-30H
8			2.428		0.00	10.72	151.5	0	133	
9			2.426		0.00	10.79	151.4	0	104	
B007 7	4.00	3.86	2.409	2.502	3.72	9.71	150.3	34.6	192	
8			2.435		2.68	8.73	151.9	34.3	203	
9			2.436		2.64	8.70	152.0	37.7	157	
B008 7	2.90	2.82	2.373	2.583	8.13	10.09	148.1	59.7	136	
8			2.351		8.98	10.93	146.7	60.5	163	
9			2.354		8.87	10.81	146.9	63.2	100	
B009 7	7.00	6.47	2.400	2.407	0.29	12.49	149.8	0	74	
8			2.400		0.29	12.49	149.8	0	151	
9			2.412		0.00	12.05	150.5	0	115	
B010 7	5.13	4.88	2.430	2.444	0.57	9.89	151.6	0	139	
8			2.424		0.82	10.11	151.3	0	100	
9			2.427		0.70	10.00	151.4	0	165	
B011 7	3.00	3.03	2.306	2.562	9.99	13.23	143.9	60.0	155	B-P
8			2.338		8.74	12.02	145.9	56.6	187	
9			2.316		9.60	12.85	144.5	59.0	179	
B012 7	5.00	4.68	2.446	2.499	2.12	9.53	152.6	31.6	193	
8			2.432		2.68	10.04	151.8	37.3	207	
9			2.434		2.60	9.97	151.9	36.0	204	
B013 7	6.00	5.68	2.446	2.446	0.00	10.47	152.6	0 [a]	133	
8			2.446		0.00	10.47	152.6	11.9 [a]	144	
9			2.451		0.00	10.29	152.9	13.9 [a]	119	
B014 7	7.00	6.47	2.427	2.416	0.00	11.91	151.4	3.7 [a]	98	
8			2.425		0.00	11.99	151.3	4.8 [a]	103	
9			2.429		0.00	11.84	151.6	3.5 [a]	80	
B015 7	3.79	3.66	2.443	2.517	2.94	8.67	152.4	30.2	165	
8			2.440		3.06	8.78	152.3	28.1	218	
9			2.431		3.42	9.12	151.7	29.4	186	
B016 7	8.26	7.63	2.363	2.382	0.80	16.44	147.5	56.1	146	C-100
8			2.387		0.00	15.59	148.9	48.2	177	
9			2.399		0.00	15.16	149.7	49.7	202	
B017 7	5.00	4.68	2.435	2.527	3.64	11.14	151.9	36.6	154	
8			2.433		3.72	11.21	151.8	36.8	218	
9			2.434		3.68	11.18	151.9	31.4	199	
B018 7	8.26	7.63	2.360	2.382	0.92	16.54	147.3	0 [a]	33	
8			2.370		0.50	16.19	147.9	0.4 [a]	50	
9			2.372		0.38	16.08	148.1	0.9 [a]	40	
B019 7	6.00	5.68	2.445	2.465	0.81	11.71	152.6	10.0 [a]	95	
8			2.449		0.65	11.57	152.8	9.6 [a]	123	
9			2.448		0.69	11.60	152.8	9.0 [a]	122	
B020 7	7.00	6.47	2.429	2.424	0.00	13.02	151.6	2.5 [a]	84	
8			2.423		0.04	13.24	151.2	3.3 [a]	79	
9			2.425		0.00	13.17	151.3	4.2 [a]	98	
B021 7	6.00	5.68	2.445	2.439	0.00	10.65	152.6	19.1	125	C-100L
8			2.455		0.00	10.65	152.6	16.0	135	
9			2.455		0.00	10.29	153.2	12.7	172	
B022 7	7.00	6.47	2.430	2.427	0.00	11.94	151.6	19.9	158	
8			2.424		0.12	12.16	151.3	16.1	128	
9			2.424		0.12	12.16	151.3	16.5	153	

[a] Extrapolated stability values (from log P_v - log P_h plots).

Bituminous mix design data by Hveem method — Series B, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Hveem stability	Cohesiometer value	Gradation
B023	7	4.24	4.07	2.397	2.504	4.27	10.91	149.6	41.8	135	C-100L
	8			2.403		4.03	10.69	149.9	46.1	155	
	9			2.402		4.07	10.72	149.9	45.6	149	
B024	7	2.90	2.82	2.282	2.567	11.10	14.08	142.4	51.0	156	
	8			2.304		10.25	13.25	143.8	50.7	148	
	9			2.284		11.03	14.00	142.5	50.0	169	
B025	7	5.13	4.88	2.420	2.475	2.22	10.81	151.0	35.6	152	
	8			2.412		2.55	11.11	150.5	33.9	163	
	9			2.428		1.90	10.52	151.5	30.0	167	
B026	7	7.37	6.86	2.424	2.419	0.00	12.49	151.3	1.7[a]	138	B-30
	8			2.414		0.21	12.85	150.6	0.5[a]	114	
	9			2.425		0.00	12.46	151.3	0.3[a]	132	
B027	7	5.13	4.88	2.445	2.467	0.89	9.86	152.6	9.3[a]	184	
	8			2.448		0.77	9.75	152.8	10.6[a]	165	
	9			2.446		0.85	9.82	152.6	10.3[a]	164	
B028	7	6.25	5.88	2.431	2.440	0.37	11.32	151.7	3.1[a]	152	
	8			2.432		0.33	11.28	151.8	2.7[a]	130	
	9			2.431		0.37	11.32	151.7	2.1[a]	143	
B029	7	4.00	3.86	2.428	2.536	4.26	9.52	151.5	36.9	230	
	8			2.434		4.02	9.30	151.9	36.0	182	
	9			2.418		4.65	9.10	150.9	44.8	167	
B030	7	3.00	3.03	2.376	2.697	11.90	10.70	148.3	55.5	192	
	8			2.367		12.24	11.04	147.7	61.7	169	
	9			2.368		12.20	10.99	147.8	55.5	154	
B031	7	5.00	4.68	2.432	2.476	1.78	9.59	151.8	19.1	179	A-30L
	8			2.433		1.74	9.55	151.8	24.7	165	
	9			2.441		1.41	9.25	152.3	23.6	144	
B032	7	3.35	3.24	2.391	2.535	5.68	9.77	149.2	35.4	163	
	8			2.382		6.04	10.11	148.6	48.3	156	
	9			2.349		7.34	11.35	146.6	51.6	168	
B033	7	7.00	6.47	2.398	2.421	0.95	12.53	149.6	2.0[a]	125	
	8			2.420		0.04	11.72	151.0	3.9[a]	75	
	9			2.417		0.17	11.83	150.8	6.8[a]	141	
B034	7	6.00	5.68	2.425	2.434	0.37	10.79	151.3	17.9	193	
	8			2.408		1.07	11.42	150.3	30.8	232	
	9			2.426		0.33	10.76	151.4	27.4	244	
B035	7	4.00	3.86	2.416	2.520	4.13	9.41	150.8	42.7	186	
	8			2.423		3.85	9.15	151.2	50.5	266	
	9			2.407		4.48	9.75	150.2	46.3	232	
B036	7	5.00	4.68	2.420	2.418	0.00	10.00	151.0	26.7	173	A-8
	8			2.417		0.04	10.11	150.8	50.5	212	
	9			2.430		0.00	9.63	151.6	26.1	168	
B037	7	4.24	4.07	2.374	2.454	3.26	11.14	148.1	50.5	151	
	8			2.376		3.23	11.07	148.3	50.5	147	
	9			2.397		2.32	10.28	149.6	52.9	111	
B038	7	6.00	5.68	2.429	2.425	0.00	10.61	151.6	15.0	112	
	8			2.427		0.00	10.69	151.4	17.3	105	
	9			2.428		0.00	10.65	151.5	11.9	185	
B039	7	3.35	3.24	2.369	2.521	6.03	10.56	147.8	55.5	169	
	8			2.349		6.82	11.32	142.6	49.3	111	
	9			2.386		5.36	9.92	148.9	50.5	156	
B040	7	2.00	1.97	2.283	2.600	12.19	12.68	142.5	63.4	124	
	8			2.280		12.31	12.79	142.3	58.4	135	
	9			2.283		12.19	12.68	142.5	65.3	126	
B041	7	7.14	6.67	2.407	2.389	0.00	12.59	150.2	11.8	98	A-I
	8			2.406		0.00	12.63	150.1	10.3	83	
	9			2.408		0.00	12.55	150.3	11.2	96	
B042	7	5.80	5.47	2.410	2.426	0.66	11.36	150.4	13.2	156	
	8			2.404		0.91	11.58	150.3	19.0	215	
	9			2.414		0.50	11.21	150.6	20.2	177	
B043	7	3.00	3.03	2.321	2.529	8.23	12.43	144.8	54.1	154	
	8			2.299		9.10	13.26	143.5	55.5	139	
	9			2.315		8.46	12.65	144.5	56.9	130	
B044	7	4.24	4.07	2.353	2.552	7.80	12.17	146.8	50.5	214	
	8			2.359		7.56	11.95	147.2	52.9	198	
	9			2.363		7.41	11.80	147.5	55.5	206	

Bituminous mix design data by Hveem method — Series B, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Hveem stability	Cohesiometer value	Gradation
B045	7	5.00	4.68	2.406	2.450	1.80	10.76	150.1	42.7	127	A-I
	8			2.398		2.12	11.06	149.6	48.3	181	
	9			2.403		1.92	10.87	149.9	46.3	180	
B046	7	5.00	4.68	2.386	2.455	2.81	11.30	148.9	49.3	238	A-30LH
	8			2.389		2.69	11.19	149.0	47.2	269	
	9			2.379		3.10	11.56	148.4	39.6	166	
B047	7	4.00	3.86	2.300	2.547	9.70	13.76	143.5	49.3	167	
	8			2.343		8.01	12.15	146.2	55.5	231	
	9			2.346		7.89	12.03	146.4	46.3	202	
B048	7	7.00	6.47	2.421	2.427	0.25	11.69	151.1	12.5	107	
	8			2.420		0.29	11.72	151.0	12.3	139	
	9			2.421		0.25	11.69	151.1	16.8	163	
B049	7	3.00	3.03	2.281	2.528	10.13	13.73	142.3	61.7	193	
	8			2.282		10.09	13.70	142.4	56.9	162	
	9			2.298		9.46	13.09	143.4	58.4	202	
B050	7	6.00	5.68	2.388	2.418	1.24	12.15	149.0	29.6	198	
	8			2.421		0.00	10.94	151.1	39.6	158	
	9			2.413		0.21	11.24	150.6	28.8	134	
B051	7	4.00	3.86	2.336	2.493	6.30	12.17	145.8	46.3	156	A-F
	8			2.352		5.66	11.57	146.8	52.9	166	
	9			2.374		4.77	10.74	148.1	47.2	133	
B052	7	4.69	4.48	2.398	2.443	1.84	10.42	149.6	39.6	164	
	8			2.401		1.72	10.31	149.8	41.1	187	
	9			2.391		2.13	10.68	149.2	46.3	192	
B053	7	6.00	5.68	2.414	2.416	0.08	10.96	150.6	24.7	152	
	8			2.416		0.00	10.88	150.8	23.4	169	
	9			2.414		0.08	10.96	150.6	23.4	192	
B054	7	3.00	3.03	2.317	2.543	8.89	12.13	144.6	35.8	173	
	8			2.340		7.98	11.26	146.0	49.3	147	
	9			2.332		8.30	11.56	145.5	55.5	225	
B055	7	7.00	6.47	2.415	2.399	0.00	11.66	150.7	21.3	228	
	8			2.410		0.00	11.85	150.4	20.9	138	
	9			2.412		0.00	11.78	150.5	28.8	165	
B056	7	3.00	3.03	2.318	2.579	10.12	13.51	144.6	65.3	181	C-I
	8			2.301		10.78	14.15	143.6	61.7	148	
	9			2.312		10.35	13.74	144.3	61.7	139	
B057	7	7.00	6.47	2.432	2.441	0.37	12.48	151.8	29.6	207	
	8			2.436		0.21	12.34	152.0	22.7	229	
	9			2.436		0.21	12.34	152.0	23.1	219	
B058	7	4.00	3.86	2.362	2.558	7.66	12.63	147.4	54.1	212	
	8			2.337		8.64	13.55	145.8	56.9	202	
	9			2.358		7.82	12.78	147.1	54.1	202	
B059	7	6.00	5.68	2.427	2.464	1.50	11.75	151.4	38.3	233	
	8			2.430		1.38	11.64	151.6	28.8	221	
	9			2.422		1.71	11.93	151.1	29.6	243	
B060	7	5.00	4.68	2.417	2.506	3.55	11.36	150.8	32.2	212	
	8			2.415		3.63	11.43	150.7	30.4	269	
	9			2.410		3.83	11.61	150.4	34.7	195	
B061	7	5.13	4.88	2.407	2.413	0.25	10.60	150.2	20.4	205	A-8LH
	8			2.413		0.00	10.38	150.6	17.6	230	
	9			2.405		0.33	10.67	150.1	17.6	223	
B062	7	7.14	6.67	2.394	2.390	0.00	12.76	149.4	6.0[a]	146	
	8			2.398		0.00	12.61	149.6	7.1[a]	144	
	9			2.397		0.00	12.65	149.6	5.8[a]	140	
B063	7	4.00	3.86	2.399	2.450	2.08	9.94	149.7	34.2	249	
	8			2.394		2.29	10.13	149.4	30.4	201	
	9			2.409		1.67	9.57	150.3	37.0	254	
B064	7	6.00	5.68	2.392	2.397	0.21	11.90	149.3	0[a]	162	
	8			2.398		0.00	11.68	149.6	6.3[a]	140	
	9			2.401		0.00	11.57	149.8	7.5[a]	160	
B065	7	2.90	2.82	2.355	2.524	6.70	10.64	147.0	52.9	306	
	8			2.331		7.65	11.55	145.5	52.9	229	
	9			2.345		7.09	11.02	146.3	51.6	227	
B066	7	6.25	5.88	2.398	2.414	0.66	12.04	149.7	39.6	204	A-30
	8			2.422		0.00	11.16	151.1	26.4	214	
	9			2.410		0.17	11.60	150.4	30.4	184	

Bituminous mix design data by Hveem method — Series B, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Hveem stability	Cohesiometer value	Gradation
B067	7	5.00	4.68	2.371	2.469	3.97	11.92	148.0	45.2	207	A-30
	8			2.380		3.61	11.59	148.5	35.2	193	
	9			2.378		3.69	11.66	148.4	51.6	189	
B068	7	3.79	3.66	2.381	2.511	5.18	10.61	148.6	51.6	272	
	8			2.372		5.54	10.94	148.0	44.4	266	
	9			2.387		4.94	10.38	148.9	37.6	249	
B069	7	3.00	3.03	2.292	2.601	11.88	13.39	143.0	54.1	224	
	8			2.300		11.57	13.08	143.5	48.3	145	
	9			2.330		10.42	11.95	145.4	55.5	203	
B070	7	7.00	6.47	2.396	2.419	0.95	12.67	149.5	4.8[a]	148	
	8			2.389		1.24	12.92	149.1	3.8[a]	110	
	9			2.394		1.03	12.74	149.4	5.8[a]	209	
B071	7	7.14	6.67	2.390	2.379	0.00	12.70	149.1	9.6[a]	140	A-4L
	8			2.395		0.00	12.52	149.4	8.4[a]	120	
	9			2.409		0.00	12.00	150.2	9.0[a]	148	
B072	7	5.00	4.68	2.401	2.439	1.56	10.43	149.8	29.6	163	
	8			2.392		1.93	10.76	149.3	43.5	234	
	9			2.409		1.23	10.13	150.3	27.1	192	
B073	7	4.24	4.07	2.399	2.447	1.96	9.93	149.7	44.4	192	
	8			2.389		2.37	10.30	149.1	49.3	157	
	9			2.400		1.92	9.89	149.8	42.7	224	
B074	7	3.00	3.03	2.347	2.583	9.14	10.92	146.5	51.6	206	
	8			2.339		9.45	11.23	146.0	50.5	176	
	9			2.359		8.67	10.47	147.2	52.9	164	
B075	7	5.80	5.49	2.418	2.417	0.00	10.56	150.9	15.5	209	
	8			2.417		0.00	10.60	150.8	13.7	142	
	9			2.417		0.00	10.60	150.8	13.3	162	
B076	7	7.00	6.47	2.412	2.392	0.00	11.88	150.5	11.2	173	
	8			2.413		0.00	11.84	150.6	8.7[a]	207	
	9			2.410		0.00	11.95	150.4	11.3	104	
B077	7	2.90	2.82	2.307	2.565	10.06	12.42	144.0	37.0	186	A-4LH
	8			2.314		9.79	12.16	144.4	60.0	198	
	9			2.297		10.45	12.80	143.3	54.1	126	
B078	7	5.00	4.68	2.427	2.443	0.66	9.63	151.4	22.9	211	
	8			2.419		0.98	9.93	150.9	39.6	218	
	9			2.420		0.94	9.89	151.0	32.6	209	
B079	7	6.00	5.68	2.423	2.399	0.00	10.73	151.2	32.2	225	
	8			2.429		0.00	10.51	151.6	22.7	168	
	9			2.425		0.00	10.65	151.3	22.2	173	
B080	7	4.00	3.86	2.373	2.452	3.22	10.88	148.1	39.6	165	
	8			2.416		1.47	9.27	150.8	47.2	201	
	9			2.421		1.26	9.08	151.1	47.2	232	
B081	7	3.13	3.03	2.273	2.590	12.24	14.00	141.8	63.4	117	A-8H
	8			2.234		13.75	15.48	139.4	54.8	113	
	9			2.257		12.86	14.61	140.8	60.8	158	
B082	7	6.03	5.67	2.412	2.414	0.08	11.23	150.5	10.3[a]	270	
	8			2.408		0.25	11.38	150.3	9.8[a]	277	
	9			2.414		0.00	11.15	150.6	11.4[a]	179	
B083	7	6.90	6.46	2.395	2.399	0.17	12.59	149.4	2.1[a]	113	
	8			2.397		0.08	12.52	149.6	5.0[a]	116	
	9			2.409		0.00	12.08	150.3	5.5[a]	139	
B084	7	4.68	4.47	2.397	2.453	2.28	10.66	149.6	24.6	269	
	8			2.401		2.12	10.51	149.8	30.1	281	
	9			2.399		2.20	10.58	149.7	23.2	245	
B085	7	4.01	3.85	2.343	2.551	8.15	12.10	146.2	48.2	242	
	8			2.334		8.51	12.44	145.6	53.4	233	
	9			2.333		8.48	12.48	145.6	55.9	227	
B086	7	4.00	3.85	2.339	2.541	7.95	12.53	146.0	40.0	225	B-8L
	8			2.310		9.09	13.61	144.1	46.8	245	
	9			2.310		9.01	13.54	144.3	46.0	206	
B087	7	3.33	3.23	2.271	2.602	12.72	14.52	141.7	55.4	201	
	8			2.267		12.88	14.67	141.5	52.6	176	
	9			2.289		12.03	13.84	142.8	55.5	199	
B088	7	6.67	6.25	2.387	2.409	0.91	12.96	148.9	2.8[a]	150	
	8			2.382		1.12	13.14	148.6	3.3[a]	152	
	9			2.377		1.33	13.32	148.3	3.3[a]	120	

Bituminous mix design data by Hveem method — Series B, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Hveem stability	Cohesiometer value	Gradation
B089	7	4.67	4.46	2.383	2.484	4.07	11.45	148.7	36.6	314	B-8L
	8			2.373		4.47	11.82	148.0	32.3	276	
	9			2.379		4.23	11.60	148.4	29.7	272	
B090	7	6.00	5.66	2.394	2.397	0.13	12.15	149.4	4.9[a]	171	
	8			2.394		0.13	12.15	149.4	4.7[a]	178	
	9			2.397		0.00	12.04	149.6	5.0[a]	209	
B091	7	4.91	4.68	2.335	2.486	6.07	13.66	145.7	42.5	244	B-30L
	8			2.353		5.35	13.00	146.8	43.2	196	
	9			2.343		5.75	13.37	146.2	47.0	267	
B092	7	6.92	6.47	2.384	2.388	0.17	15.51	148.8	10.2[a]	188	
	8			2.386		0.08	13.44	148.9	9.8[a]	199	
	9			2.383		0.21	13.54	148.7	9.8[a]	206	
B093	7	3.35	3.24	2.240	2.560	12.50	15.93	139.8	53.1	222	
	8			2.220		13.28	16.68	138.5	49.1	196	
	9			2.262		11.64	15.10	141.1	36.6	189	
B094	7	6.25	5.88	2.388	2.432	1.81	12.82	149.0	23.4	280	
	8			2.376		2.30	13.26	148.3	20.0	264	
	9			2.401		1.28	12.34	149.8	22.3	299	
B095	7	3.79	3.66	2.296	2.526	9.10	14.20	143.3	50.6	220	
	8			2.315		8.35	13.49	144.5	51.7	260	
	9			2.316		8.31	13.45	144.5	48.5	249	
B096	7	6.25	5.88	2.412	2.470	2.35	12.45	150.5	16.2	226	C-P
	8			2.415		2.23	12.34	150.7	14.7	273	
	9			2.421		1.98	12.12	151.1	15.5	274	
B097	7	3.13	3.03	2.287	2.600	12.04	14.47	142.7	37.2	144	
	8			2.262		13.00	15.41	141.1	44.6	175	
	9			2.278		12.38	14.81	142.1	51.0	200	
B098	7	4.02	3.86	2.322	2.573	9.76	13.91	144.9	51.9	248	
	8			2.328		9.52	13.68	145.3	54.4	182	
	9			2.312		10.14	14.28	144.3	47.8	246	
B099	7	4.91	4.68	2.336	2.538	7.96	14.13	145.8	47.7	269	
	8			2.361		6.97	13.21	147.3	48.7	238	
	9			2.361		6.97	13.21	147.3	40.4	242	
B100	7	6.70	6.28	2.418	2.430	0.49	12.60	150.9	4.0[a]	194	
	8			2.416		0.58	12.68	150.8	8.2	173	
	9			2.415		0.62	12.71	150.7	5.2	217	
B101	7	2.91	2.83	2.270	2.424	9.02	15.84	141.6	68.3	103	B-B
	8			2.270		8.91	15.84	141.6	60.7	86	
	9			2.290		9.09	15.10	142.9	47.3	100	
B102	7	4.03	3.87	2.310	2.472	6.55	15.28	144.1	43.4	95	
	8			2.300		6.96	15.64	143.5	46.1		
	9			2.300		6.96	15.64	143.5	54.7	100	
B103	7	6.94	6.49	2.390	2.458	2.77	14.73	149.2	14.0	149	
	8			2.400		2.36	14.38	149.7	22.8	135	
	9			2.400		2.36	14.38	149.7	22.9	138	
B104	7	6.04	5.70	2.393	2.463	2.84	13.90	149.3	33.9	84	
	8			2.406		2.31	13.44	150.1	42.6	115	
	9			2.401		2.52	13.62	149.8	40.7	95	
B105	7	5.15	4.89	2.370	2.494	5.00	14.00	147.9	61.2	144	
	8			2.375		4.77	13.82	148.2	52.6	152	
	9			2.376		4.73	13.78	148.3	53.1	204	
B106	7	3.80	3.66	2.394	2.518	4.92	9.84	149.4	63.2	250	A-8L
	8			2.352		6.59	11.42	146.8	47.6	290	
	9			2.374		5.72	10.59	148.1	49.1	181	
B107	7	3.36	3.25	2.327	2.600	10.50	11.99	145.2	51.2	204	
	8			2.329		10.42	11.91	145.3	50.2	234	
	9			2.327		10.50	11.99	145.2	50.7	211	
B108	7	6.04	5.70	2.411	2.443	1.31	11.12	150.5	6.4[a]	154	
	8			2.399		1.80	11.56	149.7	3.5[a]	138	
	9			2.410		1.35	11.16	150.4	5.9[a]	169	
B109	7	6.94	6.49	2.391	2.342	0.04	12.60	149.2	2.4[a]	111	
	8			2.393		0.00	12.52	149.3	2.4[a]	117	
	9			2.389		0.12	12.67	149.1	1.3[a]	111	
B110	7	4.92	4.69	2.414	2.442	1.19	10.10	150.6	6.1[a]	209	
	8			2.415		1.15	10.02	150.7	8.4[a]	185	
	9			2.414		1.19	10.10	150.6	7.5[a]	184	

Bituminous mix design data by Hveem method — Series B, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Hveem stability	Cohesiometer value	Gradation
B111	7	4.00	3.85	2.304	2.557	9.89	13.74	142.9	53.5	103	B-100L
	8			2.319		9.31	13.17	143.8	46.3	198	
	9			2.326		9.03	12.91	144.7	52.1	184	
B112	7	3.33	3.23	2.249	2.618	14.10	15.25	140.3	54.3	164	
	8			2.256		13.83	14.99	140.8	49.6	180	
	9			2.267		13.41	14.57	141.5	52.6	157	
B113	7	6.89	6.44	2.418	2.426	0.33	11.90	150.9	30.0	178	
	8			2.414		0.50	12.05	150.6	17.9	170	
	9			2.421		0.21	11.80	151.1	19.5	196	
B114	7	6.00	5.66	2.407	2.434	1.11	11.58	150.2	24.5	227	
	8			2.411		0.94	11.43	150.5	22.0	216	
	9			2.409		1.03	11.50	150.3	23.7	172	
B115	7	4.89	4.66	2.399	2.456	2.32	10.93	149.7	34.6	205	
	8			2.411		1.83	10.49	150.5	38.5	206	
	9			2.406		2.04	10.67	150.1	35.3	190	
B116	7	3.36	3.25	2.329	2.604	10.56	12.86	145.3	52.9	189	C-8L
	8			2.330		10.52	12.83	145.4	48.6	205	
	9			2.293		11.94	14.21	143.1	52.4	195	
B117	7	6.71	6.29	2.439	2.433	0.00	11.62	152.2	2.3[a]	135	
	8			2.439		0.00	11.62	152.2	3.0[a]	165	
	9			2.439		0.00	11.62	152.2	3.4[a]	118	
B118	7	4.03	3.87	2.359	2.578	8.50	12.31	147.2	53.4	233	
	8			2.316		10.16	13.91	144.5	50.2	154	
	9			2.332		9.54	13.31	145.5	45.9	187	
B119	7	6.04	5.70	2.430	2.445	0.61	11.39	151.6	3.0[a]	107	
	8			2.432		0.53	11.32	151.8	5.5[a]	85	
	9			2.433		0.49	11.28	151.8	4.8[a]	130	
B120	7	4.70	4.49	2.430	2.555	4.89	10.25	151.6	28.5	239	
	8			2.434		4.74	10.10	151.9	26.2	183	
	9			2.440		4.50	9.88	152.3	29.9	149	
B121	7	3.13	3.04	2.329	2.609	10.73	12.03	145.3	42.5	172	A-4H
	8			2.309		11.50	12.78	144.1	44.0	149	
	9			2.315		11.27	12.56	144.5	50.3	191	
B122	7	4.92	4.69	2.403	2.478	3.03	10.78	149.9	47.0	206	
	8			2.388		3.63	11.34	149.0	50.8	238	
	9			2.366		4.52	12.15	147.6	46.6	195	
B123	7	6.04	5.70	2.426	2.421	0.00	10.88	151.4	11.9	205	
	8			2.426		0.00	10.88	151.4	19.1	267	
	9			2.429		0.00	10.77	151.6	12.7	162	
B124	7	4.03	3.87	2.357	2.506	5.95	11.73	147.1	44.6	286	
	8			2.379		5.35	11.17	148.0	50.9	214	
	9			2.379		5.07	10.91	148.5	48.4	273	
B125	7	6.71	6.29	2.430	2.401	0.00	11.29	151.6	9.7[a]	211	
	8			2.417		0.00	11.77	150.8	9.1[a]	217	
	9			2.412		0.00	11.95	150.5	19.8	202	
B126	7	4.90	4.50	2.410	2.497	3.48	11.27	150.4	22.8	367	B-100
	8			2.395		4.08	11.83	149.5	28.8	347	
	9			2.393		4.16	11.90	149.3	32.6	318	
B127	7	6.01	5.50	2.410	2.433	0.94	12.20	150.4	13.3	202	
	8			2.411		0.90	12.17	150.5	13.8	239	
	9			2.411		0.90	12.17	150.5	12.6	223	
B128	7	3.12	2.90	2.309	2.578	10.43	13.57	144.1	34.7	272	
	8			2.303		10.67	13.79	143.7	45.2	154	
	9			2.290		11.71	14.28	142.9	49.8	158	
B129	7	6.90	6.30	2.399	2.426	1.11	13.34	149.7	3.1[a]	116	
	8			2.403		0.95	13.20	149.9	6.4[a]	153	
	9			2.402		0.99	13.24	149.9	5.3[a]	131	
B130	7	4.01	3.70	2.272	2.560	11.25	15.65	141.8	51.7	203	
	8			2.283		10.82	15.25	142.5	51.2	222	
	9			2.317		9.49	13.98	144.6	46.3	234	
B131	7	6.03	5.70	2.428	2.458	1.22	11.67	151.5	10.6[a]	168	C-8
	8			2.428		1.22	11.67	151.5	14.1	175	
	9			2.426		1.30	11.74	151.4	15.2	180	
B132	7	6.92	6.50	2.432	2.433	0.04	12.27	151.8	5.1[a]	150	
	8			2.436		0.00	12.13	152.0	5.5[a]	156	
	9			2.436		0.00	12.13	152.0	8.0[a]	181	

Bituminous mix design data by Hveem method — Series B, continued.

Specimen No.	% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Hveem stability	Cohesiometer value	Gradation
B133 7	4.02	3.90	2.277	2.566	11.26	15.58	142.1	56.6	185	C-8
8			2.299		10.40	14.76	143.5	49.1	200	
9			2.307		10.09	14.47	144.0	51.9	194	
B134 7	4.91	4.70	2.369	2.527	6.25	12.90	147.8	43.1	235	
8			2.375		6.02	12.68	148.2	49.9	256	
9			2.362		6.53	13.16	147.4	39.9	261	
B135 7	3.13	3.00	2.314	2.586	10.52	13.40	144.4	38.5	198	
8			2.305		10.87	13.74	143.8	48.9	106	
9			2.306		10.83	13.70	143.9	52.4	133	
B136 7	6.90	6.46	2.418	2.422	0.16	11.51	150.9	12.8	198	A-100L
8			2.419		0.12	11.74	150.9	14.2	177	
9			2.427		0.00	11.18	151.4	14.7	130	
B137 7	4.01	3.85	2.359	2.481	4.92	11.26	147.2	43.6	170	
8			2.368		4.56	10.92	147.8	48.7	133	
9			2.382		3.99	10.40	148.6	51.2	215	
B138 7	6.01	5.67	2.406	2.427	0.86	11.21	150.1	27.4	148	
8			2.413		0.58	10.95	150.6	27.5	161	
9			2.412		0.62	10.98	150.5	39.2	173	
B139 7	4.68	4.47	2.372	2.455	3.38	11.35	148.0	41.6	154	
8			2.392		2.57	10.60	149.3	40.8	237	
9			2.405		2.04	10.11	150.1	42.4	228	
B140 7	3.12	3.02	2.341	2.534	7.62	11.18	146.1	49.9	198	
8			2.340		7.66	11.22	146.0	55.0	176	
9			2.320		8.44	11.97	144.8	54.3	275	
B141 7	6.94	6.49	2.415	2.428	0.54	12.13	150.7	25.2	176	A-4
8			2.411		0.70	12.28	150.4	26.0	157	
9			2.424		0.16	11.80	151.3	29.7	211	
B142 7	4.25	4.08	2.394	2.505	4.43	10.65	149.4	45.1	183	
8			2.362		5.71	11.84	147.4	46.2	162	
9			2.399		4.23	10.46	149.7	51.3	166	
B143 7	6.04	5.70	2.439	2.440	0.04	10.51	152.2	12.5	212	
8			2.429		0.45	10.87	151.6	15.2	186	
9			2.435		0.20	10.65	151.9	11.1	186	
B144 7	3.36	3.25	2.347	2.562	8.39	11.64	146.5	55.1	202	
8			2.320		9.45	12.66	144.8	45.9	190	
9			2.342		8.59	11.83	141.6	45.9	169	
B145 7	4.92	4.69	2.401	2.493	3.69	10.96	149.8	43.8	214	
8			2.426		2.69	10.03	151.4	37.0	260	
9			2.414		3.17	10.48	150.6	50.0	297	
B146 7	6.00	5.70	2.436	2.469	1.34	11.44	152.0	7.9[a]	193	C-30L
8			2.446		0.93	11.08	152.6	13.6	198	
9			2.439		1.22	11.34	152.2	14.3	203	
B147 7	4.30	4.10	2.260	2.561	11.75	16.45	141.0	45.5	146	
8			2.267		11.48	16.	141.5	47.5	152	
9			2.252		12.07	16.74	140.5	51.7	175	
B148 7	3.40	3.20	2.253	2.632	14.40	15.92	140.6	55.6	125	
8			2.245		14.70	16.22	140.1	48.8	165	
9			2.229		15.31	16.82	139.1	40.4	118	
B149 7	7.00	6.50	2.422	2.447	1.02	12.70	151.1	13.8	187	
8			2.425		0.90	12.59	151.3	11.7	215	
9			2.429		0.74	12.45	151.6	9.7[a]	201	
B150 7	5.00	4.68	2.341	2.552	8.27	13.98	146.1	43.2	227	
8			2.339		8.35	14.05	146.0	43.1	174	
9			2.343		8.19	13.90	146.2	46.2	225	
B151 7	6.00	5.88	2.422	2.442	0.80	11.06	151.1	18.8	192	A-P
8			2.428		0.57	10.84	151.5	18.5	189	
9			2.403		1.60	11.76	149.9	21.9	212	
B152 7	5.00	4.68	2.410	2.488	3.14	9.80	150.4	40.5	238	
8			2.387		4.06	10.66	148.9	37.2	106	
9			2.384		4.18	10.77	148.8	36.4	183	
B153 7	7.00	6.47	2.417	2.401	0.00	11.80	150.8	2.6[a]	163	
8			2.407		0.00	12.16	150.2	0.7[a]	152	
9			2.412		0.00	11.98	150.5	4.9[a]	171	
B154 7	4.00	3.86	2.359	2.525	6.57	11.51	147.2	36.0	211	
8			2.374		5.98	10.95	148.1	39.5	234	
9			2.368		6.22	11.18	147.8	41.9	251	

Bituminous mix design data by Hveem method — Series B, continued.

Specimen No.	% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Hveem stability	Cohesiometer value	Gradation
B155 7	3.13	3.03	2.247	2.625	14.40	14.99	140.2	48.8	122	A-P
8			2.258		13.98	14.57	140.9	54.3	168	
9			2.284		12.99	13.59	142.5	52.1	178	
B156 7	3.13	3.03	2.276	2.616	13.00	14.98	142.0	56.1	171	C-30
8			2.293		12.35	14.35	143.1	44.7	108	
9			2.298		12.16	14.16	143.4	50.2	122	
B157 7	5.00	4.68	2.346	2.564	8.50	13.86	146.4	47.5	217	
8			2.354		8.54	13.90	146.9	37.6	186	
9			2.370		7.57	12.98	147.9	38.3	127	
B158 7	7.00	6.47	2.412	2.461	1.99	13.10	150.5	21.1	234	
8			2.401		2.40	13.50	149.8	24.1	278	
9			2.409		2.11	13.21	150.3	24.9	230	
B159 7	6.00	5.68	2.400	2.474	2.99	12.80	149.8	23.2	230	
8			2.403		2.87	12.69	149.9	20.9	202	
9			2.410		2.59	12.44	150.4	23.6	222	
B160 7	4.00	3.86	2.350	2.564	8.35	12.97	146.6	29.2	206	
8			2.328		9.20	13.78	145.3	37.2	179	
9			2.311		9.87	14.42	144.2	49.7	139	
B161 7	4.00	3.87	2.371	2.536	6.51	11.55	148.0	54.4	182	A-100
8			2.417		4.69	9.84	150.8	39.9	101	
9			2.347		7.45	12.45	146.5	61.2	75	
B162 7	6.00	5.70	2.407	2.454	1.92	11.92	150.2	1.7[a]		
8			2.412		1.71	11.74	150.5	5.8[a]	71	
9			2.415		1.59	11.63	150.7	8.8[a]	47	
B163 7	5.15	4.89	2.441	2.487	1.85	9.91	152.3	9.3[a]	103	
8			2.428		2.37	10.39	151.5	10.8[a]	106	
9			2.419		2.73	10.72	150.9	12.2[a]	65	
B164 7	7.00	6.49	2.409	2.440	1.27	12.59	150.3	2.7[a]	103	
8			2.412		1.15	12.48	150.5	4.8[a]	82	
9			2.413		1.11	12.44	140.8	3.3[a]	108	
B165 7	3.13	3.04	2.333	2.575	9.40	12.22	145.6	55.9	141	
8			2.341		9.09	11.92	146.1	57.9	93	
9			2.348		8.82	11.66	146.5	62.4	201	

Appendix H-1. Bituminous mix design data by Marshall method — Series C.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability[a], lb, Meas.	Stability[a], lb, Adj.	Flow, in. (x 0.01)	Gradation
C01	1	6.00	5.67	2.392	2.473	3.27	12.58	149.3		2673	12	C-100L
	2			2.371		4.12	13.35	148.0		3550	12	
	3			2.377		2.87	13.13	148.3		3650	10	
	4			2.374		4.00	13.24	148.1		3500	2	
	5			2.368		4.24	13.46	147.8		3366	11	
	6			2.359		4.60	13.78	147.2		389.1		
C02	1	4.68	4.47	2.306	2.504	7.92	14.65	143.9		3072	9	
	2			2.250		10.16	16.72	140.4		3149	9	
	3			2.253		10.04	16.61	140.6		3290	10	
	4			2.405		3.97	10.98	150.1		3610	12	
	5			2.252		10.08	16.65	140.5		3149	10	
	6			2.244		10.40	16.94	140.0				
C03	1	3.00	3.02	2.210	2.615	15.49	16.96	137.9		2520	8	
	2			2.202		15.80	17.26	137.4		3118	8	
	3			2.206		15.64	17.11	137.7		3100	8	
	4			2.209		15.53	16.70	137.8		2750	9	
	5			2.203		15.76	17.22	137.5		2376	9	
	6			2.188		16.37	17.82	136.5		150.1		
C04	1	6.68	6.26	2.377	2.429	2.14	13.67	148.3		1717	17	
	2			2.394		1.44	13.05	149.4		3050	13	
	3			2.389		1.65	13.23	149.1		3168	13	
	4			2.384		1.85	13.42	148.8		2920	15	
	5			2.394		1.44	13.05	149.4		2800	15	
	6			2.386		1.73	13.31	148.9		289.7		
C05	1	3.79	3.66	2.208	2.593	14.84	17.58	137.8		2366	8	
	2			2.194		15.38	18.11	136.9		2861	8	
	3			2.173		16.19	18.89	135.6		2470	8	
	4			2.200		15.15	17.88	137.3		2548	9	
	5			2.182		15.84	18.55	136.2		2304	10	
	6			2.176		16.08	18.78	135.8		174.2		
C06	1	7.00	6.44	2.373	2.399	1.09	13.85	148.1		1989	18	B-P
	2			2.390		0.38	13.23	149.1		2856	16	
	3			2.393		0.26	13.12	149.3		2950	16	
	4			2.392		0.30	13.16	149.3		3050	14	
	5			2.392		0.30	13.16	149.3		2950	17	
	6			2.389		0.43	13.27	149.1		311.4		
C07	1	6.00	5.66	2.386	2.437	2.10	12.65	148.9		2111	18	
	2			2.384		2.18	12.73	148.8		3528	12	
	3			2.378		2.43	12.95	148.4		3234	11	
	4			2.381		2.31	12.84	148.6		3686	13	
	5			2.375		2.55	13.05	148.2		3234	13	
	6			2.377		2.47	12.98	148.3		331.6		
C08	1	3.00	3.02	2.231	2.589	13.84	16.04	139.2		2622	9	
	2			2.227		13.99	16.19	139.0		3366	10	
	3			2.229		13.92	16.12	139.1		3168	8	
	4			2.228		13.95	16.15	139.0		2821	12	
	5			2.230		13.88	16.08	139.2		2650	11	
	6			2.220		14.30	16.49	138.5		219.7		
C09	1	4.00	3.85	2.270	2.251	0.00	15.30	141.7		2945	9	
	2			2.255		0.00	15.86	140.7		4141	9	
	3			2.244		0.00	16.27	140.0		3626	9	
	4			2.260		0.00	15.68	141.0		4242	12	
	5			2.245		0.25	16.24	140.1		3450	11	
	6			2.239		0.52	16.46	139.7		253.1		
C10	1	5.00	4.66	2.344	2.501	6.29	13.28	146.3		2878	11	
	2			2.348		6.13	13.13	146.5		3927	11	
	3			2.329		6.89	13.84	145.3		3800	11	
	4			2.354		5.89	12.91	146.9		3774	12	
	5			2.321		7.21	14.13	144.8		3234	12	
	6			2.342		6.37	13.35	146.1		370.5		
C11	1	4.00	3.87	2.231	2.562	12.93	18.17	139.2		3008	9	B-B
	2			2.232		12.89	18.14	139.3		3400	9	
	3			2.246		12.34	17.62	140.1		4141	9	
	4			2.248		12.26	17.55	140.3		3737	11	
	5			2.239		12.61	17.88	139.7		3400	11	
	6			2.227		13.08	18.32	139.0		221.8		
C12	1	7.00	6.49	2.350	2.479	5.20	16.16	146.6		3250	13	
	2			2.342		5.52	16.44	146.1		4405	12	
	3			2.340		5.60	16.52	146.0		4455	12	
	4			2.399		5.64	16.55	146.0		4752	14	
	5			2.341		5.56	16.48	146.1		4108	14	
	6			2.338		5.68	16.59	145.9		341.5		

[a] Indirect tensile strength, psi, for specimen No. 6 in each batch.

Bituminous mix design data by Marshall method — Series C, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability[a], lb, Meas.	Stability[a], lb, Adj.	Flow, in. (x 0.01)	Gradation
C13	1	5.00	4.69	2.288	2.518	9.14	16.80	142.8		3540	9	B-B
	2			2.286		9.22	16.87	142.6		4500	11	
	3			2.288		9.14	16.80	142.8		4400	11	
	4			2.280		9.46	17.09	142.3		4158	12	
	5			2.272		9.78	17.38	141.8		3613	12	
	6			2.269		9.90	17.49	141.6		297.3		
C14	1	6.00	5.70	2.325	2.501	7.02	16.35	145.1		3550	9	
	2			2.290		8.42	17.61	142.9		4025	11	
	3			2.275		9.02	18.15	142.0		4128	11	
	4			2.297		8.14	17.36	143.3		3920	13	
	5			2.284		8.66	17.82	142.5		3600	13	
	6			2.278		8.90	18.04	142.1		321.6		
C15	1	3.00	3.04	2.233	2.569	13.09	17.39	139.3		2820	8	
	2			2.223		13.48	17.76	138.7		3700	9	
	3			2.223		13.48	17.76	138.7		2424	9	
	4			2.234		13.05	17.36	139.4		3315	10	
	5			2.225		13.40	17.69	138.8		3213	10	
	6			2.224		13.44	17.73	138.8		198.1		
C16	1	6.00	5.70	2.394	2.477	3.35	12.16	149.4		2856	14	A-4
	2			2.395		3.31	12.12	149.4		3723	12	
	3			2.396		3.27	12.08	149.5		3960	12	
	4			2.391		3.48	12.27	149.2		3977	13	
	5			2.384		3.76	12.52	148.8		4263	14	
	6			2.380		3.92	12.67	148.5		303.1		
C17	1	4.00	3.87	2.315	2.588	10.55	13.41	144.5		3504	9	
	2			2.282		11.83	14.64	142.4		4268	9	
	3			2.286		11.67	14.49	142.6		4365	9	
	4			2.283		11.79	14.61	142.5		4268	11	
	5			2.266		12.45	15.24	141.4		3562	10	
	6			2.252		12.99	15.76	140.5		234.2		
C18	1	3.00	3.04	2.275	2.617	13.08	14.17	142.0		3325	9	
	2			2.231		14.76	15.83	139.2		3264	8	
	3			2.234		14.64	15.72	139.4		3264	8	
	4			2.244		14.26	15.34	140.0		3264	10	
	5			2.262		13.57	14.66	141.1		3185	9	
	6			2.243		14.30	15.38	140.0		215.0		
C19	1	7.00	6.49	2.386	2.414	1.17	13.18	148.9		1734	22	
	2			2.407		0.31	12.42	150.2		2750	17	
	3			2.407		0.31	12.42	150.2		2474	16	
	4			2.416		0.00	12.09	150.8		3232	18	
	5			2.404		0.43	12.53	150.0		2722	18	
	6			2.406		0.34	12.46	150.1		242.1		
C20	1	5.00	4.69	2.377	2.465	3.57	11.85	148.3		2500	10	
	2			2.335		5.27	13.41	145.7		2707	11	
	3			2.351		4.62	12.81	146.7		2989	12	
	4			2.347		2.78	12.96	146.5		3007	11	
	5			2.335		5.27	13.41	145.7		3072	13	
	6			2.339		5.11	13.26	146.0		311.2		
C21	1	4.00	3.87	2.390	–	–	10.85	149.1		2940	10	A-100
	2			2.360		–	11.96	147.9		3381	10	
	3			2.360		–	11.96	147.3		3185	10	
	4			2.360		–	11.96	147.3		3136	13	
	5			2.330		–	13.00	145.4		3055	12	
	6			2.360		2.00	11.96	147.3		322.6		
C22	1	6.26	5.89	2.420	2.515	3.80	11.62	151.0		1161	35	
	2			2.420		3.80	11.62	151.0		1584	22	
	3			2.430		–	11.26	151.9		1782	27	
	4			2.420		3.80	11.62	151.3		1515	35	
	5			2.410		4.20	11.99	150.6		1400	31	
	6			2.420		3.80	11.62	150.8		228.1		
C23	1	4.70	4.49	2.400	2.437	1.50	11.05	149.9		1717	18	
	2			2.410		1.09	10.68	150.4		2772	18	
	3			2.410		1.09	10.68	150.6		3550	13	
	4			2.400		1.50	11.05	150.0		2970	16	
	5			2.400		1.50	11.05	149.6		2744	17	
	6			2.380		2.32	11.79	148.4		322.2		
C24	1	7.00	6.49	2.390	2.431	1.69	13.28	149.3		1212	34	
	2			2.420		0.46	12.19	150.8		1236	34	
	3			2.410		0.87	12.55	150.3		1250	33	
	4			2.420		0.46	12.19	150.8		1581	35	
	5			2.410		0.87	12.55	150.1		1450	34	
	6			2.410		0.87	12.55	150.5		218.8		

Bituminous mix design data by Marshall method — Series C, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability[a], lb, Meas.	Stability[a], lb, Adj.	Flow, in. (x 0.01)	Gradation
C25	1	3.00	2.73	2.310	2.634	12.29	12.81	143.9		2565	13	A-100
	2			2.310		12.29	12.81	144.1		2940	9	
	3			2.300		12.67	13.19	143.4		2475	10	
	4			2.330		11.53	12.05	145.6		2915	11	
	5			2.320		11.91	12.43	144.6		2572	12	
	6			2.320		11.91	12.43	144.8		255.5		
C26	1	5.00	4.69	2.394	2.511	4.67	10.87	149.4		2134	14	A-4LH
	2			2.387		4.95	11.13	149.0		2891	12	
	3			2.390		4.83	11.02	149.1		2871	12	
	4			2.324		7.46	13.48	145.0		1656	12	
	5			2.362		5.95	12.06	147.4		2473	14	
	6			2.372		5.55	11.69	148.0		299.4		
C27	1	4.47	4.28	2.384	2.479	3.84	10.86	148.8		1947	14	
	2			2.369		4.44	11.42	147.8		2673	10	
	3			2.378		4.08	11.09	148.4		2727	12	
	4			2.361		4.76	11.72	147.3		2350	11	
	5			2.357		4.93	11.87	147.1		2254	13	
	6			2.353		5.09	12.02	146.8		301.6		
C28	1	6.71	6.29	2.401	2.469	2.73	12.11	149.8		1617	18	
	2			2.397		2.90	12.26	149.6		1960	16	
	3			2.391		3.14	12.48	149.2		2037	17	
	4			2.402		2.69	12.07	149.9		1872	18	
	5			2.395		2.98	12.33	149.4		1794	34	
	6			2.392		3.10	12.44	149.3		252.0		
C29	1	3.36	2.35	2.317	2.578	10.11	12.43	144.6		2162	12	
	2			2.292		11.08	13.38	143.0		2910	15	
	3			2.285		11.35	13.64	142.6		2667	11	
	4			2.324		9.84	12.17	145.0		2600	12	
	5			2.288		11.24	13.53	142.8		2375	13	
	6			2.291		11.12	13.42	143.0		215.3		
C30	1	5.82	5.50	2.391	2.470	3.19	11.74	149.2		1732	19	
	2			2.385		3.44	11.96	148.8		2470	13	
	3			2.379		3.68	12.18	148.4		2688	14	
	4			2.405		2.63	11.22	150.1		3100	15	
	5			2.385		3.44	11.96	148.8		2279	14	
	6			2.389		3.28	11.81	149.1		302.5		
C31	1	7.16	6.68	2.381	2.394	0.56	13.14	148.6		1568	35	A-8L
	2			2.399		0.00	12.48	149.7		1734	23	
	3			2.405		0.00	12.26	150.1		1734	17	
	4			2.393		0.05	12.70	149.3		1414	17	
	5			2.395		0.00	12.63	149.4		1262	16	
	6			2.398		0.00	12.59	149.5		208.3		
C32	1	6.26	5.89	2.391	2.382	0.00	12.03	149.2		1515	35	
	2			2.401		0.00	11.67	149.8		1400	21	
	3			2.400		0.00	11.70	149.8		1363	20	
	4			2.404		0.00	11.56	150.0		1750	21	
	5			2.401		0.00	11.67	149.8		1287	30	
	6			2.397		0.00	11.81	149.6		223.9		
C33	1	4.00	3.87	2.376	2.462	3.49	10.71	148.3		1261	18	
	2			2.361		4.09	11.27	147.3		1509	24	
	3			2.392		2.84	10.11	149.3		1519	19	
	4			2.390		2.92	10.18	149.1		1336	31	
	5			2.402		2.43	9.73	149.9		1530	19	
	6			2.403		2.39	9.96	149.9		267.6		
C34	1	3.00	2.83	2.293	2.603	11.91	12.90	143.1		1932	14	
	2			2.282		12.34	13.31	142.4		2178	11	
	3			2.300		11.64	12.63	143.5		2376	10	
	4			2.291		11.99	12.97	143.0		1617	13	
	5			2.295		11.84	12.82	143.0		1764	13	
	6			2.305		11.45	12.44	143.8		221.5		
C35	1	5.15	4.90	2.396	2.460	2.59	10.93	149.5		1358	22	
	2			2.417		1.74	10.14	150.8		2100	17	
	3			2.423		1.50	9.92	151.2		1969	17	
	4			2.407		2.15	10.51	150.2		1980	24	
	5			2.440		0.80	9.29	152.3		1887	21	
	6			2.411		1.98	10.37	150.4		264.2		
C36	1	5.00	4.86	2.374	2.475	4.08	12.05	148.1		2182	9	B-100L
	2			2.379		3.87	11.86	148.4		2797	8	
	3			2.372		4.16	12.12	148.0		2676	8	
	4			2.333		5.73	13.57	145.6		2156	12	
	5			2.329		5.90	13.71	145.3		2279	12	
	6			2.323		6.14	13.94	144.9		252.3		

Bituminous mix design data by Marshall method — Series C, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability[a], lb, Meas.	Stability[a], lb, Adj.	Flow, in. (x 0.01)	Gradation
C37	1	3.33	3.23	2.266	2.553	11.23	14.61	141.4		2314	9	B-100L
	2			2.232		12.56	15.89	139.3		2182	9	
	3			2.241		12.21	15.55	139.8		2475	8	
	4			2.251		11.82	15.18	140.5		1980	11	
	5			2.228		12.72	16.04	139.0		2522	11	
	6			2.229		12.68	16.00	139.1		212.1		
C38	1	4.22	4.05	2.292	2.535	9.57	14.36	143.0		2070	10	
	2			2.262		10.75	15.48	141.1		2209	9	
	3			2.268		10.51	15.26	141.5		2352	9	
	4			2.272		10.36	15.11	141.8		1794	12	
	5			2.276		10.20	14.96	142.0		1776	12	
	6			2.272		10.36	15.11	141.8		249.5		
C39	1	7.56	7.02	2.371	2.394	0.96	14.15	148.0		1813	12	
	2			2.351		1.08	14.88	146.7		1782	9	
	3			2.322		3.01	15.93	144.9		1600	9	
	4			2.313		3.39	16.25	144.3		1455	13	
	5			2.313		3.39	16.25	144.3		1440	14	
	6			2.314		3.35	16.22	144.4		236.8		
C40	1	6.00	5.66	2.380	2.436	2.28	12.57	148.5		1666	14	
	2			2.370		2.69	12.93	147.7		1868	11	
	3			2.367		2.82	13.04	147.7		1813	11	
	4			2.375		2.49	12.75	148.2		1512	14	
	5			2.369		2.73	12.79	147.8		1515	13	
	6			2.361		3.06	13.26	147.3		290.2		
C41	1	4.25	4.08	2.369	2.544	6.89	11.41	147.8		3250	11	A-30H
	2			2.332		8.35	12.79	145.5		3300	11	
	3			2.346		7.80	12.27	146.4		3050	10	
	4			2.381		6.42	10.96	148.6		3500	12	
	5			2.333		8.31	12.76	145.6		3450	12	
	6			2.344		7.50	12.00	146.3		328.2		
C42	1	6.00	5.70	2.399	2.443	1.79	11.80	149.7		1750	23	
	2			2.403		1.62	11.66	150.0		2400	17	
	3			2.403		1.63	11.66	150.0		2200	18	
	4			2.404		1.58	11.62	150.0		2350	18	
	5			2.422		0.85	10.96	151.1		2850	18	
	6			2.390		1.40	11.41	149.2		299.1		
C43	1	7.00	6.49	2.375	2.392	0.71	13.42	148.2		1350	30	
	2			2.405		0.00	12.32	150.1		2050	22	
	3			2.406		0.00	12.29	150.1		1700	20	
	4			2.400		0.00	12.51	149.8		1800	23	
	5			2.403		0.00	12.40	150.0		1800	23	
	6			2.352		0.00	12.50	146.8		314.8		
C44	1	5.15	4.89	2.383	2.469	3.46	11.64	148.7		2100	19	
	2			2.353		4.68	12.75	146.8		1950	12	
	3			2.399		2.82	11.05	149.7		2050	21	
	4			2.355		4.60	12.68	147.0		3050	15	
	5			2.364		4.23	12.34	147.5		2650	12	
	6			2.369		4.03	12.12	147.8		330.6		
C45	1	3.36	3.25	2.325	2.544	6.62	12.30	145.1		3200	10	
	2			2.261		11.14	14.72	141.1		2750	13	
	3			2.268		10.86	14.45	141.5		3100	10	
	4			2.282		10.31	13.92	142.4		2600	12	
	5			2.288		10.08	13.70	142.8		2750	12	
	6			2.234		10.27	13.81	139.4		188.3		
C46	1	4.00	3.87	2.346	2.559	8.31	12.01	146.4		3696	10	A-8
	2			2.283		10.78	14.37	142.5		2867	9	
	3			2.281		10.85	14.45	142.3		3008	11	
	4			2.291		10.46	14.46	142.9		2929	12	
	5			2.303		9.99	13.62	143.7		3040	10	
	6			2.290		10.50	14.11	142.9		263.3		
C47	1	5.00	4.69	2.387	2.429	1.73	11.23	148.9		2716	13	
	2			2.281		6.09	15.18	142.3		1755	11	
	3			2.370		2.43	11.87	147.9		3000	11	
	4			2.352		3.17	12.54	146.8		2496	14	
	5			2.279		6.17	15.25	142.2		1820	12	
	6			2.552		3.66	12.98	146.0		302.4		
C48	1	7.16	6.68	2.380	2.404	0.99	13.34	148.5		1649	22	
	2			2.329		3.11	15.20	145.3		1344	16	
	3			2.389		0.61	13.02	149.1		2163	16	
	4			2.401		0.11	12.58	149.8		1938	18	
	5			2.393		0.45	12.87	149.3		2000	16	
	6			2.390		0.57	12.98	149.1		238.5		

Bituminous mix design data by Marshall method — Series C, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability[a], lb, Meas.	Stability[a], lb, Adj.	Flow, in. (x 0.01)	Gradation
C49	1	3.00	2.83	2.309	2.559	9.77	12.46	144.1		2565	9	A-8
	2			2.294		10.36	13.03	143.1		3111	8	
	3			2.275		11.10	13.75	142.0		2376	13	
	4			2.283		10.79	13.45	142.5		2777	11	
	5			2.281		10.87	13.52	142.3		2744	10	
	6			2.294		10.36	13.03	143.1		271.2		
C50	1	5.82	5.50	2.366	2.474	4.37	12.76	147.6		1782	17	
	2			2.376		3.97	12.39	148.3		2231	16	
	3			2.381		3.77	12.21	148.6		2376	13	
	4			2.374		4.05	12.47	148.1		2317	14	
	5			2.375		4.01	12.43	148.2		2397	14	
	6			2.380		3.81	12.25	148.5		172.1		
C51	1	7.13	6.65	2.374	2.406	1.32	14.57	148.1		1200	35	B-100
	2			2.394		0.49	13.85	149.4		1313	35	
	3			2.397		0.36	13.74	149.6		1363	35	
	4			2.395		0.44	13.81	149.4		1313	35	
	5			2.400		0.24	13.63	149.8		1313	35	
	6			2.400		0.24	13.63	149.8		191.5		
C52	1	4.00	3.85	2.337	2.552	8.41	13.38	145.8		2612	11	
	2			2.270		11.03	15.86	141.6		2491	10	
	3			2.282		10.56	15.41	142.4		2639	11	
	4			2.302		9.78	14.67	143.6		2325	12	
	5			2.279		10.68	15.53	142.2		2093	15	
	6			2.307		9.58	14.49	144.0		265.1		
C53	1	3.12	3.02	2.306	2.609	11.61	13.79	143.9		3055	8	
	2			2.259		13.41	15.54	141.0		3003	9	
	3			2.267		13.10	15.25	141.5		2775	11	
	4			2.275		12.80	14.95	142.0		2275	12	
	5			2.259		13.41	15.54	141.0		1980	13	
	6			2.246		13.91	16.03	140.2		183.6		
C54	1	5.35	5.07	2.392	2.494	4.08	12.46	149.3		1960	20	
	2			2.370		4.96	13.27	147.9		2350	13	
	3			2.390		4.16	12.54	149.1		2328	14	
	4			2.359		5.41	13.67	147.2		1984	17	
	5			2.355		5.57	13.82	146.9		2040	17	
	6			2.350		5.77	14.00	146.6		272.2		
C55	1	6.24	5.87	2.394	2.438	1.82	13.13	149.4		1386	30	
	2			2.403		1.45	12.80	149.9		1633	21	
	3			2.403		1.45	12.80	149.9		1632	20	
	4			2.407		1.28	12.66	150.2		1632	24	
	5			2.403		1.45	12.80	149.9		1715	21	
	6			2.406		1.53	12.87	149.8		211.4		
C56	1	3.35	3.24	2.322	2.585	10.19	13.39	144.9		861	13	C-30L
	2			2.218		14.21	17.27	138.4		1729	10	
	3			2.180		15.68	18.68	136.1		1665	12	
	4			2.192		15.22	18.24	137.0		682	13	
	5			2.195		15.10	18.12	137.0		864	15	
	6			2.188		15.37	18.38	136.5		—		
C57	1	5.00	4.88	2.345	2.513	6.67	14.01	146.3		2115	13	
	2			2.342		6.79	14.12	146.1		2897	11	
	3			2.335		7.06	14.38	145.7		3168	11	
	4			2.348		6.55	13.90	146.5		2878	13	
	5			2.323		7.54	14.82	145.0		2522	14	
	6			2.323		7.54	14.82	145.0		276.7		
C58	1	6.25	5.88	2.382	2.430	1.96	13.57	148.6		1358	19	
	2			2.379		2.08	13.68	148.4		1947	14	
	3			2.394		1.47	13.14	149.4		2037	14	
	4			2.380		2.04	13.64	148.5		1824	18	
	5			2.386		1.79	13.43	148.9		1960	14	
	6			2.383		1.92	13.54	149.7		268.1		
C59	1	4.00	3.86	2.239	2.574	12.97	17.02	139.7		1968	10	
	2			2.227		13.44	17.46	139.0		1421	11	
	3			2.236		13.09	17.13	139.5		1386	13	
	4			2.233		13.21	17.24	139.3		1764	13	
	5			2.233		13.21	17.24	139.3		1680	14	
	6			2.219		13.75	17.76	138.5		182.1		
C60	1	7.00	6.47	2.402	2.387	0.00	13.39	150.0		1650	22	
	2			2.409		0.00	13.14	150.3		2171	17	
	3			2.409		0.00	13.14	150.3		2150	17	
	4			2.390		0.00	13.83	149.1		1911	18	
	5			2.343		1.84	15.52	146.2		1645	18	
	6			2.388		0.00	13.90	149.0		248.8		

Bituminous mix design by Marshall method — Series C, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability[a], lb. Meas.	Stability[a], lb. Adj.	Flow, in. (x 0.01)	Gradation
C61	1	3.57	3.45	2.265	2.585	12.37	15.63	141.3		2912	9	C-8
	2			2.241		13.30	16.52	140.0		2328	9	
	3			2.234		13.57	16.79	139.4		2220	10	
	4			2.235		13.53	16.30	139.5		2375	9	
	5			2.240		13.34	16.56	139.8		2597	10	
	6			2.570		13.26	16.49	139.9		191.9		
C62	1	6.47	6.08	2.414	2.467	2.15	12.53	150.6		1900	20	
	2			2.409		2.36	12.71	150.3		2450	15	
	3			2.418		1.99	12.38	150.9		2623	15	
	4			2.417		2.03	12.42	150.8		2871	16	
	5			2.412		2.23	12.60	150.5		2450	20	
	6			2.408		2.40	12.75	150.3		259.9		
C63	1	7.14	6.67	2.393	2.432	1.60	13.84	149.3		1464	23	
	2			2.414		0.73	13.08	150.6		2079	19	
	3			2.408		0.98	13.30	150.3		1969	18	
	4			2.408		0.98	13.30	150.3		1950	19	
	5			2.410		0.90	13.22	150.4		2000	20	
	6			2.406		1.06	13.37	150.1		216.0		
C64	1	5.13	4.88	2.401	2.513	4.46	11.89	149.8		2722	12	
	2			2.378		5.38	12.73	148.4		2722	11	
	3			2.373		5.58	12.92	148.1		2821	11	
	4			2.370		5.70	13.03	147.9		2574	12	
	5			2.382		5.22	12.59	148.6		2850	12	
	6			2.375		5.50	12.84	148.2		285.4		
C65	1	4.24	4.07	2.377	2.529	6.00	12.03	148.3		2550	10	
	2			2.324		8.09	13.99	145.0		2327	11	
	3			2.318		8.33	14.21	144.6		2137	12	
	4			2.332		7.78	13.69	145.5		2182	13	
	5			2.354		6.91	12.88	146.9		2376	15	
	6			2.355		6.87	12.84	146.9		304.9		
C66	1	5.00	4.69	2.343	2.445	4.19	12.67	146.2		2350	11	A-F
	2			2.433		0.51	9.31	151.8		2254	11	
	3			2.324		4.96	13.37	145.0		2326	11	
	4			2.322		5.05	13.45	144.9		2376	12	
	5			2.314		5.37	13.75	144.4		2375	14	
	6			2.327		4.84	13.26	145.2		238.8		
C67	1	3.13	3.04	2.278	2.549	10.63	13.62	142.2		2610	10	
	2			2.250		11.73	14.68	140.4		2650	10	
	3			2.241		12.08	15.02	139.8		2673	9	
	4			2.253		11.61	14.57	140.6		2450	9	
	5			2.238		12.20	15.14	139.7		1950	12	
	6			2.249		11.77	14.72	140.3		228.7		
C68	1	6.26	5.89	2.371	2.416	1.85	12.74	148.0		2150	18	
	2			2.342		3.05	13.80	146.1		2000	13	
	3			2.372		1.81	12.70	148.0		2250	13	
	4			2.364		2.14	12.99	147.5		2200	17	
	5			2.354		2.56	13.36	146.9		2050	16	
	6			2.367		2.02	12.88	147.7		283.8		
C69	1	6.71	6.29	2.358	2.393	1.45	13.58	147.1		1584	19	
	2			2.369		0.99	13.18	147.8		1767	17	
	3			2.369		0.99	13.18	147.8		1734	20	
	4			2.359		1.40	13.55	147.2		1600	24	
	5			2.368		1.03	13.22	147.8		1500	22	
	6			2.368		1.03	13.22	147.8		224.5		
C70	1	4.00	3.87	2.325	2.465	5.66	12.59	145.1		2200	10	
	2			2.285		7.28	14.10	145.6		3100	9	
	3			2.312		6.19	13.08	144.3		2750	10	
	4			2.300		6.67	13.53	143.5		2750	11	
	5			2.300		6.67	13.53	143.5		2900	12	
	6			2.279		7.53	14.32	142.2		269.6		
C71	1	5.56	5.26	2.406	2.449	1.75	11.34	150.1		1800	19	B-8L
	2			2.394		2.24	11.78	149.4		2400	14	
	3			2.417		1.30	10.93	150.8		2550	14	
	4			2.404		1.83	11.41	150.0		2600	17	
	5			2.384		2.65	12.15	147.8		2450	16	
	6			2.403		1.87	11.45	149.9		271.0		
C72	1	4.44	4.26	2.367	2.533	6.54	11.86	147.7		2650	13	
	2			2.345		7.40	12.68	146.3		3250	10	
	3			2.304		9.02	14.20	143.8		2600	11	
	4			2.315		8.59	13.79	144.5		2800	13	
	5			2.326		8.15	13.38	145.1		2800	12	
	6			2.383		5.90	11.26	148.7		336.5		

Bituminous mix design by Marshall method — Series C, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability[a], lb. Meas.	Stability[a], lb. Adj.	Flow, in. (x 0.01)	Gradation
C73	1	3.33	3.23	2.310	2.573	10.20	13.05	144.1		3150	11	B-8L
	2			2.249		12.58	15.35	140.3		2750	19	
	3			2.242		12.85	15.61	139.9		2950	9	
	4			2.261		12.11	14.90	141.1		2700	10	
	5			2.244		12.77	15.54	140.0		2450	11	
	6			2.254		12.38	15.16	140.6		202.1		
C74	1	7.33	6.83	2.399	2.393	0.00	13.06	149.7		1500	26	
	2			2.396		0.00	13.17	149.5		1500	26	
	3			2.399		0.00	13.06	149.7		1500	26	
	4			2.397		0.00	13.14	149.6		1600	25	
	5			2.397		0.00	13.14	149.6		1500	27	
	6			—		—	—	—		—	—	
C75	1	6.00	5.66	2.390	2.429	1.61	12.30	149.1		1900	16	
	2			2.376		2.19	12.82	148.3		2150	13	
	3			2.382		1.94	12.60	148.6		2150	14	
	4			2.370		2.44	13.04	147.9		2300	17	
	5			2.367		2.56	13.15	147.9		2350	14	
	6			2.368		2.52	13.11	147.8		256.1		
C76	1	6.24	5.87	2.335	2.411	3.15	14.01	145.7		2300	10	A-100L
	2			2.317		3.90	14.67	144.6		2400	13	
	3			2.309		4.23	14.99	144.1		2100	11	
	4			2.297		4.73	15.41	143.3		1700	9	
	5			2.297		4.73	15.41	143.3		1900	12	
	6			2.296		4.77	15.45	143.3		258.9		
C77	1	4.90	4.67	2.364	2.426	2.57	11.83	147.5		2150	10	
	2			2.334		3.80	12.95	145.6		2000	10	
	3			2.342		3.47	12.65	146.1		2050	10	
	4			2.326		4.13	13.25	145.1		1950	11	
	5			2.281		5.99	14.93	142.3		1400	13	
	6			2.334		3.80	12.95	145.6		276.5		
C78	1	2.90	2.81	2.250	2.561	12.14	14.45	140.4		2200	10	
	2			2.229		12.96	15.24	139.1		2100	9	
	3			2.251		12.10	14.41	140.5		2100	12	
	4			2.238		12.61	14.90	139.7		2050	12	
	5			2.228		13.00	15.28	139.0		1850	12	
	6			2.249		12.18	14.48	140.3		238.8		
C79	1	7.13	6.65	2.353	2.406	2.20	14.06	146.8		2000	11	
	2			2.344		2.58	14.39	146.3		2200	9	
	3			2.340		2.74	14.54	146.2		2200	9	
	4			2.323		3.45	15.16	145.0		1900	11	
	5			2.325		3.37	15.09	145.1		1900	11	
	6			2.327		3.28	15.01	145.2		255.6		
C80	1	4.23	4.06	2.321	2.469	5.99	12.88	144.8		2300	9	
	2			2.277		7.78	14.53	142.1		2200	9	
	3			2.293		7.13	13.93	143.1		2450	9	
	4			2.267		8.18	14.91	141.5		1900	10	
	5			2.284		7.49	14.27	142.5		2000	10	
	6			2.291		7.21	14.01	143.0		292.8		
C81	1	4.02	3.86	2.335	2.490	6.22	13.53	145.7		2700	10	C-30
	2			2.305		7.43	14.64	143.8		2800	10	
	3			2.309		7.27	14.49	144.1		2800	12	
	4			2.327		6.55	13.83	145.2		3400	10	
	5			2.314		7.07	14.30	144.4		3100	10	
	6			2.313		7.11	14.34	144.3		316.2		
C82	1	7.14	6.67	2.366	2.422	2.31	14.94	147.6		1950	12	
	2			2.374		1.98	14.65	148.1		2500	9	
	3			2.381		1.69	14.40	148.6		2550	14	
	4			2.380		1.73	14.40	148.5		2550	13	
	5			2.377		1.86	14.54	148.3		2400	14	
	6			2.383		1.61	14.33	148.7		258.9		
C83	1	4.02	3.86	2.309	2.542	9.17	14.49	144.1		3000	9	
	2			2.291		9.87	15.16	143.0		3350	9	
	3			2.282		10.23	15.49	142.4		3100	9	
	4			2.282		10.23	15.49	142.4		2850	10	
	5			2.271		10.66	15.90	141.7		2700	10	
	6			2.278		10.39	15.64	142.1		283.0		
C84	1	6.03	5.68	2.367	2.448	3.31	14.00	147.7		2850	11	
	2			2.343		4.21	14.80	146.2		3350	10	
	3			2.343		4.29	14.87	146.2		3150	10	
	4			2.347		4.13	14.73	146.5		3150	10	
	5			2.334		4.66	15.20	145.6		3100	11	
	6			2.315		5.43	15.89	144.5		302.7		

Bituminous mix design by Marshall method — Series C, continued.

Specimen No.	% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability[a], lb. Meas.	Stability[a], lb. Adj.	Flow, in. (X 0.01)	Gradation
C85 1	3.35	3.24	2.269	2.561	11.40	15.43	141.6		3400	8	C-30
2			2.241		12.50	16.47	139.8		3200	10	
3			2.232		12.85	16.81	139.3		2800	10	
4			2.237		12.65	16.62	139.6		2800	9	
5			2.245		12.34	16.32	140.1		2850	9	
6			2.235		12.73	16.70	139.5		221.1		

Appendix H-2. Bituminous mix design data by Hveem method — Series C.

Specimen No.	% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Hveem stability	Cohesiometer value	Gradation
C01 7	6.00	5.67	2.422	2.473	2.05	11.48	151.1	23.3	236	C-100L
8			2.420		2.14	11.55	151.0	14.3	202	
9			2.426		1.89	11.34	151.4	23.6	258	
C02 7	4.68	4.47	2.336	2.504	6.72	13.54	145.8	34.2	157	
8			2.333		6.84	13.65	145.6	37.9	207	
9			2.331		6.92	13.72	145.5	39.9	207	
C03 7	3.10	3.02	2.235	2.615	14.54	16.02	139.5	42.4	76	
8			2.244		14.19	15.68	140.0	47.6	127	
9			2.231		14.69	16.17	139.2	48.3	111	
C04 7	6.68	6.26	2.412	2.429	0.70	12.40	150.5	11.3	231	
8			2.417		0.49	12.22	150.8	—	268	
9			2.417		0.49	12.22	150.8	11.9	191	
C05 7	3.79	3.66	2.263	2.593	12.72	15.53	141.2	50.6	167	
8			2.257		12.95	15.75	140.8	46.1	115	
9			2.248		13.30	16.09	140.3	52.7	116	
C06 7	7.00	6.44	2.407	2.399	0.00	12.61	150.2	0 [a]	193	B-P
8			2.405		0.00	12.68	150.1	0 [a]	238	
9			2.399		0.08	12.90	149.7	0 [a]	225	
C07 7	6.00	5.66	2.406	2.437	1.28	11.92	150.1	14.9	240	
8			2.405		1.32	11.96	150.1	16.5	231	
9			2.404		1.36	11.99	150.0	11.5	256	
C08 7	3.10	3.02	2.263	2.589	12.60	14.84	141.2	39.8	139	
8			2.265		12.52	14.76	141.3	46.7	228	
9			2.271		12.29	14.54	141.7	57.8	208	
C09 7	4.00	3.85	2.267	2.251	0.00	15.42	141.5	54.5	162	
8			2.261		0.00	15.64	141.1	46.5	208	
9			2.266		0.00	15.45	141.4	51.6	197	
C10 7	5.00	4.66	2.359	2.501	5.69	12.76	147.2	41.6	207	
8			2.354		5.89	12.91	146.9	44.2	289	
9			2.360		5.65	12.69	147.3	37.4	279	
C11 7	4.00	3.87	2.289	2.562	10.67	16.05	142.8	46.5	198	B-B
8			2.294		10.47	15.86	143.1	50.1	147	
9			2.283		10.90	16.27	142.5	40.5	184	
C12 7	7.00	6.49	2.374	2.479	4.23	15.30	148.1	29.8	223	
8			3.381		3.95	15.05	148.6	24.7	242	
9			2.380		3.99	15.09	148.5	20.3	244	
C13 7	5.00	4.69	2.336	2.518	7.24	15.05	145.8	42.2	181	
8			2.334		7.31	15.13	145.6	33.1	262	
9			2.322		7.79	15.56	144.9	45.4	195	
C14 7	6.00	5.70	2.357	2.501	5.74	15.20	147.1	40.7	234	
8			2.347		6.14	15.56	146.5	41.4	227	
9			2.357		5.74	15.20	147.1	42.4	225	
C15 7	3.00	3.04	2.268	2.569	11.73	16.10	141.5	46.7	152	
8			2.267		11.77	16.14	141.5	54.5	182	
9			2.262		11.96	16.32	141.1	40.4	123	
C16 7	6.00	5.70	2.406	2.477	2.87	11.72	150.1	27.4	179	A-4
8			2.413		2.59	11.46	150.6	21.7	248	
9			2.414		2.55	11.42	150.6	24.2	192	
C17 7	4.00	3.87	2.345	2.588	9.39	12.29	146.3	43.6	193	
8			2.284		11.75	14.57	142.5	47.1	122	
9			2.311		10.71	13.56	144.2	46.1	138	
C18 7	3.00	3.04	2.249	2.617	14.07	15.15	140.3	49.4	73	
8			2.271		13.23	14.32	141.7	53.6	104	
9			2.264		13.50	14.58	141.3	51.5	127	
C19 7	7.00	6.49	2.412	2.414	0.10	12.24	150.5	0 [a]	133	
8			2.413		0.05	12.20	150.6	0 [a]	167	
9			2.409		0.22	12.35	150.3	0 [a]	158	
C20 7	5.00	4.69	2.392	2.465	2.96	11.29	149.3	40.6	123	
8			2.392		2.96	11.29	149.3	32.6	187	
9			2.395		2.84	11.18	149.5	35.7	181	
C21 7	4.00	3.87	2.40	2.440	1.64	10.47	149.8	60.7	206	A-100
8			2.40		1.64	10.47	149.8	68.3	275	
9			2.38		2.46	11.22	148.5	68.5	140	
C22 7	6.26	5.84	2.420	2.516	3.80	11.62	151.0	6.1 [a]	—	
8			2.420		3.80	11.62	151.0	7.1 [a]	—	
9			2.420		3.80	11.62	151.0	— [a]	—	

[a] Extrapolated stability values (from log P_v - log P_h plots).

Bituminous mix design data by Hveem method — Series C, continued.

Specimen No.	% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Hveem stability	Cohesiometer value	Gradation
C45 7	3.36	3.25	2.285	2.544	10.19	13.81	142.6	62.9	95	A-30H
8			2.294		9.84	13.47	143.1	63.8	109	
9			2.307		9.33	12.98	144.0	63.4	130	
C46 7	4.00	3.87	2.326	2.559	0.09	12.76	145.1	62.5	144	A-8
8			2.326		9.09	12.76	145.1	67.5	166	
9			2.335		8.74	12.42	145.7	55.6	103	
C47 7	5.00	4.69	2.375	2.429	2.22	11.68	148.2	58.9	141	
8			2.381		1.97	11.46	148.6	68.3	141	
9			2.374		2.26	11.72	148.1	59.8	118	
C48 7	7.16	6.68	2.399	2.404	0.20	12.65	149.7	24.1	69	
8			2.420		0.00	11.89	151.0	11.0	118	
9			2.401		0.11	12.58	149.8	12.5[a]	58	
C49 7	3.00	2.83	2.296	2.559	10.28	12.95	143.3	64.0	146	
8			2.303		10.01	12.69	143.7	67.9	124	
9			2.308		9.81	12.50	144.0	63.4	126	
C50 7	5.82	5.50	2.398	2.474	3.08	11.58	149.6	27.5	84	
8			2.400		3.00	11.51	149.8	23.5	133	
9			2.395		3.20	11.69	149.4	25.1	90	
C51 7	7.13	6.65	2.391	2.406	0.61	13.96	149.2	1.3[a]	24	B-100
8			2.380		1.07	14.35	148.5	0.8[a]	—	
9			2.391		0.61	13.96	149.2	0.5[a]	61	
C52 7	4.00	3.85	2.367	2.552	7.23	12.26	147.7	42.9	124	
8			2.336		8.45	13.41	145.8	50.8	117	
9			2.337		8.41	13.38	145.8	52.1	140	
C53 7	3.12	3.02	2.297	2.609	11.95	14.12	143.3	62.0	95	
8			2.316		11.22	13.41	144.5	58.7	108	
9			2.308		11.53	13.71	144.0	61.5	151	
C54 7	5.35	5.07	2.413	2.494	3.24	11.69	150.6	25.0	110	
8			2.406		3.52	11.95	150.1	28.4	121	
9			2.406		3.52	11.95	150.1	26.3	139	
C55 7	6.24	5.87	2.410	2.438	1.16	12.55	150.4	6.1[a]	56	
8			2.413		1.04	12.44	150.6	4.4[a]	80	
9			2.419		0.79	12.22	150.9	8.1[a]	104	
C56 7	3.35	3.24	2.264	2.585	12.43	15.55	141.3	62.7	103	C-30L
8			2.285		11.62	14.77	142.6	60.5	107	
9			2.291		11.39	14.54	143.0	53.6	89	
C57 7	5.00	4.88	2.402	2.513	4.40	11.92	149.0	31.6	114	
8			2.405		4.28	11.81	150.1	26.9	91	
9			2.422		3.60	11.18	151.1	30.8	135	
C58 7	6.25	5.88	2.414	2.430	0.64	12.41	150.6	14.8[a]	80	
8			2.410		0.81	12.56	150.4	9.8[a]	75	
9			2.417		0.52	12.30	150.8	8.1[a]	95	
C59 7	4.00	3.86	2.307	2.508	10.33	14.50	144.0	51.4	111	
8			2.297		10.72	14.87	143.3	52.2	153	
9			2.324		9.67	13.87	145.0	58.6	162	
C60 7	7.00	6.47	2.429	2.387	0.00	12.42	151.6	10.8	82	
8			2.421		0.00	12.71	151.0	5.0[a]	79	
9			2.427		0.00	12.49	151.4	7.5[a]	107	
C61 7	3.00	3.45	2.289	2.585	11.44	14.74	142.8	63.2	88	C-8
8			2.273		12.06	15.33	141.8	61.2	91	
9			2.284		11.64	14.92	142.5	60.5	75	
C62 7	6.47	6.08	2.433	2.467	1.38	11.84	151.8	11.0	78	
8			2.434		1.34	11.81	151.9	14.8	144	
9			2.428		1.58	12.02	151.5	14.4	108	
C63 7	7.14	6.67	2.420	2.432	0.49	12.86	151.0	4.8[a]	120	
8			2.417		0.61	12.97	150.8	5.8[a]	88	
9			2.419		0.53	12.90	150.9	4.9[a]	85	
C64 7	5.13	4.88	2.414	2.513	3.95	11.41	150.6	32.6	125	
8			2.413		3.99	11.45	150.6	27.1	124	
9			2.422		3.63	11.12	151.1	32.8	120	
C65 7	4.24	4.07	2.398	2.529	5.16	11.25	149.6	42.7	45	
8			2.390		5.48	11.55	149.1	48.7	91	
9			2.406		4.85	10.95	150.1	31.3	98	
C66 7	5.00	4.69	2.353	2.445	3.78	12.29	146.8	53.6	118	A-F
8			2.363		3.37	11.92	147.5	57.4	155	
9			2.363		3.37	11.92	147.5	62.4	139	

Bituminous mix design data by Hveem method — Series C, continued.

Specimen No.	% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Hveem stability	Cohesiometer value	Gradation
C67 7	3.13	3.04	2.268	2.549	11.02	14.00	141.5	61.8	50	A-P
8			2.290		10.02	13.16	143.0	70.3	125	
9			2.268		11.02	14.00	141.5	63.1	86	
C68 7	6.26	5.89	2.387	2.416	1.19	12.15	149.0	49.7	104	
8			2.393		0.94	11.93	149.3	47.4	124	
9			2.388		1.15	12.11	149.0	40.1	89	
C69 7	6.71	6.29	2.380	2.393	0.53	12.78	148.5	3.3[a]	68	
8			2.384		0.36	12.63	148.8	6.8[a]	68	
9			2.390		0.11	12.41	149.1	8.1[a]	104	
C70 7	4.00	3.87	2.359	2.465	4.28	11.31	142.2	68.5	173	
8			2.340		5.05	12.03	145.9	68.9	163	
9			2.352		4.56	11.58	146.8	67.7	152	
C71 7	5.56	5.26	2.423	2.449	1.06	10.71	151.2	19.2[a]	52	B-8L
8			2.416		1.34	10.97	150.8	17.6	143	
9			2.423		1.06	10.71	151.2	11.9[a]	113	
C72 7	4.44	4.26	2.387	2.533	5.75	11.11	148.9	31.0	142	
8			2.375		6.22	11.56	148.2	48.5	130	
9			2.375		6.22	11.56	148.2	49.1	120	
C73 7	3.33	3.23	2.280	2.573	11.37	14.18	142.3	60.0	82	
8			2.287		11.10	13.92	142.7	67.9	120	
9			2.280		11.37	14.18	142.3	60.3	51	
C74 7	7.33	6.83	—	2.393	—	—	—	—	—	
8			2.390		0.11	13.39	149.1	2.9[a]	76	
9			2.375		0.74	13.93	148.2	3.7[a]	71	
C75 7	6.00	5.66	2.401	2.429	1.16	11.90	149.8	22.1	98	
8			2.415		0.58	11.38	150.7	29.9	152	
9			2.403		1.08	11.82	149.9	55.1	149	
C76 7	6.24	5.87	2.365	2.411	1.91	12.91	147.6	40.5	131	A-100L
8			2.363		1.99	12.98	147.5	51.5	120	
9			2.359		2.16	13.12	147.2	56.2	149	
C77 7	4.90	4.67	2.377	2.426	2.03	11.35	148.3	49.0	129	
8			2.375		2.11	11.42	148.2	49.1	111	
9			2.374		2.16	11.46	148.1	45.5	109	
C78 7	2.90	2.81	2.286	2.561	10.74	13.08	142.6	55.0	90	
8			2.262		11.68	13.99	141.1	55.0	107	
9			2.256		11.91	14.22	140.8	45.8	88	
C79 7	7.13	6.65	2.353	2.406	2.20	14.06	146.2	53.0	108	
8			2.358		2.00	13.88	147.1	52.2	82	
9			2.352		2.24	14.10	146.8	53.4	76	
C80 7	4.23	4.06	2.359	2.469	4.46	11.45	147.2	59.4	136	
8			2.345		5.02	11.98	146.3	60.2	134	
9			2.351		4.78	11.75	146.7	65.5	129	
C81 7	5.02	4.86	2.357	2.490	5.34	12.71	147.1	63.4	182	C-30
8			2.363		5.10	12.49	147.5	65.9	172	
9			2.367		4.94	12.34	147.7	63.1	130	
C82 7	7.14	6.67	2.395	2.422	1.11	13.90	149.4	28.0	88	
8			2.391		1.28	14.04	149.2	34.5	85	
9			2.391		1.28	14.04	149.2	26.7	94	
C83 7	4.02	3.86	2.336	2.542	8.10	13.49	145.8	60.3	162	
8			2.318		8.81	14.16	144.6	67.1	154	
9			2.319		8.77	14.12	144.7	62.7	144	
C84 7	6.03	5.68	2.368	2.448	3.27	13.96	147.8	46.7	141	
8			2.386		2.53	13.31	148.9	54.0	126	
9			2.371		3.15	13.85	147.9	54.7	110	
C85 7	3.35	3.24	2.277	2.561	11.09	15.13	142.1	61.2	129	
8			2.287		10.76	14.76	142.8	65.7	102	
9			2.272		11.28	15.32	141.8	64.5	100	

Appendix I-1. Bituminous mix design data for Marshall method — Series D.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb, Meas.	Stability, lb, Adj.	Flow, in. (X 0.01)	Gradation
D01	1	6.03	5.69	2.431	2.448	0.96	12.56	151.7		1500	25	A-I
	2			2.447		0.04	11.99	152.7		1600	24	
	3			2.448		0.00	11.95	152.8		1600	21	
	4			2.449		0.00	11.91	152.8		1600	25	
	5			2.451		0.00	11.84	152.9		1650	25	
	6			2.449		0.00	11.91	152.8	3600		228.0[a]	
D02	1	4.02	3.86	2.429	2.523	3.73	10.94	151.6		2250	13	
	2			2.404		4.72	11.85	150.0		2400	11	
	3			2.404		4.72	11.85	150.0		2350	12	
	4			2.409		4.52	11.67	150.3		2250	15	
	5			2.400		4.88	12.00	149.8		2250	13	
	6			2.400		4.88	12.00	149.8	4500		279.6[a]	
D03	1	6.70	6.28	2.420	2.439	0.78	13.50	151.0		1500	31	
	2			2.432		0.29	13.07	151.8		1650	24	
	3			2.432		0.29	13.07	151.8		1500	21	
	4			2.427		0.49	13.25	151.4		1650	25	
	5			2.427		0.49	13.25	151.4		1550	25	
	6			2.431		0.33	13.11	151.7	2700		172.5[a]	
D04	1	2.90	2.82	2.368	2.537	6.66	12.23	147.8		2350	11	
	2			2.344		7.61	13.12	146.3		3200	9	
	3			2.348		7.45	12.98	146.5		3600	10	
	4			2.360		6.98	12.53	147.3		3250	11	
	5			2.350		7.37	12.90	146.6		3400	11	
	6			2.350		7.37	12.90	146.6	4450		276.8[a]	
D05	1	5.14	4.88	2.438	2.493	2.21	11.56	152.1		1950	14	
	2			2.434		2.37	11.70	151.9		2350	14	
	3			2.430		2.53	11.84	151.6		2450		
	4			2.420		2.93	12.21	151.0		2300	17	
	5			2.426		2.69	11.99	151.4		2300	15	
	6			2.426		2.69	11.99	151.4	4300		269.6[a]	
D06	1	4.24	4.07	2.337	2.508	6.82	14.43	145.8		2500	9	C-I
	2			2.313		7.78	15.31	144.3		2500	9	
	3			2.329		7.14	14.72	145.3		2850	9	
	4			2.332		7.02	14.62	145.5		2700	10	
	5			2.309		7.94	15.46	144.1		2350	13	
	6			2.316		7.66	15.20	144.5	4400		279.4[a]	
D07	1	4.91	4.68	2.380	2.489	4.38	13.41	148.5		2400	9	
	2			2.358		5.26	14.21	147.1		2550	10	
	3			2.349		5.62	14.54	146.6		2550	10	
	4			2.342		5.91	14.79	146.1		2600	12	
	5			2.338		6.07	14.94	145.9		2350	11	
	6			2.335		6.19	15.05	145.7	4400		279.1[a]	
D08	1	6.91	6.47	2.393	2.434	1.68	14.57	149.3		1800	20	
	2			2.399		1.44	14.36	149.7		2000	18	
	3			2.398		1.48	14.40	149.6		1900	17	
	4			2.398		1.89	14.72	149.0		1950	17	
	5			2.398		1.48	14.40	149.6		2000	18	
	6			2.402		1.32	14.25	149.9	3700		235.5[a]	
D09	1	6.02	5.67	2.397	2.449	2.12	13.70	149.6		1950	17	
	2			2.390		2.41	13.95	149.1		2200	13	
	3			2.397		2.12	13.70	149.6		2150	14	
	4			2.403		1.88	13.48	149.9		2200	15	
	5			2.392		2.33	13.88	149.3		2150	15	
	6			2.395		2.20	13.77	149.4	4000		253.2[a]	
D10	1	2.67	2.60	2.242	2.435	7.93	16.65	139.9		2200	7	
	2			2.226		8.58	17.25	138.9		1950	9	
	3			2.248		7.68	16.43	140.3		2250	9	
	4			2.244		7.84	16.59	140.0		2350	7	
	5			2.242		7.92	16.65	139.9		2350	8	
	6			2.244		7.84	16.58	140.0	3000		194.4[a]	
D11	1	2.90	2.82	2.288	2.556	10.48	15.10	142.8		2600	8	B-8
	2			2.260		11.58	16.14	141.0		2100	8	
	3			2.261		11.54	16.10	141.1		2250	9	
	4			2.237		12.48	16.99	139.6		1500	9	
	5			2.254		11.82	16.36	140.6		2400	9	
	6			2.247		12.09	16.62	140.2	2800		174.4[a]	
D12	1	4.24	4.07	2.382	2.520	5.48	12.75	148.6		2600	9	
	2			2.348		6.82	14.00	146.5		2850	10	
	3			2.343		7.02	14.18	146.2		2500	9	
	4			2.354		6.59	13.78	146.9		2400	11	
	5			2.342		7.06	14.22	146.1		2450	12	
	6			2.342		7.06	14.22	146.1	4200		262.6[a]	

[a] Indirect tensile strength, psi, for specimen No. 6 in each batch.

Bituminous mix design data for Marshall method — Series D, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb, Meas.	Stability, lb, Adj.	Flow, in. (× 0.01)	Gradation
D13	1	4.91	4.68	2.422	2.489	2.69	11.85	151.1		2200	13	B-8
	2			2.412		3.09	12.21	150.5		2600	11	
	3			2.413		3.05	12.18	150.6		2600	11	
	4			2.416		2.93	12.07	150.8		2700	12	
	5			2.419		2.81	11.96	150.9		2650	12	
	6			2.416		2.93	12.07	150.8	5300		339.9[a]	
D14	1	6.03	5.69	2.420	2.451	1.26	12.86	151.0		1700	22	
	2			2.427		0.98	12.60	151.4		2000	19	
	3			2.428		0.94	12.57	151.5		1950	18	
	4			2.424		1.10	12.71	151.3		1850	21	
	5			2.426		1.02	12.64	151.4		1800	20	
	6			2.422		1.18	12.78	151.4	3600		224.8[a]	
D15	1	6.92	6.47	2.416	2.420	0.16	13.72	150.8		1400	28	
	2			2.423		0.00	13.47	151.2		1550	24	
	3			2.425		0.00	13.40	151.3		1500	25	
	4			2.423		0.00	13.47	151.2		1550	25	
	5			2.427		0.00	13.33	151.4		1700	26	
	6			2.424		0.00	13.43	151.3	3000		193.6[a]	
D16	1	6.02	5.67	2.423	2.445	0.90	12.90	151.2		1550	22	B-30
	2			2.436		0.37	12.43	152.0		1650	22	
	3			2.429		0.65	12.68	151.6		1700	24	
	4			2.430		0.61	12.64	151.6		1650	25	
	5			2.438		0.29	12.36	152.1		1500	23	
	6			2.432		0.53	12.57	151.8	3300		208.3[a]	
D17	1	4.01	3.85	2.401	2.507	4.23	12.02	149.8		2550	9	
	2			2.380		5.07	12.79	148.5		2650	10	
	3			2.379		5.11	12.83	148.4		2950	9	
	4			2.369		5.51	13.19	147.8		2700	12	
	5			2.366		5.62	13.30	147.8		2700	12	
	6			2.366		5.62	13.30	147.6	4800		298.9[a]	
D18	1	4.90	4.67	2.421	2.489	2.73	12.04	151.1		2350	16	
	2			2.420		2.77	12.08	151.0		2000	13	
	3			2.424		2.61	11.94	151.3		2750	12	
	4			2.413		3.05	12.34	150.6		2600	14	
	5			2.423		2.65	11.97	151.2		2750	15	
	6			2.418		2.85	12.15	150.9	4550		289.1[a]	
D19	1	2.90	2.82	2.313	2.559	9.61	14.34	144.3		3250	9	
	2			2.296		10.28	14.97	143.3		3350	9	
	3			2.296		10.28	14.97	143.3		3250	9	
	4			2.302		10.04	14.74	143.6		3150	9	
	5			2.301		10.08	14.78	143.6		3150	9	
	6			2.303		10.00	14.71	143.7	3700		238.5[a]	
D20	1	6.91	6.46	2.411	2.432	0.86	14.05	150.4		1650	27	
	2			2.428		0.16	13.45	151.5		1750	25	
	3			2.428		0.16	13.45	151.5		1700	23	
	4			2.425		0.29	13.55	151.3		1600	26	
	5			2.426		0.25	13.52	151.4		1750	25	
	6			2.422		0.41	13.66	151.1	3200		205.1[a]	
D21	1	2.91	2.82	2.354	2.557	7.94	13.02	146.9		2000	12	A-30L
	2			2.330		8.88	13.91	145.4		2250	11	
	3			2.335		8.41	13.46	146.1		2000	12	
	4			2.334		8.72	13.76	145.6		1950	15	
	5			2.335		8.68	13.72	145.7		1700	13	
	6			2.313		9.54	14.53	144.3	3600		212.4[a]	
D22	1	4.92	4.69	2.434	2.485	2.05	11.79	151.9		1550	13	
	2			2.428		2.29	12.01	151.5		1500	12	
	3			2.421		2.58	12.26	151.1		1500	12	
	4			2.413		2.90	12.55	150.6		3300	15	
	5			2.416		2.78	12.44	150.8		3150	26	
	6			2.420		2.62	12.30	151.0	4000		250.6[a]	
D23	1	6.04	5.70	2.414	2.446	1.31	13.45	150.6		1450	17	
	2			2.419		1.10	13.27	150.9		1400	13	
	3			2.403		1.76	13.84	149.9		1350	13	
	4			2.388		2.37	14.38	149.0		1350	18	
	5			2.382		2.62	14.59	148.6		1200	21	
	6			2.395		2.08	14.13	149.4	4100		261.1[a]	
D24	1	4.03	3.87	2.366	2.494	5.13	13.52	147.6		1300	9	
	2			2.386		4.33	12.79	148.9		1800	12	
	3			2.392		4.09	12.57	149.3		1900	12	
	4			2.385		4.37	12.82	148.8		1650	17	
	5			2.390		4.17	12.64	149.1		1750	18	
	6			2.385		4.37	12.82	148.8	3600		231.8[a]	

Bituminous mix design data for Marshall method — Series D, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb. Meas.	Stability, lb. Adj.	Flow, in. (X 0.01)	Gradation
D25	1	6.94	6.49	2.408	2.422	0.58	14.38	150.3		1200	22	
	2			2.406		0.66	14.45	150.1		1550	14	
	3			2.383		1.61	15.27	148.7		1300	14	
	4			2.416		0.25	14.10	150.8		1400	16	
	5			2.411		0.45	14.28	150.4		1300	16	
	6			2.376		1.90	14.52	148.3	3300		205.1[a]	
D26	1	4.90	4.67	2.404	2.506	4.07	12.76	150.0		2900	11	C-100
	2			2.393		4.51	13.16	149.3		2600	12	
	3			2.372		5.35	13.92	148.0		2600	10	
	4			2.357		5.95	14.47	147.1		2400	12	
	5			2.346		6.38	14.87	146.4		2350	11	
	6			2.343		6.50	14.98	146.2	4150		257.8[a]	
D27	1	4.01	3.85	2.350	2.529	7.08	13.99	146.6		3000	8	
	2			2.325		8.07	14.90	145.1		2950	8	
	3			2.314		8.50	15.31	144.4		2600	9	
	4			2.303		8.94	15.71	143.7		2250	14	
	5			2.313		8.51	15.34	144.3		2750	9	
	6			2.296		9.21	15.96	143.3	3650		226.3[a]	
D28	1	6.91	6.46	2.404	2.431	1.11	14.40	150.0		1350	33	
	2			2.418		0.54	13.90	150.9		1500	25	
	3			2.413		0.78	14.12	150.5		1500	25	
	4			2.411		0.82	14.15	150.4		1600	29	
	5			2.413		0.74	14.08	150.6		1650	30	
	6			2.415		0.66	14.01	150.7	3100		196.7[a]	
D29	1	6.02	5.67	2.415	2.444	1.19	13.28	150.7		1450	29	
	2			2.416		1.15	13.25	150.8		1800	22	
	3			2.416		1.15	13.25	150.8		1700	22	
	4			2.418		1.06	13.18	150.9		1850	22	
	5			2.417		1.10	13.28	150.8		1800	21	
	6			2.417		1.10	13.21	150.8	3500		221.7[a]	
D31	1	4.03	3.87	2.465	2.513	1.91	9.80	153.8		2050	15	A-8LH
	2			2.433		3.18	10.97	151.8		2050	17	
	3			2.430		3.30	11.08	151.6		2050	18	
	4			2.414		3.94	11.66	150.6		1800	17	
	5			2.428		3.38	11.15	151.5		1900	17	
	6			2.424		3.54	11.30	151.3	4650		289.1[a]	
D32	1	6.04	5.70	2.447	2.429	0.00	12.03	152.7		1750	25	
	2			2.453		0.00	11.81	153.1		1750	17	
	3			2.455		0.00	11.74	153.1		1800	13	
	4			2.429		0.00	12.68	151.6		1750	28	
	5			2.449		0.00	11.96	152.8		1750	21	
	6			2.419		0.41	13.03	150.9	3500		217.8[a]	
D33	1	6.94	6.49	2.430	2.371	0.00	13.37	151.6		1550	22	
	2			2.488		0.00	11.30	155.3		1350	21	
	3			2.429		0.00	13.41	151.6		1500	22	
	4			2.421		0.00	13.69	151.1		1200	23	
	5			2.431		0.00	13.34	151.7		1350	28	
	6			2.423		0.00	13.62	151.2	3100		194.6[a]	
D34	1	2.91	2.83	2.377	2.552	6.86	11.94	148.3		1750	15	
	2			2.387		6.47	11.57	148.9		2100	11	
	3			2.369		7.17	12.24	147.8		2250	10	
	4			2.359		7.56	12.61	147.2		2300	13	
	5			2.379		6.78	11.87	148.4		2400	12	
	6			2.375		6.94	12.02	148.2	4200		270.9[a]	
D35	1	4.92	4.86	2.442	2.503	2.44	11.42	152.4		1750	15	
	2			2.415		2.08	11.10	150.7		1850	12	
	3			2.420		3.32	12.22	151.0		1850	14	
	4			2.428		3.00	11.93	151.5		1850	23	
	5			2.407		3.84	12.70	150.2		1600	15	
	6			2.418		3.40	12.30	150.9	—		—	
D41	1	6.92	6.47	2.421	2.429	0.33	13.67	151.1		1550	35	C-P
	2			2.429		0.00	13.39	151.6		1750	22	
	3			2.422		0.29	13.69	151.1		1600	26	
	4			2.424		0.21	13.57	151.3		1650	24	
	5			2.426		0.12	13.50	151.4		1700	26	
	6			2.420		0.37	13.71	151.0	3300		209.7[a]	
D42	1	6.03	5.69	2.421	2.446	1.02	12.95	151.1		1550	26	
	2			2.424		0.90	12.84	151.3		1750	18	
	3			2.419		1.10	13.02	150.9		1700	20	
	4			2.425		0.86	12.81	151.3		1850	22	
	5			2.415		1.27	13.17	150.7		1750	21	
	6			2.420		1.10	13.00	151.0	2850		201.7[a]	

Bituminous mix design data for Marshall method — Series D, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb, Meas.	Stability, lb, Adj.	Flow, in. (X 0.01)	Gradation
D43	1	4.02	3.86	2.387	2.504	4.67	12.51	148.9		2400	10	C-P
	2			2.377		5.07	12.88	148.3		3000	10	
	3			2.389		4.59	12.44	149.1		2950	10	
	4			2.360		5.75	13.50	147.3		2700	13	
	5			2.373		5.23	13.02	148.1		2900	12	
	6			2.296		8.31	15.84	143.3	3000		232.7[a]	
D44	1	2.90	2.82	2.266	2.569	11.79	16.05	141.4		2250	7	
	2			2.269		11.68	15.94	141.6		2450	9	
	3			2.260		12.03	16.27	141.0		2300	13	
	4			2.278		11.33	15.60	142.1		2600	9	
	5			2.278		12.07	16.31	141.0		2250	9	
	6			2.256		12.18	16.42	140.8	3000		184.7[a]	
D45	1	4.91	4.68	2.404	2.493	3.57	12.64	150.0		2350	17	
	2			2.412		3.25	12.35	150.5		2900	13	
	3			2.397		3.85	12.89	149.6		2650	11	
	4			2.399		3.77	12.82	149.7		2700	12	
	5			2.394		3.97	13.00	149.4		2500	14	
	6			2.386		4.30	13.30	148.9	4700		296.2[a]	
D46	1	6.92	6.47	2.420	2.426	0.25	14.07	151.0		1450	24	B-30L
	2			2.421		0.21	14.03	151.1		1300	17	
	3			2.406		0.82	14.57	150.1		1450	15	
	4			2.413		0.54	14.32	150.6		1250	20	
	5			2.407		0.78	14.53	150.2		1300	19	
	6			2.411		0.62	14.49	150.4	3400		212.0[a]	
D47	1	4.02	3.86	2.414	2.504	3.59	11.89	150.6		1900	11	
	2			2.365		5.55	13.68	147.6		1700	11	
	3			2.369		5.39	13.53	147.8		1800	12	
	4			2.373		5.23	13.39	148.1		1800	12	
	5			2.387		4.67	12.88	148.9		1750	17	
	6			2.361		5.71	13.82	147.3	4300		267.0[a]	
D48	1	5.58	5.29	2.401	2.492	3.65	13.67	149.8		1550	13	
	2			2.385		4.29	14.24	148.8		1550	11	
	3			2.370		4.90	14.78	147.9		1350	10	
	4			2.372		4.82	14.71	148.0		1350	17	
	5			2.384		4.33	14.28	148.8		1500	17	
	6			2.377		4.62	14.53	148.3	3850		245.8[a]	
D49	1	6.03	5.69	2.437	2.437	0.49	13.17	151.3		1400	17	
	2			2.399		1.56	14.10	149.7		1300	12	
	3			2.384		2.18	14.64	148.8		1250	15	
	4			2.395		1.72	14.25	149.4		1600	15	
	5			2.392		1.85	14.36	149.3		1400	12	
	6			2.406		1.27	13.85	150.1	3850		245.3[a]	
D50	1	3.80	3.66	2.327	2.531	8.06	14.89	145.2		1450	14	
	2			2.309		8.77	15.55	144.1		1600	14	
	3			2.308		8.81	15.58	144.0		1800	12	
	4			2.320		8.34	15.14	144.8		2000	12	
	5			2.303		9.01	15.77	143.7		1800	14	
	6			2.292		9.44	16.17	143.0	3850		240.2[a]	
D51	1	5.15	4.90	2.452	2.479	1.09	11.13	153.0		1950	20	C-8L
	2			2.485		0.00	9.94	155.1		1850	17	
	3			2.482		0.00	10.05	154.9		1950	16	
	4			2.422		2.30	12.22	151.1		1900	17	
	5			2.430		1.98	11.93	151.6		1950	17	
	6			2.397		3.31	13.13	149.6	3850		235.2[a]	
D52	1	4.03	3.86	2.406	2.548	5.57	11.85	150.1		2500	11	
	2			2.368		7.06	13.24	147.8		2000	12	
	3			2.383		6.79	12.98	148.2		2450	13	
	4			2.369		7.02	13.20	147.8		2200	13	
	5			2.376		6.75	12.95	148.3		2250	14	
	6			2.382		6.52	12.73	148.6	4450		235.2[a]	
D54	1	6.04	5.70	2.436	2.462	1.06	12.46	152.0		1450	26	
	2			2.449		0.53	11.99	152.8		1650	25	
	3			2.446		0.65	12.10	152.6		1600	25	
	4			2.438		0.98	12.38	152.1		1600	29	
	5			2.447		0.61	12.06	152.7		1550	26	
	6			2.442		0.81	12.24	152.4	3250		204.9[a]	
D55	1	6.94	6.49	2.406	2.424	0.74	14.26	150.1		1000	34	
	2			2.423		0.04	13.65	151.2	1250	1250	22	
	3			2.425		0.00	13.58	150.8		1200	34	
	4			2.421		0.12	13.72	151.1		1300	35	
	5			2.421		0.12	13.72	151.1		1225	35	
	6			2.422		0.08	13.69	151.1	2400		153.9[a]	

Bituminous mix design data for Marshall method — Series D, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb, Meas.	Stability, lb, Adj.	Flow, in. (× 0.01)	Gradation
D56	1	3.80	3.67	2.418	2.536	4.65	11.20	150.9		2000	12	A-4H
	2			2.400		5.36	11.86	149.8		2350	13	
	3			2.393		5.64	12.12	149.3		2200	12	
	4			2.410		4.97	11.49	150.4		2400	16	
	5			2.399		5.40	11.90	149.7		2250	15	
	6			2.399		5.40	11.90	149.7	4250		266.8[a]	
D58	1	6.04	5.70	2.438	2.474	1.45	12.35	152.1		1700	18	
	2			2.441		1.33	12.24	152.3		1850	17	
	3			2.439		1.82	12.68	152.3		1950	17	
	4			2.441		1.33	12.24	152.3		1850	22	
	5			2.443		1.25	12.17	152.4		1800	20	
	6			2.435		1.58	12.46	151.9	3850		244.3[a]	
D59	1	4.92	4.68	2.440	2.488	1.93	11.33	152.3		1950	16	
	2			2.426		2.49	11.84	151.4		1950	15	
	3			2.424		2.57	11.91	151.3		2150	15	
	4			2.420		2.73	12.06	151.0		1700	17	
	5			2.434		2.17	11.55	151.9		1800	15	
	6			2.413		3.01	12.31	150.6	3900		245.9[a]	
D60	1	3.27	3.18	2.339	2.560	8.63	13.66	146.0		1800	12	
	2			2.350		8.20	13.26	146.6		2250	10	
	3			2.327		9.10	14.11	145.2		2050	10	
	4			2.341		8.55	13.59	146.1		1950	13	
	5			2.341		8.55	13.59	146.1		2000	13	
	6			2.327		9.10	14.11	145.2	3700		234.5[a]	
D61	1	2.91	2.83	2.331	2.595	10.17	13.65	145.5		2100	10	A-4L
	2			2.327		10.33	13.80	145.2		2150	8	
	3			2.334		10.06	13.54	145.6		2050	12	
	4			2.320		10.60	14.05	144.8		1900	10	
	5			2.314		10.83	14.28	144.4		1650	11	
	6			2.328		10.29	13.76	145.3	3100		195.2[a]	
D62	1	6.04	5.70	2.449	2.483	1.37	11.96	152.8		1300	26	
	2			2.457		1.05	11.67	153.3		1400	21	
	3			2.452		1.25	11.85	153.0		1500	23	
	4			2.457		1.05	11.67	153.3		1500	26	
	5			2.448		1.41	11.99	152.8		1500	34	
	6			2.451		1.29	11.88	152.9	3000		191.3[a]	
D63	1	4.92	4.69	2.450	2.482	1.29	10.98	152.9		1600	22	
	2			2.450		1.05	10.76	153.3		1500	23	
	3			2.452		1.21	10.90	153.0		1400	17	
	4			2.448		1.37	11.05	152.8		1700	25	
	5			2.501		0.00	9.12	156.1		1400	20	
	6			2.453		1.17	10.87	153.1	3100		195.7[a]	
D65	1	4.03	3.87	2.441	2.502	2.44	10.54	152.3		1550	20	
	2			2.442		2.40	10.50	152.4		1850	14	
	3			2.433		2.76	10.83	151.8		2050	14	
	4			2.433		2.76	10.83	151.8		1850	23	
	5			2.442		2.40	10.50	152.4		1900	21	
	6			2.431		2.84	10.91	151.7	4000		251.8[a]	
D66	1	4.08	3.42	2.435	2.5432	5.25	10.24	151.9		2550	13	A-8H
	2			2.426		4.61	10.57	151.4		2550	10	
	3			2.403		5.51	11.42	149.9		2150	11	
	4			2.419		4.88	10.83	150.9		2750	7	
	5			2.419		4.88	10.83	150.9		2500	14	
	6			2.392		5.95	11.82	149.3	4600		287.1[a]	
D67	1	4.91	4.68	2.442	2.518	3.02	11.16	152.4		1650	14	
	2			2.438		3.18	11.30	152.1		1900	13	
	3			2.427		3.61	11.70	151.4		1750	12	
	4			2.445		2.90	11.05	152.6		1800	16	
	5			2.439		3.14	11.27	152.2		2100	16	
	6			2.440		3.12	11.21	152.3	3700		241.2[a]	
D69	1	6.03	5.68	2.440	2.453	0.53	12.16	152.3		1700	16	
	2			2.445		0.33	11.98	152.6		1750	16	
	3			2.453		0.00	11.69	153.1		1750	16	
	4			2.448		0.20	11.87	152.8		2000	19	
	5			2.443		0.41	12.05	152.4		1850	20	
	6			2.441		0.49	12.12	152.3	3400		215.7[a]	
D70	1	2.90	2.82	2.345	2.473	5.18	13.02	146.3		2400	10	
	2			2.321		6.15	13.91	144.8		2300	9	
	3			2.332		5.70	13.50	145.5		2400	8	
	4			2.330		5.78	13.58	145.4		2550	10	
	5			2.313		6.47	14.21	144.3		1850	13	
	6			2.317		6.31	14.06	144.6	3550		220.0[a]	

Bituminous mix design data for Marshall method — Series D, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb, Meas.	Stability, lb, Adj.	Flow, in. (× 0.01)	Gradation
D71	1	3.79	3.66	2.418	2.536	4.65	11.29	150.9		2100	6	A-30LH
	2			2.387		5.88	12.43	148.9		1800	14	
	3			2.384		5.99	12.54	148.8		2000	11	
	4			2.397		5.48	12.06	149.6		2200	13	
	5			2.395		5.56	12.13	149.4		2100	17	
	6			2.403		5.24	11.84	150.0	4500		283.8[a]	
D72	1	5.82	5.50	2.439	2.467	1.14	12.23	152.2		1600	19	
	2			2.441		1.05	12.16	152.3		1450	17	
	3			2.439		1.14	12.23	152.2		1550	20	
	4			2.445		0.89	12.01	152.6		1700	22	
	5			2.430		1.50	12.55	151.6		1350	21	
	6			2.431		1.46	12.52	151.7	3200		201.1[a]	
D73	1	4.91	4.68	2.437	2.497	2.41	11.54	152.1		1750	16	
	2			2.418		3.16	12.23	150.9		1650	16	
	3			2.411		3.44	12.48	150.4		1500	15	
	4			2.404		3.72	12.74	150.0		1500	19	
	5			2.409		3.52	12.56	150.3		1650	20	
	6			2.425		2.88	11.98	151.3	3800		238.0[a]	
D74	1	6.92	6.47	2.427	2.402	0.00	13.56	151.4		1600	21	
	2			2.430		0.00	13.45	151.6		1650	13	
	3			2.427		0.00	13.56	151.4		1500	14	
	4			2.427		0.00	13.56	151.4		1500	19	
	5			2.426		0.00	13.59	151.4		1550	17	
	6			2.430		0.00	13.45	151.6	3100		196.5[a]	
D75	1	2.90	2.82	2.371	2.527	6.17	12.26	148.0		1500	11	
	2			2.389		5.46	11.59	149.1		2000	12	
	3			2.378		5.90	12.00	148.4		1900	12	
	4			2.364		6.45	12.52	147.5		2100	16	
	5			2.378		5.90	12.52	148.4		2150	14	
	6			2.366		6.37	12.44	147.6	4000		252.6[a]	
D76	1	6.92	6.47	2.442	2.452	0.41	12.92	152.4		1750	22	A-P
	2			2.433		0.77	13.25	151.8		1500	19	
	3			2.426		1.06	13.50	151.4		1450	18	
	4			2.442		0.41	13.92	152.4		1550	17	
	5			2.440		0.49	13.00	152.2		1750	20	
D77	1	3.80	3.66	2.443	2.498	2.20	10.27	152.5		1900	21	
	2			2.432		2.64	10.68	151.8		1800	16	
	3			2.439		2.36	10.42	152.2		1850	13	
	4			2.444		2.16	10.23	152.5		2050	16	
	5			2.437		2.44	10.49	152.0		1750	16	
	6			2.435		2.52	10.57	151.9	4150		266.6[a]	
D78	1	4.91	4.68	2.429	2.474	1.82	11.73	151.6		1650	15	
	2			2.429		1.82	11.73	151.6		1900	13	
	3			2.413		2.47	12.31	150.6		1700	12	
	4			2.417		2.30	12.17	150.8		1800	17	
	5			2.407		2.71	12.53	150.2		1700	16	
	6			2.407		2.71	12.53	150.2	3700		231.7[a]	
D79	1	6.03	5.69	2.439	2.452	0.53	12.31	152.2		1550	23	
	2			2.443		0.37	12.16	152.4		1700	17	
	3			2.447		0.37	12.02	152.7		1800	19	
	4			2.449		0.12	11.95	152.8		1750	23	
	5			2.448		0.16	11.98	152.8		1750	17	
	6			2.449		0.12	11.95	152.8	3100		199.6[a]	
D80	1	2.90	2.82	2.372	2.519	5.84	12.12	148.0		1500	12	
	2			2.386		5.28	11.60	148.9		3000	10	
	3			2.393		5.00	11.34	149.3		2900	12	
	4			2.401		4.68	11.04	149.8		3200	11	
	5			2.371		5.88	12.16	148.0		2750	13	
	6			2.384		5.36	11.67	148.8	4650		294.9[a]	
D81	1	2.90	2.82	2.302	2.581	10.81	14.68	143.6		2250	7	A-30
	2			2.296		11.04	14.90	143.3		2550	8	
	3			2.318		10.19	14.09	144.6		2850	8	
	4			2.315		10.31	14.20	144.5		2450	9	
	5			2.287		11.39	15.24	142.7		2200	9	
	6			2.293		11.16	15.01	143.1	2700		191.4[a]	
D82	1	6.92	6.47	2.418	2.441	0.94	13.75	150.9		1600	29	
	2			2.432		0.37	13.25	151.8		1600	22	
	3			2.447		0.00	12.71	152.7		1750	21	
	4			2.434		0.29	13.18	151.9		1700	23	
	5			2.434		0.29	13.18	151.9		1750	25	
	6			2.440		0.04	12.96	152.3	2700		171.1[a]	

Bituminous mix design data for Marshall method — Series D, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb, Meas.	Stability, lb, Adj.	Flow, in. (× 0.01)	Gradation
D83	1	4.02	3.86	2.444	2.501	2.28	10.39	152.5		2400	11	A-30
	2			2.441		2.40	10.50	152.3		3100	13	
	3			2.422		3.16	11.19	151.1		2750	11	
	4			2.415		3.44	11.45	150.7		2550	13	
	5			2.428		2.92	10.97	151.5		2900	15	
	6			2.425		3.04	11.08	151.3	4650		291.2[a]	
D84	1	4.69	4.48	2.439	2.480	1.65	11.15	152.2		2200	17	
	2			2.443		1.49	11.00	152.4		2400	17	
	3			2.450		1.21	10.75	152.9		2750	17	
	4			2.434		1.85	11.33	151.9		2400	20	
	5			2.444		1.45	10.96	152.5		2400	18	
	6			2.441		1.57	11.07	152.3	3850		244.3[a]	
D85	1	5.82	5.50	2.443	2.471	1.13	11.95	152.4		1500	23	
	2			2.452		0.77	11.70	153.0		1800	25	
	3			2.450		0.85	11.70	152.9		1550	20	
	4			2.452		0.77	11.63	153.0		2100	25	
	5			2.455		0.65	11.52	153.2		1700	23	
	6			2.446		1.01	11.84	152.6	3250		208.1[a]	

Appendix I-2. Bituminous mix design data by Hveem method — Series D.

Specimen No.	% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Hveem stability	Cohesiometer value	Gradation
D01 7	6.03	5.69	2.452	2.447	0.00	11.81	153.0	0.0[a]	51	A-I
8			2.439		0.37	12.27	152.2	0.4[a]	66	
9			2.453		0.00	11.77	153.1	1.6[a]	88	
D02 7	4.02	3.86	2.425	2.523	3.88	11.08	151.3	42.6	113	
8			2.434		3.53	10.75	151.9	42.3	93	
9			2.449		2.93	10.20	152.8	31.3	120	
D03 7	6.70	6.28	2.429	2.439	0.41	13.20	151.6	0.0[a]	72	
8			2.434		0.20	13.00	151.9	1.5[a]	85	
9			2.437		0.08	12.90	152.1	4.9[a]	65	
D04 7	2.90	2.82	2.356	2.537	7.13	12.68	147.0	54.4	77	
8			2.375		6.38	11.98	148.2	56.6	79	
9			2.386		5.95	11.57	148.9	58.4	136	
D05 7	5.14	4.88	2.441	2.493	2.09	11.45	152.3	30.2	94	
8			2.433		2.41	11.74	151.8	23.0	72	
9			2.445		1.92	11.30	152.6	29.7	82	
D06 7	4.24	4.07	2.385	2.508	4.90	12.67	148.8	58.3	125	C-I
8			2.384		4.94	12.71	148.8	58.1	146	
9			2.388		4.78	12.56	149.0	52.5	130	
D07 7	4.91	4.68	2.399	2.489	3.62	12.72	149.7	57.4	183	
8			2.396		3.74	12.83	149.5	44.4	102	
9			2.399		3.62	12.72	149.7	48.7	109	
D08 7	6.91	6.47	2.411	2.434	0.94	13.93	150.4	21.0	61	
8			2.415		0.78	13.79	150.7	11.2	67	
9			2.412		0.90	13.90	150.5	15.1		
D09 7	6.02	5.67	2.421	2.449	1.14	12.84	151.1	28.8	63	
8			2.421		1.14	12.84	151.1	41.0	71	
9			2.426		0.94	12.66	151.4	28.7		
D10 7	2.67	2.60	2.313	2.435	5.01	14.01	144.3	49.2	107	
8			2.301		5.50	14.46	143.6	49.6		
9			2.300		5.54	14.50	143.5	52.5	75	
D11 7	2.90	2.82	2.326	2.556	9.00	13.69	145.1	49.3	105	B-8
8			2.331		8.88	13.51	145.5	53.1	121	
9			2.323		9.12	13.80	145.0	42.5	91	
D12 7	4.24	4.07	2.388	2.520	5.24	12.53	140.0	52.6	142	
8			2.398		4.84	12.16	149.6	55.2	128	
9			2.405		4.56	11.91	150.1	51.7	145	
D13 7	4.91	4.68	2.433	2.489	2.25	11.45	151.8	32.6	80	
8			2.435		2.17	11.38	151.9	38.5	108	
9			2.439		2.01	11.23	152.2	35.3	89	
D14 7	6.03	5.69	2.436	2.451	0.61	12.28	152.0	4.9[a]	88	
8			2.437		0.57	12.24	152.1	5.3[a]	75	
9			2.436		0.61	12.28	152.0	12.8	78	
D15 7	6.92	6.47	2.419	2.420	0.04	13.61	150.9	0.5[a]	77	
8			2.419		0.04	13.61	150.9	0.0[a]	62	
9			2.429		0.00	13.26	151.6	4.7[a]	96	
D16 7	6.02	5.67	2.437	2.445	0.33	12.39	152.1	4.2[a]	100	B-30
8			2.435		0.41	12.46	151.9	2.7[a]	87	
9			2.434		0.45	12.50	151.9	1.0[a]	71	
D17 7	4.01	3.85	2.424	2.507	3.31	11.18	151.3	47.1	125	
8			2.398		4.35	12.13	149.6	58.1	127	
9			2.407		4.00	11.80	150.2	57.5	160	
D18 7	4.90	4.67	2.442	2.489	1.89	11.28	152.4	27.3	98	
8			2.440		1.97	11.36	152.3	26.1	120	
9			2.432		2.29	11.64	151.8	41.5	105	
D19 7	2.90	2.82	2.330	2.559	8.95	13.71	145.4	57.1	109	
8			2.329		8.99	13.74	145.3	61.3	137	
9			2.328		9.03	13.78	145.3	59.8	133	
D20 7	6.91	6.46	2.423	2.432	0.37	13.62	151.2	0.0[a]	93	
8			2.418		0.58	13.80	150.9	1.7[a]	72	
9			2.414		0.74	13.95	150.6	2.8[a]	71	
D21 7	2.91	2.82	2.383	2.557	6.81	11.95	148.7	58.7	178	A-30L
8			2.392		6.45	11.61	149.3	58.3	89	
9			2.392		6.45	11.61	149.3	52.5	125	
D22 7	4.92	4.69	2.449	2.485	1.45	11.25	152.8	24.2	133	
8			2.459		1.05	10.89	153.4	30.3	108	
9			2.454		1.25	11.07	153.1	30.0	98	

[a] Extrapolated stability values (from log P_v - log P_h plots).

Bituminous mix design data by Hveem method — Series D, continued.

Specimen No.	% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Hveem stability	Cohesiometer value	Gradation
D23 7	6.04	5.70	2.437	2.446	0.37	12.62	152.1	19.3	90	A-30L
8			2.444		0.08	12.37	152.5	20.9	108	
9			2.437		0.37	12.62	152.1	20.1	73	
D24 7	4.03	3.87	2.440	2.494	2.16	10.82	152.3	34.5	124	
8			2.442		2.08	10.74	152.4	37.8	120	
9			2.439		2.61	11.22	151.6	47.7	150	
D25 7	6.94	6.49	2.429	2.422	0.00	13.64	151.6	7.3[a]	84	
8			2.439		0.00	13.28	152.2	9.6	105	
9			2.440		0.00	13.24	152.3	20.4	126	
D26 7	4.90	4.67	2.398	2.506	4.31	12.98	149.6	48.9	116	C-100
8			2.405		4.03	12.73	150.1	44.7	85	
9			2.403		4.11	12.80	149.9	39.4	82	
D27 7	4.01	3.85	2.355	2.529	6.89	13.80	147.0	65.3	146	
8			2.356		6.84	13.77	147.0	65.1	135	
9			2.365		6.48	13.44	147.6	64.9	145	
D28 7	6.91	6.46	2.403	2.431	1.15	14.44	149.9	0.0[a]	81	
8			2.401		1.23	14.51	149.8	0.0[a]	89	
9			2.399		1.32	14.58	149.7	0.8[a]	32	
D29 7	6.02	5.67	2.421	2.444	0.94	13.07	151.1	1.7[a]	101	
8			2.419		1.02	13.14	190.9	7.2[a]	89	
9			2.420		0.98	13.10	151.0	3.6[a]	76	
D31 7	4.03	3.87	2.467	2.513	1.83	9.72	153.9	39.8	118	A-8LH
8			2.473		1.59	9.50	154.3	29.3	121	
9			2.471		1.67	9.58	154.2	21.4	136	
D32 7	6.04	5.70	2.466	2.429	0.00	11.34	153.9	50.9	103	
8			2.460		0.00	11.56	153.5	33.0	113	
9			2.461		0.00	11.52	153.6	24.1	100	
D33 7	6.94	6.49	2.454	2.371	0.00	12.52	153.1	20.2	81	
8			2.452		0.00	12.59	153.3	9.5	92	
9			2.441		0.00	12.98	152.3	7.6	66	
D34 7	2.91	2.83	2.431	2.552	4.74	9.94	151.7	47.8	146	
8			2.429		4.82	10.02	151.6	47.3	113	
9			2.436		4.54	9.76	152.0	43.6	123	
D35 7	4.92	4.86	2.450	2.503	2.12	11.14	152.9	41.1	117	
8			2.462		1.64	10.70	153.6	44.0	118	
9			2.465		1.52	10.59	153.8	33.5	128	
D41 7	6.92	6.47	2.425	2.429	0.16	13.53	151.3	3.8[a]	75	C-P
8			2.423		0.25	13.60	151.2	2.1[a]	93	
9			2.425		0.16	13.53	151.3	2.6[a]		
D42 7	6.03	5.69	2.438	2.446	0.33	12.34	152.1	4.1[a]	79	
8			2.426		0.82	12.77	151.4	3.4[a]	46	
9			2.426		0.82	12.77	151.4	2.6[a]	85	
D43 7	4.02	3.86	2.416	2.504	3.51	11.45	150.8	42.6	114	
8			2.408		3.83	11.74	150.3	44.0	107	
9			2.408		3.83	11.74	150.3	47.3	119	
D44 7	2.90	2.82	2.300	2.569	10.47	14.79	143.5	60.3	73	
8			2.314		9.93	14.27	144.4	55.6	110	
9			2.300		10.47	14.79	143.5	56.8	97	
D45 7	4.91	4.68	2.423	2.493	2.81	11.95	151.2	44.8	142	
8			2.427		2.65	11.80	151.4	38.6	122	
9			2.428		2.61	11.77	151.5	45.8	97	
D46 7	6.92	6.47	2.435	2.426	0.00	13.54	151.9	14.0	57	B-30L
8			2.430		0.00	13.71	151.6	8.7[a]	69	
9			2.428		0.00	13.78	151.5	5.5	50	
D47 7	4.02	3.86	2.437	2.504	2.68	11.05	152.1	42.5	72	
8			2.423		3.24	11.56	151.2	40.4	95	
9			2.423		3.24	11.56	151.2	41.4	87	
D48 7	5.58	5.29	2.420	2.492	2.89	12.98	151.0	41.7	70	
8			2.449		1.73	11.94	152.8	42.0	68	
9			2.436		2.25	12.41	152.0	42.4	88	
D49 7	6.03	5.69	2.429	2.437	0.33	13.03	151.6	27.3	64	
8			2.446		0.00	12.42	152.6	26.4	46	
9			2.437		0.00	12.74	152.1	28.1	69	
D50 7	3.80	3.66	2.362	2.531	6.68	13.61	147.4	52.1	114	
8			2.394		5.41	12.44	149.4	41.3	125	
9			2.364		6.60	13.54	147.5	54.7	161	

Bituminous mix design data by Hveem method — Series D, continued.

Specimen No.	% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Hveem stability	Cohesiometer value	Gradation
D51 7	5.15	4.90	2.453	2.479	1.05	11.10	153.1	12.1	134	C-8L
8			2.456		0.93	10.99	153.2	27.6	112	
9			2.453		1.05	11.10	153.1	30.5	99	
D52 7	4.03	3.86	2.420	2.548	5.02	11.33	151.0	45.5	128	
8			2.411		5.38	11.66	150.4	54.1	156	
9			2.411		5.38	11.66	150.4	52.5	123	
D54 7	6.04	5.70	2.435	2.462	1.10	12.49	151.9	2.0[a]	93	
8			2.437		1.02	12.42	152.1	1.3[a]	94	
9			2.435		1.10	12.49	151.9	2.6[a]	90	
D55 7	6.94	6.49	2.399	2.424	1.03	14.51	149.7	—	—	
8			2.401		0.95	14.44	149.8	—	—	
9			2.402		0.91	14.40	149.9	—	—	
D56 7	3.80	3.67	2.438	2.536	3.86	10.46	152.1	25.5	102	A-4H
8			2.440		3.78	10.39	152.3	38.6	195	
9			2.441		3.75	10.35	152.3	32.2	134	
D58 7	6.04	5.70	2.455	2.474	0.77	11.74	153.2	7.5[a]	65	
8			2.448		1.05	11.99	152.8	12.8	60	
9			2.454		0.81	11.78	153.1	11.6	74	
D59 7	4.92	4.68	2.456	2.488	1.29	10.75	153.3	18.1	105	
8			2.464		0.96	10.46	153.8	22.1	153	
9			2.462		1.05	10.53	153.6	20.1	104	
D60 7	3.27	3.18	2.389	2.560	6.68	11.82	149.1	47.5	186	
8			2.381		6.99	12.11	148.6	54.3	196	
9			2.380		7.03	12.15	148.5	51.3	108	
D61 7	2.91	2.83	2.384	2.595	8.13	11.69	148.8	59.8	166	A-4L
8			2.367		8.79	12.31	147.7	64.7	146	
9			2.381		8.25	11.80	148.6	56.5	188	
D62 7	6.04	5.70	2.467	2.483	0.64	11.31	153.9	10.2[a]	91	
8			2.455		1.13	11.74	153.2	4.6[a]	95	
9			2.463		0.81	11.45	153.7	7.0[a]	108	
D63 7	4.92	4.69	2.471	2.482	0.44	10.21	154.2	10.9	129	
8			2.479		0.12	9.92	154.7	14.5	132	
9			2.471		0.44	10.21	154.2	13.7	124	
D65 7	4.03	3.87	2.470	2.502	1.28	9.48	154.1	22.0	140	
8			2.466		1.44	9.62	153.9	23.4	138	
9			2.466		1.44	9.62	153.9	23.3	131	
D66 7	4.08	3.42	2.441	2.543	4.02	10.02	152.3	55.6	181	A-8H
8			2.448		3.74	9.76	152.8	44.4	204	
9			2.449		3.70	9.72	152.8	39.9	137	
D67 7	4.91	4.68	2.454	2.518	2.54	10.72	153.1	15.1	112	
8			2.456		2.46	10.65	153.3	18.6	109	
9			2.463		2.18	10.39	153.7	20.3	122	
D69 7	6.03	5.68	2.450	2.453	0.12	11.80	152.9	8.3[a]	107	
8			2.458		0.00	11.51	153.4	11.8	68	
9			2.454		0.00	11.66	153.1	11.2	86	
D70 7	2.90	2.82	2.394	2.473	3.19	11.20	149.4	58.0	141	
8			2.398		3.03	11.05	149.6	58.0	95	
9			2.390		3.36	11.35	149.1	49.1	148	
D71 7	3.79	3.66	2.411	2.546	4.93	11.55	150.4	51.9	139	A-30LH
8			2.427		4.30	10.96	151.4	47.1	145	
9			2.440		3.79	10.48	152.3	45.5	114	
D72 7	5.82	5.50	2.453	2.467	0.57	11.73	153.1	6.2[a]	72	
8			2.460		0.28	11.47	153.5	8.0	77	
9			2.458		0.36	11.55	153.4	8.5	95	
D73 7	4.91	4.68	2.453	2.497	1.76	10.96	153.1	22.6	83	
8			2.458		1.56	10.78	153.4	18.9	79	
9			2.457		1.60	10.81	153.3	25.7	100	
D74 7	6.92	6.47	2.443	2.402	0.00	12.99	152.4	34.5	151	
8			2.428		0.00	13.52	151.5	6.6	84	
9			2.446		0.00	12.88	152.6	12.2	72	
D75 7	2.90	2.82	2.408	2.527	4.71	10.89	150.3	52.6	155	
8			2.440		3.44	9.70	152.3	43.8	118	
9			2.429		3.88	10.11	151.6	46.3	174	
D76 7	6.92	6.47	2.454	2.452	0.00	12.50	153.1	14.0	100	A-P
8			2.450		0.08	12.64	152.8	12.5	95	
9			2.453		0.00	12.53	153.1	15.7	115	

Bituminous mix design data by Hveem method — Series D, continued.

Specimen No.	% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Hveem stability	Cohesiometer value	Gradation
D77 7	3.80	3.66	2.464	2.498	1.36	9.50	153.7	31.0	158	A-P
8			2.470		1.12	9.28	154.1	18.8	143	
9			2.466		1.28	9.43	153.9	18.1	94	
D78 7	4.91	4.68	2.449	2.474	1.01	11.00	152.8	37.0	170	
8			2.452		0.89	10.89	153.0	30.3	98	
9			2.456		0.73	10.75	153.3	34.8	122	
D79 7	6.03	5.69	2.455	2.452	0.00	11.73	153.2	15.8	119	
8			2.463		0.00	11.44	153.7	13.9	99	
9			2.450		0.08	11.91	152.9	11.1	132	
D80 7	2.90	2.82	2.423	2.519	3.81	10.23	151.2	47.7	148	
8			2.441		3.10	9.56	152.3	47.2	180	
9			2.424		3.37	9.82	151.9	47.4	145	
D81 7	2.90	2.82	2.345	2.581	9.14	13.09	146.3	67.3	137	A-30
8			2.362		8.49	12.46	147.4	63.6	153	
9			2.370		8.18	12.16	147.9	67.7	142	
D82 7	6.92	6.47	2.430	2.441	0.45	13.32	151.6	–	70	
8			2.433		0.33	13.21	151.8	–	66	
9			2.438		0.12	13.03	152.1	–	71	
D83 7	4.02	3.86	2.451	2.501	2.00	10.13	152.9	30.8	155	
8			2.459		1.68	9.84	153.4	39.0	135	
9			2.452		1.96	10.09	153.0	41.7	125	
D84 7	4.69	4.48	2.455	2.480	1.01	10.56	153.2	17.6	58	
8			2.496		0.00	9.07	155.8	16.1	92	
9			2.453		1.09	10.64	153.1	15.6	97	
D85 7	5.82	5.50	2.421	2.471	2.02	12.74	151.1	–	84	
8			2.437		1.38	12.17	152.1	–	37	
9			2.448		0.93	11.77	152.8	–	57	

Appendix J-1. Bituminous mix design data by Marshall method — Series F.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb.[a] Meas.	Stability, lb.[a] Adj.	Flow, in. (× 0.01)	Gradation
F01	1	6.04	5.70	2.428	2.477	1.98	12.51	151.5	1900	1900	13	A-4
	2			2.427		2.02	12.55	151.4	2100	2050	15	
	3			2.431		1.86	12.40	151.7	1800	1800	15	
	4			2.416		2.46	12.94	150.8	2000	1900	13	
	5			2.413		2.58	13.05	150.6	1950	1900	12	
	6			2.420		2.30	12.80	151.0		210.4		
F02	1	3.80	3.66	2.374	2.544	6.68	12.61	148.1	2000	1950	9	
	2			2.349		7.67	13.53	146.6	2150	2150	10	
	3			2.341		7.98	13.82	146.1	2250	2200	9	
	4			2.344		7.86	13.71	146.3	1900	1850	11	
	5			2.337		8.14	13.97	145.8	1975	1900	12	
	6			2.339		8.06	13.89	146.0		232.8		
F03	1	2.91	2.83	2.319	2.570	9.77	13.89	144.7	2000	1800	8	
	2			2.321		9.69	13.82	144.8	2150	2150	9	
	3			2.318		9.81	13.93	144.6	2450	2400	8	
	4			2.284		11.13	15.19	142.5	1650	1600	8	
	5			2.291		10.86	14.93	143.0	2000	2000	8	
	6			2.295		10.70	14.79	143.2		197.5		
F04	1	6.71	6.29	2.430	2.471	1.66	12.99	151.6	1550	1550	19	
	2			2.445		1.05	12.45	152.6	1900	1950	16	
	3			2.439		1.30	12.66	152.2	1900	1900	16	
	4			2.451		0.81	12.23	152.9	1850	1900	17	
	5			2.447		0.97	12.38	152.7	1900	1900	17	
	6			2.428		1.74	13.06	151.5		–		
F05	1	4.92	4.69	2.429	2.496	2.68	11.54	151.6	1850	1850	11	
	2			2.423		2.92	11.76	151.2	2450	2500	12	
	3			2.433		2.52	11.39	151.8	2200	2200	11	
	4			2.415		3.25	12.05	150.7	1750	1800	10	
	5			2.411		3.41	12.19	150.4	2200	2250	14	
	6			2.419		3.08	11.90	150.9		248.5		
F06	1	3.13	3.04	2.355	2.581	8.76	13.21	147.0	2650	2500	9	A-4L
	2			2.322		10.03	14.43	144.9	1600	1600	8	
	3			2.338		9.42	13.84	145.9	2250	2250	9	
	4			2.380		7.79	12.29	148.5	2750	2950	10	
	5			2.334		9.57	13.99	145.6	1650	1700	9	
	6			2.334		9.57	13.99	145.6		225.0		
F07	1	6.04	5.70	2.445	2.466	0.85	12.37	152.6	1575	1650	22	
	2			2.437		1.18	12.65	152.1	1750	1700	20	
	3			2.446		0.81	12.33	152.6	1650	1650	17	
	4			2.442		0.97	12.47	152.4	1500	1500	18	
	5			2.451		0.61	12.15	152.9	1600	1600	18	
	6			2.449		0.69	12.22	152.8		188.1		
F08	1	4.92	4.69	2.455	2.501	1.84	11.07	153.2	1800	1850	17	
	2			2.419		3.28	12.37	150.9	1800	1850	16	
	3			2.425		3.04	12.15	151.3	1600	1550	14	
	4			2.415		3.44	12.51	150.7	1725	1700	16	
	5			2.413		3.52	12.59	150.6	1500	1400	14	
	6			2.428		2.92	12.04	151.5		221.9		
F09	1	6.94	6.49	2.430	2.448	0.74	13.63	151.6	1450	1500	24	
	2			2.431		0.69	13.60	151.7	1400	1450	30	
	3			2.435		0.53	13.46	151.9	1350	1400	26	
	4			2.449		0.00	12.96	152.8	1525	1550	26	
	5			2.445		0.12	13.10	152.6	1575	1650	25	
	6			2.445		0.12	13.10	152.6		155.3		
F10	1	4.25	4.08	2.417	2.543	4.95	11.88	150.8	1750	1700	12	
	2			2.406		5.39	12.28	150.1	2400	2250	14	
	3			2.414		5.07	11.99	150.6	2250	2300	12	
	4			2.399		5.66	12.54	149.7	2150	2250	12	
	5			2.407		5.35	12.25	150.2	2250	2300	11	
	6			2.414		5.07	11.99	150.6		316.3		
F11	1	4.03	3.87	2.400	2.522	4.84	12.51	149.8	2400	2350	9	A-8
	2			2.366		6.19	13.75	147.6	2275	2150	10	
	3			2.389		5.27	12.91	149.1	2700	2650	9	
	4			2.375		5.83	13.42	148.2	2600	2550	10	
	5			2.382		5.55	13.17	148.6	2600	2600	12	
	6			2.384		5.47	13.09	148.8		296.8		
F12	1	4.92	4.69	2.423	2.502	3.16	12.42	151.2	2350	2350	11	
	2			2.394		4.32	13.47	149.4	2225	2200	9	
	3			2.383		4.76	13.87	148.7	1800	1700	9	
	4			2.407		3.80	13.00	150.2	2375	2375	10	
	5			2.392		4.40	13.55	149.3	2300	2250	13	
	6			2.389		4.52	13.65	149.1		266.0		

[a] Indirect tensile strength, psi, for specimen No. 6 in each batch.

Bituminous mix design data by Marshall method — Series F, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb, Meas.	Stability, lb, Adj.	Flow, in. (× 0.01)	Gradation
F13	1	6.94	6.49	2.423	2.448	1.02	14.08	151.2	1600	1650	18	A-8
	2			2.431		0.69	13.79	151.7	1725	1725	16	
	3			2.432		0.65	13.76	151.8	1850	1900	15	
	4			2.426		0.90	13.97	151.4	1550	1550	16	
	5			2.441		0.29	13.44	152.3	1600	1650	16	
	6			2.449		0.00	13.16	152.8		188.6		
F14	1	3.13	3.04	2.299	2.540	9.49	15.47	143.5	1700	1600	9	
	2			2.320		8.66	14.70	144.8	1850	1900	9	
	3			2.289		9.88	15.84	142.8	1650	1650	8	
	4			2.315		8.86	14.88	144.5	1900	1950	11	
	5			2.313		8.94	14.95	144.3	1975	1975	11	
	6			—		—	—	—		—		
F15	1	6.04	5.70	2.428	2.474	1.86	13.17	151.5	1550	1600	16	
	2			2.430		1.78	13.10	151.6	2050	2100	14	
	3			2.434		1.62	12.96	151.9	2050	2100	15	
	4			2.438		1.46	12.82	152.1	2075	2075	14	
	5			2.443		1.25	12.64	152.4	1750	1800	14	
	6			2.423		2.06	13.35	151.2		303.1		
F16	1	6.94	6.49	2.424	2.443	0.78	14.24	151.3	1425	1500	34	A-8L
	2			2.455		0.00	13.14	153.2	1425	1475	20	
	3			2.452		0.00	13.25	153.0	1750	1750	22	
	4			2.449		0.00	13.35	152.8	1425	1500	22	
	5			2.448		0.00	13.39	152.8	1300	1300	23	
	6			2.437		0.25	13.78	152.1		158.5		
F17	1	4.90	4.69	2.456	2.493	1.48	11.43	153.3	1700	1750	18	
	2			2.460		1.32	11.29	153.5	1600	1550	12	
	3			2.455		1.52	11.47	153.2	1925	1850	15	
	4			2.452		1.64	11.58	153.0	1750	1700	14	
	5			2.421		2.89	12.70	151.1	1400	1350	17	
	6			2.449		1.76	11.69	152.8		228.5		
F18	1	2.91	2.83	2.340	2.566	8.81	13.97	146.0	2225	2100	9	
	2			2.324		9.43	14.56	145.0	2100	2000	9	
	3			2.311		9.94	15.04	144.2	2000	1900	11	
	4			2.298		10.44	15.51	143.4	1600	1400	9	
	5			2.295		10.56	15.62	143.2	1500	1350	9	
	6			2.303		10.25	15.33	143.7		191.9		
F19	1	4.03	3.87	2.419	2.556	5.36	12.01	150.9	2225	2200	10	
	2			2.379		6.93	13.47	148.4	2350	2200	11	
	3			2.387		6.61	13.18	148.9	2600	2500	12	
	4			2.372		7.20	13.73	148.0	2350	2250	11	
	5			2.382		6.81	13.36	148.6	2425	2250	10	
	6			2.363		7.55	14.05	147.5		232.5		
F20	1	6.04	5.70	2.457	2.465	0.33	12.34	153.3	1450	1500	21	
	2			2.463		0.08	12.12	153.7	1700	1800	18	
	3			2.441		0.97	12.91	152.3	1625	1725	17	
	4			2.435		1.22	13.12	151.9	1650	1700	18	
	5			2.460		0.20	12.23	153.5	1625	1700	17	
	6			2.446		0.77	12.73	152.6		207.6		
F21	1	2.90	2.82	2.317	2.585	10.37	14.42	144.6	1700	1550	8	A-30
	2			2.308		10.72	14.75	144.0	1600	1650	7	
	3			2.321		10.21	14.27	144.8	2275	2350	9	
	4			2.306		10.79	14.82	143.9	1700	1750	8	
	5			2.298		11.10	15.12	143.4	2150	2200	11	
	6			2.307		10.75	14.79	144.0		227.7		
F22	1	6.92	6.47	2.423	2.459	1.46	13.86	151.2	1350	1400	24	
	2			2.434		1.02	13.47	151.9	1650	1650	20	
	3			2.434		1.02	13.47	151.9	1650	1650	20	
	4			2.436		0.94	13.40	152.0	1600	1550	20	
	5			2.433		1.06	13.51	151.8	1600	1600	20	
	6			2.452		0.29	12.83	153.0		198.7		
F23	1	4.24	4.07	2.378	2.527	5.90	13.30	148.4	2350	2250	9	
	2			2.372		6.13	13.51	148.0	2150	2200	9	
	3			2.383		5.70	13.11	148.7	2050	2100	8	
	4			2.367		6.33	13.70	147.7	2200	2250	10	
	5			2.366		6.37	13.73	147.6	1875	1900	8	
	6			2.370		6.21	13.59	147.9		276.1		
F24	1	4.91	4.68	2.414	2.505	3.63	12.54	150.6	2325	2300	11	
	2			2.430		2.99	11.96	151.6	2600	2650	13	
	3			2.439		2.64	11.64	152.2	2550	2650	12	
	4			2.433		2.87	11.85	151.8	2600	2700	12	
	5			2.427		3.11	12.07	151.4	2600	2650	12	
	6			2.418		3.47	12.40	150.9		290.1		

Bituminous mix design data by Marshall method — Series F, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb, Meas.	Stability, lb, Adj.	Flow, in, (× 0.01)	Gradation
F25	1	6.03	5.68	2.433	2.480	1.90	12.78	151.8	1725	1650	16	A-30
	2			2.437		1.73	12.64	152.1	2025	2000	15	
	3			2.438		1.69	12.60	152.1	2100	2050	17	
	4			2.441		1.57	12.49	152.3	2000	1950	16	
	5			2.449		1.25	12.21	152.8	2200	2100	16	
	6			2.446		1.37	12.31	152.6		205.7		
F26	1	4.92	4.69	2.417	2.505	3.51	12.28	150.8	2400	2400	14	A-30L
	2			2.397		4.31	13.00	149.6	2250	2150	11	
	3			2.401		4.15	12.86	149.8	2350	2350	13	
	4			2.391		4.55	13.22	149.2	2375	2275	13	
	5			2.380		4.99	13.62	148.5	2300	2200	15	
	6			2.380		4.99	13.62	141.3		244.5		
F27	1	2.91	2.83	2.317	2.574	9.98	14.26	144.6	2450	2250	8	
	2			2.278		11.50	15.71	142.1	1950	1800	9	
	3			2.278		11.50	15.71	142.1	1900	1800	9	
	4			2.273		11.69	15.89	141.8	2000	1800	8	
	5			2.270		11.81	16.00	141.6	1500	1400	10	
	6			2.264		12.04	16.23	141.3		167.3		
F28	1	6.94	6.49	2.424	2.444	0.82	13.68	151.3	1475	1450	18	
	2			2.422		0.90	13.75	151.1	1825	1800	13	
	3			2.412		1.31	14.11	150.5	2000	1950	15	
	4			2.406		1.56	14.32	150.1	1725	1700	11	
	5			2.403		1.68	14.43	149.9	1775	1750	12	
	6			2.409		1.43	14.22	150.3		203.9		
F29	1	6.04	5.70	2.414	2.448	1.39	13.31	150.6	1525	1475	12	
	2			2.405		1.76	13.64	150.1	1600	1550	12	
	3			2.388		2.45	14.25	149.0	1700	1650	12	
	4			2.409		1.59	13.49	150.3	1600	1550	12	
	5			2.392		2.29	14.10	149.3	1550	1450	11	
	6			2.388		2.45	14.25	149.0		213.2		
F30	1	4.03	3.87	2.319	2.526	8.20	15.11	144.7	1825	1650	10	
	2			2.268		10.21	16.98	142.6	1350	1250	11	
	3			2.308		8.63	15.51	144.0	1700	1650	10	
	4			2.317		8.27	15.18	144.6	1650	1600	11	
	5			2.315		8.35	15.26	144.5	1500	1450	12	
	6			2.306		8.71	15.58	143.9		202.8		
F31	1	2.91	2.83	2.302	2.590	11.12	15.34	143.6	1550	1400	7	A-100
	2			2.310		10.81	15.04	144.1	1275	1275	8	
	3			2.319		10.46	14.71	144.7	1600	1600	7	
	4			2.312		10.73	14.97	144.3	1750	1800	7	
	5			2.275		12.16	16.33	142.0	1500	1450	9	
	6			2.285		11.78	15.96	142.6		148.0		
F32	1	4.03	3.87	2.377	2.539	6.38	13.51	148.3	2125	2100	9	
	2			2.330		8.23	15.22	145.4	2075	2000	8	
	3			2.345		7.64	14.68	146.3	2250	2150	7	
	4			2.316		8.78	15.73	144.5	1650	1600	8	
	5			2.331		8.19	15.19	145.5	2050	2000	10	
	6			2.328		8.31	15.30	145.3		218.7		
F33	1	6.04	5.70	2.428	2.482	2.18	13.34	151.5	1975	1975	14	
	2			2.411		2.86	13.95	150.4	2175	2150	14	
	3			2.415		2.70	13.80	150.3	1975	1925	14	
	4			2.396		3.47	14.48	149.5	1750	1700	17	
	5			2.416		2.66	13.77	150.8	2100	2050	14	
	6			2.418		2.58	13.70	150.9		220.1		
F34	1	6.94	6.49	2.416	2.448	1.31	14.49	150.8	1400	1450	20	
	2			2.434		0.58	13.85	151.9	1400	1450	20	
	3			2.434		0.57	13.85	151.9	1925	2000	18	
	4			2.436		0.49	13.78	152.0	1750	1850	19	
	5			2.431		0.69	13.96	151.7	1800	1850	20	
	6			2.434		0.57	13.85	151.9		173.4		
F35	1	4.92	4.69	2.410	2.506	3.83	13.06	150.4	2250	2200	13	
	2			2.405		4.03	13.24	150.1	2150	2100	11	
	3			2.390		4.63	13.78	149.1	1950	1950	12	
	4			2.394		4.47	13.64	149.4	1850	1800	12	
	5			2.378		5.11	14.21	148.4	1800	1700	13	
	6			2.393		4.51	13.67	149.3		204.4		
F36	1	6.24	5.87	2.407	2.471	2.59	13.75	150.2	1650	1600	9	A-100L
	2			2.364		4.33	15.29	147.5	1700	1650	10	
	3			2.349		4.94	15.83	146.6	1300	1200	11	
	4			2.368		4.17	15.15	147.8	1450	1400	12	
	5			2.343		5.18	16.05	146.2	1500	1350	12	
	6			2.343		5.18	16.05	146.2		207.1		

Bituminous mix design data by Marshall method — Series F, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb, Meas.	Stability, lb, Adj.	Flow, in. (X 0.01)	Gradation
F37	1	4.92	4.69	2.366	2.559	7.54	14.17	147.6	1725	1650	9	A-100L
	2			2.379		7.03	13.70	148.4	1650	1650	9	
	3			2.372		7.31	13.96	148.0	1675	1650	10	
	4			2.360		7.78	14.39	147.3	1500	1500	11	
	5			2.347		8.28	14.86	146.5	1350	1300	10	
	6			2.387		6.72	13.41	148.9		239.6		
F38	1	3.13	3.04	2.295	2.497	8.09	15.29	143.2	1900	1750	8	
	2			2.300		7.89	15.11	143.5	1600	1600	7	
	3			2.313		7.37	14.63	144.3	2025	2075	8	
	4			2.288		8.37	15.55	142.8	1700	1750	10	
	5			2.311		7.45	14.70	144.2	1650	1650	10	
	6			2.307		7.61	14.85	144.0		219.6		
F39	1	6.94	6.49	2.420	2.484	0.33	13.86	157.0	1575	1575	14	
	2			2.399		1.19	14.61	149.7	1450	1450	13	
	3			2.417		0.45	13.97	150.8	1700	1750	13	
	4			2.415		0.54	14.04	150.7	1500	1550	13	
	5			2.412		0.66	14.14	150.5	1350	1400	14	
	6			2.417		0.45	13.97	150.8		209.0		
F40	1	4.03	3.87	2.336	2.531	7.70	14.52	145.8	1650	1550	10	
	2			2.325		8.14	14.92	145.1	1700	1650	10	
	3			2.334		7.78	14.59	145.6	1675	1625	10	
	4			2.321		8.30	15.07	144.8	1500	1450	10	
	5			2.314		8.57	15.32	144.4	1500	1450	10	
	6			2.314		8.57	15.32	144.4		196.5		
F41	1	2.91	2.83	2.200	2.546	13.59	17.24	137.3	1400	1250	6	Natural gradation
	2			2.207		13.32	16.98	137.7	1175	1225	6	
	3			2.201		13.55	17.20	137.3	1200	1300	6	
	4			2.184		14.21	17.84	136.3	800	800	7	
	5			2.188		14.06	17.69	136.5	800	800	7	
	6			2.204		13.43	17.09	137.5		130.0		
F42	1	4.03	3.87	2.181	2.500	12.76	18.83	136.1	750	660	6	
	2			2.183		12.68	18.76	136.2	800	850	5	
	3			2.193		12.28	18.38	136.8	800	850	5	
	4			2.174		13.04	19.09	135.7	600	650	7	
	5			2.181		12.76	18.83	136.1	650	650	7	
	6			2.164		13.44	19.46	135.0		158.4		
F43	1	4.92	4.69	2.217	2.488	10.89	18.20	138.3	750	650	6	
	2			2.227		10.49	17.83	139.0	1000	1050	6	
	3			2.212		11.09	18.38	138.0	925	900	6	
	4			2.232		10.29	17.64	139.3	800	850	7	
	5			2.239		10.01	17.38	139.7	750	800	7	
	6			2.239		10.01	17.38	139.7		201.3		
F44	1	6.04	5.70	2.312	2.438	5.17	15.59	144.3	1050	1000	6	
	2			2.301		5.62	16.00	143.6	1350	1300	7	
	3			2.297		5.78	16.14	143.3	1125	1125	7	
	4			2.288		6.15	16.47	142.8	950	900	7	
	5			2.291		6.03	16.36	143.0	1000	950	7	
	6			2.291		6.03	16.36	143.0		225.9		
F45	1	6.94	6.49	2.296	2.419	5.09	16.88	143.3	900	850	7	
	2			2.291		5.29	17.06	143.0	1100	1100	6	
	3			2.278		5.83	17.53	142.1	1125	1100	6	
	4			2.293		5.21	16.99	143.1	1000	950	7	
	5			2.297		5.04	16.84	143.3	800	850	7	
	6			2.291		5.29	17.06	143.0		219.6		
F46	1	7.16	6.68	2.300	2.440	5.74	18.91	143.5	1850	1758	7	B-B
	2			2.305		5.53	18.74	143.8	2100	2100	8	
	3			2.282		6.48	19.55	142.4		–	–	
	4			2.288		6.23	19.34	142.8		–	–	
	5			2.274		6.80	19.83	141.9		–	–	
	6			2.271		6.93	19.94	141.7		–		
F47	1	6.04	5.70	2.268	2.456	7.66	19.20	141.5	1800	1674	8	
	2			2.260		7.98	19.49	141.0	1900	1881	9	
	3			2.237		8.92	20.31	139.6		–	–	
	4			2.258		8.06	19.56	140.9		–	–	
	5			2.253		8.26	19.74	140.6		–	–	
	6			2.224		9.45	20.77	138.8		–		
F48	1	4.92	4.69	2.249	2.488	9.61	19.02	140.3	1600	1472	8	
	2			2.224		10.61	19.92	138.8	1850	1850	8	
	3			2.213		11.05	20.32	138.1		–	–	
	4			2.217		10.89	20.17	138.3		–	–	
	5			2.332		10.29	19.63	139.3		–	–	
	6			2.239		10.01	19.38	139.7		187.6		

Bituminous mix design data by Marshall method — Series F, continued.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Stability, lb, Meas.	Stability, lb, Adj.	Flow, in. (× 0.01)	Gradation
F49	1	4.03	3.87	2.238	2.462	9.10	18.72	139.7	1950	1775	7	B-B
	2			2.243		8.90	18.54	140.0	1550	1597	7	
	3			2.237		9.14	18.76	139.6		—	—	
	4			2.225		9.63	19.20	138.8		—	—	
	5			2.245		8.81	18.47	140.1		—	—	
	6			2.229		9.46	19.05	139.1		153.2		
F51	1	4.92	4.69	2.426	2.537	4.38	12.15	151.4	2350	2350	10	A-P
	2			2.410		5.01	12.73	150.4	2700	2646	10	
	3			2.392		5.72	13.38	149.3	2600	2522	11	
	4			2.403		5.28	12.98	149.9	2150	2100	10	
	5			2.397		5.52		149.8	2500	2450	9	
	6			2.394		5.64	13.31	149.4		278.9		
F52	1	6.94	6.49	2.428	2.457	1.18	13.74	151.5	1600	1648	21	
	2			2.458		0.00	12.67	153.4	2150	2150	15	
	3			2.449		0.33	12.992	152.8	2250	2295	15	
	4			2.430		1.10	13.67	151.6	1650	1600	21	
	5			2.436		0.86	13.45	152.0	1800	1800	16	
	6			2.433		0.98	13.56	151.8		182.4		
F53	1	6.04	5.70	2.428	2.470	1.70	13.01	151.5	1700	1700	16	
	2			2.437		1.34	12.69	152.1	1850	1850	15	
	3			2.431		1.58	12.90	151.7	1950	1930	12	
	4			2.435		1.42	12.69	151.9	1900	1850	15	
	5			2.430		1.62	12.94	151.6	1950	1900	19	
	6			2.432		1.54	12.87	151.8		198.8		
F54	1	4.03	3.87	2.416	2.520	4.13	11.76	150.8	2400	2400	10	
	2			2.393		5.04	12.60	149.3	2700	2610	10	
	3			2.406		4.52	12.12	150.1	2750	2750	9	
	4			2.385		5.36	12.89	148.8	2650	2550	10	
	5			2.404		4.60	12.20	150.0	2650	2650	10	
	6			2.412		4.29	11.90	150.5		293.6		
F55	1	2.91	2.83	2.342	2.564	8.68	13.54	146.1	2300	2231	8	
	2			2.320		9.52	14.35	144.8	1700	1598	11	
	3			2.327		9.24	14.10	145.2	2650	2571	9	
	4			2.316		9.67	14.50	144.5	1850	1750	8	
	5			2.334		8.97	13.83	145.6	2500	2500	9	
	6			2.312		9.83	14.64	144.3		226.7		

Appendix J-2. Bituminous mix design data by Hveem method — Series F.

Specimen No.		% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Hveem stability	Cohesiometer value	Gradation
F01	7	6.04	5.70	2.462	2.477	0.61	11.29	153.6	16.3	69	A-4
	8			2.459		0.73	11.39	153.4	17.2	66	
	9			2.462		0.61	11.29	153.6	14.0	81	
F02	7	3.80	3.66	2.394	2.544	5.90	11.87	149.4	50.1	108	
	8			2.400		5.66	11.65	149.8	53.2	99	
	9			2.385		6.25	12.20	148.8	55.2	92	
F03	7	2.91	2.83	2.339	2.570	8.99	13.15	146.0	45.6	105	
	8			2.353		8.44	12.63	146.8	50.5	115	
	9			2.342		8.87	13.04	146.1	58.7	85	
F04	7	6.71	6.29	2.453	2.471	0.73	12.16	153.1	4.0[a]	65	
	8			2.457		0.57	12.02	153.3	6.2[a]	81	
	9			2.452		0.77	12.20	153.0	6.1[a]	61	
F05	7	4.92	4.69	2.458	2.496	1.52	10.48	153.4	30.2	108	
	8			2.453		1.72	10.66	153.1	37.1	111	
	9			2.463		1.32	10.30	153.7	27.8	84	
F06	7	3.13	3.04	2.386	2.581	7.56	12.07	148.9	40.0	123	A-4L
	8			2.384		7.63	12.14	148.8	33.6	87	
	9			2.378		7.87	12.36	148.4	50.7	72	
F07	7	6.04	5.70	2.459	2.466	0.28	11.86	153.4	9.9	97	
	8			2.455		0.45	12.01	153.2	13.7	82	
	9			2.459		0.28	11.86	153.4	9.4	84	
F08	7	4.92	4.69	2.456	2.501	1.80	11.03	153.3	29.2	87	
	8			2.455		1.84	11.07	153.2	16.6	95	
	9			2.462		1.56	10.81	153.6	17.5	141	
F09	7	6.94	6.49	2.457	2.448	0.00	12.67	153.3	—	56	
	8			2.453		0.00	12.82	153.1	—	33	
	9			2.447		0.04	13.03	152.7	—	—	
F10	7	4.25	4.08	2.445	2.543	3.85	10.86	152.6	45.0	138	
	8			2.437		4.17	11.15	152.1	41.7	108	
	9			2.434		4.29	11.26	151.9	36.0	78	
F11	7	4.03	3.87	2.393	2.522	5.12	12.76	149.3	58.4	153	A-8
	8			2.425		3.85	11.60	151.3	33.7	123	
	9			2.402		4.76	12.44	149.9	42.5	114	
F12	7	4.92	4.69	2.427	2.502	3.00	12.28	151.4	40.5	100	
	8			2.429		2.92	12.21	151.6	41.7	85	
	9			2.428		2.96	12.24	151.5	45.1	116	
F13	7	6.94	6.49	2.441	2.448	0.29	13.44	152.3	7.5[a]	137	
	8			2.442		0.25	13.40	152.4	6.6[a]	76	
	9			2.458		0.00	12.84	153.4	7.1[a]	113	
F14	7	3.13	3.04	2.375	2.540	6.50	12.67	148.2	43.6	109	
	8			2.362		7.00	13.15	147.4	50.2	105	
	9			2.364		6.93	13.08	147.5	41.8	69	
F15	7	6.04	5.70	2.443	2.474	1.25	12.64	152.4	9.3	79	
	8			2.431		1.74	13.07	151.7	12.0	108	
	9			2.434		1.62	12.96	151.9	12.4	130	
F16	7	6.94	6.49	2.450	2.443	0.00	13.32	152.9	—	40	A-8L
	8			2.446		0.00	13.46	152.6	—	60	
	9			2.444		0.00	13.53	152.5	—	74	
F17	7	4.90	4.69	2.465	2.493	1.12	11.11	153.8	8.9	101	
	8			2.448		1.80	11.72	152.8	14.2	132	
	9			2.470		0.92	10.93	154.1	13.0	110	
F18	7	2.91	2.83	2.369	2.566	7.68	12.90	147.8	37.8	113	
	8			2.379		7.29	12.54	148.4	41.3	107	
	9			2.364		7.87	13.09	147.5	45.6	152	
F19	7	4.03	3.87	2.425	2.556	5.13	11.80	151.3	42.4	142	
	8			2.415		5.52	12.16	150.7	33.0	145	
	9			2.430		4.93	11.62	151.6	37.1	68	
F20	7	6.04	5.70	2.459	2.465	0.24	12.27	152.6	8.0	88	
	8			2.457		0.33	12.34	153.3	9.3[a]	141	
	9			2.459		0.24	12.27	153.4	3.2[a]	58	
F21	7	2.90	2.82	2.349	2.585	9.13	13.24	146.6	49.7	106	A-30
	8			2.356		8.86	12.98	147.0	40.5	77	
	9			2.354		8.94	13.05	146.9	41.7	40	
F22	7	6.92	6.47	2.458	2.459	0.04	12.62	153.4	2.5[a]	76	
	8			2.431		1.14	13.58	151.7	—	82	
	9			2.454		0.20	12.76	153.1	3.0[a]	107	

[a] Extrapolated stability values (from log P_v - log P_h plots).

Bituminous mix design data by Hveem method — Series F, continued.

Specimen No.	% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Hveem stability	Cohesiometer value	Gradation
F23 7	4.24	4.07	2.412	2.527	4.55	12.06	150.5	30.2	78	A-30
8			2.421		4.20	11.73	151.1	26.3	64	
9			2.394		5.26	12.71	149.4	37.6	72	
F24 7	4.91	4.68	2.425	2.505	3.19	12.14	151.3	27.9	110	
8			2.428		3.07	12.04	151.5	29.7	113	
9			2.443		2.48	11.49	152.4	22.8	104	
F25 7	6.03	5.68	2.444	2.480	1.45	12.38	152.5	6.6[a]	123	
8			2.439		1.65	12.56	152.2	13.3	106	
9			2.452		1.13	12.10	153.0	12.4	149	
F26 7	4.92	4.69	2.409	2.505	3.83	12.57	150.3	19.0	75	A-30L
8			2.427		3.11	11.91	151.4	22.0	101	
9			2.414		3.63	12.38	150.6	25.5	73	
F27 7	2.91	2.83	2.306	2.574	10.41	14.67	143.9	42.9	49	
8			2.297		10.76	15.00	143.3	45.0	22	
9			2.321		9.83	14.12	144.8	43.7	42	
F28 7	6.94	6.49	2.445	2.444	0.00	12.94	152.6	13.6	88	
8			2.437		0.29	13.22	152.1	11.1	96	
9			2.430		0.57	13.47	151.6	12.0	73	
F29 7	6.04	5.70	2.436	2.448	0.49	12.52	152.0	12.8	96	
8			2.420		1.14	13.10	151.0	13.2	76	
9			2.431		0.69	12.70	151.7	13.4	99	
F30 7	4.03	3.87	2.396	2.526	5.15	12.29	149.5	39.5	113	
8			2.383		5.66	12.77	148.7	23.8	39	
9			2.366		6.33	13.39	147.6	20.2	32	
F31 7	2.91	2.83	2.309	2.590	10.85	15.08	144.1	46.4	68	A-100
8			2.334		9.88	14.16	145.6	49.9	94	
9			2.317		10.54	14.78	144.6	53.4	81	
F32 7	4.03	3.87	2.365	2.539	6.85	13.95	147.6	41.3	45	
8			2.336		8.00	15.00	145.8	49.4	67	
9			2.360		7.05	14.13	147.3	50.2	56	
F33 7	6.04	5.70	2.425	2.482	2.30	13.45	151.3	16.5	78	
8			2.428		2.18	13.34	151.5	17.1	129	
9			2.428		2.18	13.34	151.5	14.1	102	
F34 7	6.94	6.49	2.436	2.448	0.49	13.78	152.0	6.1	100	
8			2.432		0.65	13.92	151.8	2.5[a]	102	
9			2.436		0.49	13.78	152.0	3.9[a]	94	
F35 7	4.92	4.69	2.410	2.506	3.83	13.06	150.4	19.1	135	
8			2.419		3.47	12.74	150.9	22.8	100	
9			2.418		3.51	12.77	150.9	24.2	93	
F36 7	6.24	5.87	2.407	2.471	2.59	13.75	150.2	38.3	119	A-100L
8			2.411		2.43	13.61	150.5	45.9	143	
9			2.406		2.63	13.79	150.1	25.9	60	
F37 7	4.92	4.69	2.407	2.559	5.94	12.69	150.2	40.7	137	
8			2.414		5.67	12.43	150.6	45.1	143	
9			2.381		6.96	13.63	148.6	40.6	136	
F38 7	3.13	3.04	2.327	2.497	6.81	14.11	145.2	47.4	—	
8			2.339		6.33	13.67	146.0	47.7	104	
9			2.334		6.53	13.85	145.6	45.7	82	
F39 7	6.94	6.49	2.449	2.484	0.00	12.83	152.8	15.6	65	
8			2.474		0.00	11.94	154.4	26.0	91	
9			2.455		0.00	12.61	153.2	18.1	67	
F40 7	4.03	3.87	2.376	2.531	6.12	13.06	148.3	51.0	85	
8			2.378		6.05	12.98	148.4	48.8	113	
9			2.372		6.28	13.20	148.0	51.4	98	
F41 7	2.91	2.83	2.216	2.546	12.96	16.64	138.3	17.5	—	Natural gradation
8			2.256		11.39	15.13	140.8	21.5	77	
9			—		—	—	—	—	—	
F42 7	4.03	3.87	2.281	2.500	8.76	15.11	142.3	22.2	64	
8			2.308		7.65	14.11	144.0	28.7	86	
9			2.297		7.68	14.51	143.3	29.5	63	
F43 7	4.92	4.69	2.347	2.488	5.67	13.40	146.5	26.4	58	
8			2.340		5.95	13.66	146.0	24.0	65	
9			2.326		6.51	14.17	145.0	24.5	52	
F44 7	6.04	5.70	2.358	2.438	3.28	13.91	147.1	17.1	47	
8			2.353		3.49	14.10	146.8	19.4	55	
9			2.378		2.46	13.18	148.4	18.5	81	

Bituminous mix design data by Hveem method — Series F, continued.

Specimen No.	% AC by wt. agg. (W_a)	% AC by wt. mix (P_a)	Bulk sp. gr. (G_{mb})	Ave. Rice sp. gr. (G_{mm})	Air voids, V_v, %	VMA, %	Unit wt., pcf	Hveem stability	Cohesiometer value	Gradation
F45 7	6.94	6.49	2.373	2.419	1.90	14.09	148.1	16.7	50	Natural gradation
8			2.378		1.70	13.91	148.4	16.0	83	
9			2.382		1.53	13.77	148.6	12.9	76	
F46 7	7.16	6.68	2.338	2.440	4.18	17.57	145.9	–	–	B-B
8			2.355		3.48	16.97	147.0	–	–	
9			2.354		3.52	17.01	146.9	33.5	132	
F47 7	6.04	5.70	2.318	2.456	5.62	17.42	144.6	–	–	
8			2.320		5.54	17.35	144.8	–	–	
9			2.322		5.46	17.28	144.9	33.2	74	
F48 7	4.92	4.69	2.298	2.488	7.64	17.26	143.4	–	–	
8			2.306		7.32	16.97	143.9	–	–	
9			2.290		7.96	17.54	142.9	30.5	84	
F49 7	4.03	3.87	2.280	2.462	7.39	17.20	142.3	–	–	
8			2.285		7.19	17.02	142.6	–	–	
9			2.282		7.31	17.13	142.4	27.8	62	
F51 7	4.92	4.69	2.414	2.537	4.85	12.58	150.6	47.1	107	A-P
8			2.420		4.61	12.37	151.0	48.1	126	
9			2.416		4.77	12.51	150.8	41.3	115	
F52 7	6.94	6.49	2.463	2.457	0.00	12.49	153.7	16.7	98	
8			2.450		0.28	12.96	152.9	7.3	47	
9			2.468		0.00	12.32	154.0	9.0	53	
F53 7	6.04	5.70	2.454	2.470	0.65	12.08	153.1	9.7	96	
8			2.455		0.61	12.04	153.2	18.2	88	
9			2.455		0.61	12.04	153.2	17.8	91	
F54 7	4.03	3.87	2.416	2.520	4.13	11.76	150.8	45.0	163	
8			2.403		4.64	12.23	149.9	41.0	125	
9			2.419		4.01	11.65	150.9	44.3	127	
F55 7	2.91	2.83	2.351	2.564	8.31	13.20	146.7	58.0	79	
8			2.347		8.46	13.35	146.5	46.3	89	
9			2.352		8.27	13.17	146.8	48.8	89	

Appendix K. Mix Quality Evaluation Questionnaire

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DEPARTMENT OF CIVIL ENGINEERING

Although many studies and reports have been published on bituminous concrete mixture design, there seems to be no consensus on the relative importance or significance of the various mixture properties. Nor is there precise agreement on the interpretation of the criteria used in the conventional mixture design methods, especially in light of recent findings on fatigue, stiffness or modulus, and other material properties to be considered in the rational structural design of pavements.

In a current project concerned with evaluation of gap-graded asphalt concrete mixtures, we are attempting to make comparisons or "select the winners," as one of our colleagues from the Statistics Department phrased it, among some 400 asphalt mixes. In view of your recognized expertize and experience in this field, I am requesting your help in establishing, on the basis of "new" thinking, some consensus on the relative importance of properties traditionally considered in some of the "older" mixture design methods. In Table 1 I have synthesized 50 hypothetical mixtures with Marshall properties, and, in Table 2, 40 hypothetical mixtures with Hveem properties; these properties have been randomly selected as per our "corrupted" statistician friends' instructions (using dice). It will be greatly appreciated if you could, for both (or, if you wish, either) tables

(a) rate the mixtures, based on your personal judgement of overall quality, by assigning to each, one of the numbers 1, 2, ..., 10, 1 representing a very poor mixture and 10 a very good one. Please assign these numbers in such a way that 4 is assigned to a mixture which in your judgement would produce a surface meeting minimal acceptable standards, and 8 to a mixture which, in your view, would produce a surface quality as good as any you have actually observed in your experience. Please assume here that the mixtures are to be used as surface course for medium traffic (100 psi tire pressure) in Iowa and that the aggregate is crushed limestone with maximum size of 3/4 In. In addition, please note that the ratings are to be assigned without regard to economics, in that the better mixture will be assigned the higher number, regardless of its initial cost or workability. Please also ignore the fact that many values are not realistic and that, since there is definite physical relationship between air voids, VMA and voids filled, only two of the three voids properties should be considered at a time, depending upon your personal choice.

(b) rate the importance of the properties, on a scale from 0-4, 0 being assigned any property that you consider irrelevant, and 4 to any crucial property.

(c) indicate groups of properties that you feel might be considered jointly. In other words, if, among six properties, properties 1, 4 and 5, taken as a group, corresponded to something crucial in your view, you would indicate this by writing down (1, 4, 5). For the sake of completeness, write down here individual properties as well. Thus you might well write down, for example, (1, 2), (1, 4, 5), (1), (2), (3, 6), or, for that matter, (1, 2), (1, 4, 5), (3), where the latter would show that you feel property 1 by itself not to be indicative of quality and property 6 not relevant to quality, either in combination with the other properties or by itself.

Clearly there will be some overlap in your answers to (c) and to (b). (c) calls for a more detailed introspection which you may feel is not warranted, given the present state of the art, in which case you may wish to restrict your answers to (b) and ignore (c).

(d) please indicate as explicitly as you wish major considerations underlying your ratings of the mixtures.

I am also asking other prominent people in this field to do the same and hope the results of this survey, with your help, can make some contribution to the state-of-the-art of asphalt paving mixture design. If you are interested, I will make certain that the compiled and analyzed results are sent to you. I thank you for your time and patience, and am looking forward to your reply. Of course your contribution will be fully acknowledged.

Sincerely yours,

Dah-yinn Lee
Associate Professor
Department of Civil Engineering

Enclosures

P.S. Please note that we have enclosed a stamped self-addressed envelope for your use.

Table K-1. Mix Design Data by Marshall Method (50 blows).

Mix No.	Stability lb.	Flow 0.01"	Voids %	VMA %	Voids Filled %	Ave-Film Thickness, μ	Penetration of asphalt	Mixture rating
1	3000	16	1	14	90	5	100	
2	1000	5	1	10	90	15	60	
3	3000	12	3	18	70	15	100	
4	5000	12	1	10	90	10	100	
5	500	8	3	10	80	15	60	
6	5000	16	1	18	90	5	100	
7	1000	24	1	14	70	15	60	
8	500	24	4	18	90	10	100	
9	5000	8	3	10	70	15	60	
10	1000	16	2	14	90	10	60	
11	500	24	3	10	90	15	100	
12	5000	5	8	18	90	15	60	
13	1000	5	8	18	80	10	60	
14	3000	24	8	10	90	5	100	
15	3000	12	1	14	80	10	100	
16	3000	16	1	18	90	5	100	
17	5000	12	4	10	70	5	60	
18	3000	16	3	14	70	15	60	
19	1000	12	4	14	80	10	60	
20	3000	24	3	14	90	10	100	
21	1000	12	1	10	90	5	100	
22	400	12	8	10	90	5	100	
23	3000	16	1	14	90	15	60	
24	1000	5	2	14	70	10	60	
25	500	24	4	10	90	15	60	
26	5000	8	3	18	90	10	100	
27	5000	24	4	14	70	10	60	
28	500	16	3	10	70	5	100	
29	5000	8	8	10	70	15	100	
30	500	12	4	10	90	15	100	
31	500	5	1	18	90	5	100	
32	400	5	1	14	70	15	60	
33	3000	8	3	14	90	5	100	
34	500	24	1	18	80	15	100	
35	400	16	2	14	90	10	100	
36	500	16	4	10	70	10	100	
37	5000	16	8	10	90	5	60	
38	400	8	8	18	80	5	100	
39	400	24	3	10	80	15	60	
40	400	12	1	14	90	15	60	
41	500	5	4	10	80	10	60	
42	3000	8	2	14	90	10	100	
43	5000	12	4	14	90	5	60	

Table K-1. Continued.

Mix No.	Stability lb.	Flow 0.01"	Voids %	VMA %	Voids Filled %	Ave-Film Thickness, μ	Penetration of asphalt	Mixture rating
44	5000	24	1	18	90	10	60	
45	1000	24	8	18	90	5	100	
46	5000	5	2	18	90	5	100	
47	3000	16	3	18	90	10	100	
48	500	12	2	10	90	5	60	
49	1000	5	3	10	90	15	100	
50	500	12	8	18	80	15	60	
Property Importance Rating								

Table K-2. Mix design data by Hveem Method.

Mix No.	Stability	Cohesion	Voids %	Swell in.	Ave. Film Thickness μ	Penetration of asphalt	Mix Rating
1	65	40	4	0.03	5	60	
2	25	400	2	0.03	15	100	
3	65	100	8	0.01	15	60	
4	65	40	8	0.05	10	100	
5	25	40	3	0.05	10	60	
6	65	400	4	0.03	15	100	
7	45	400	4	0.03	10	100	
8	45	60	8	0.01	10	60	
9	45	100	2	0.03	10	100	
10	65	100	4	0.01	10	60	
11	65	40	8	0.01	15	60	
12	25	400	3	0.01	10	60	
13	45	60	8	0.05	15	60	
14	25	60	4	0.01	10	100	
15	45	400	2	0.03	5	100	
16	25	100	3	0.03	5	100	
17	45	100	4	0.03	10	60	
18	45	400	2	0.01	5	60	
19	25	400	4	0.03	10	100	
20	65	60	3	0.01	5	100	
21	25	60	4	0.05	15	100	
22	25	40	2	0.03	15	100	
23	65	60	4	0.05	10	100	
24	65	100	2	0.03	15	100	
25	45	40	3	0.01	5	100	
26	25	100	3	0.05	15	60	
27	65	400	2	0.05	5	60	
28	45	40	8	0.03	15	60	
29	65	400	4	0.03	15	60	
30	25	60	4	0.01	10	100	
31	45	400	4	0.01	10	60	
32	45	100	3	0.01	5	100	
33	65	60	8	0.05	10	100	
34	25	60	8	0.01	5	100	
35	45	100	3	0.01	5	60	
36	65	100	2	0.05	15	100	
37	45	60	8	0.03	15	60	
38	25	400	2	0.05	15	60	
39	45	100	4	0.03	5	100	
40	65	100	3	0.03	10	60	
Property Importance Rating							