DESIGN OF SLURRY SEAL

(A Modification of Test No. Calif. 355)

Scope

1. This method is intended for use in determining the total liquid content for proper workability and the optimum asphalt content for a slurry seal. This test method also furnishes an index of the slurry seal mixture's resistance to abrasion in the presence of water.

Apparatus

2. The apparatus shall consist of the following:

(a) Centrifuge, hand or power driven, capable of exerting a force of 400 times gravity (400 G) on a 100 g. sample.

$$\text{Required rpm of centrifuge head} = \sqrt{\frac{14{,}000{,}000}{r}}$$

Where:

r = radius in inches to center of gravity of sample.

(b) Centrifuge cups, 2 13/16 in. in height, 2 1/16 in. in diameter, complete with perforated brass plate 0.031 in. thick with minimum of 100 holes, 0.062 in. in diameter, per square inch.

(c) Balance, 500 g. capacity, accurate to 0.1 g.

(d) Drying oven or hot plate.

(e) Assortment of round metal pans.

(f) Scale, 2 kg. capacity, accurate to 1 g.

(g) Circular metal rings, 10 in. in inside diameter with vertical sides ¼ in. deep.

(h) Abrasion apparatus, as shown in Fig. 2.

(i) Mechanical mixer (bituminous mix) or other power device capable of driving abrasion apparatus at 33 rpm (Fig. 1).

(j) Special plastic cylinder, 500 ml., with valve at bottom (see Fig. 4).

(k) Kerosene.

(l) Filter paper, Eaton Dikemann Co., size 5½ cm., No. 611.

(m) Roofing Felt, 50-60 lb. weight.

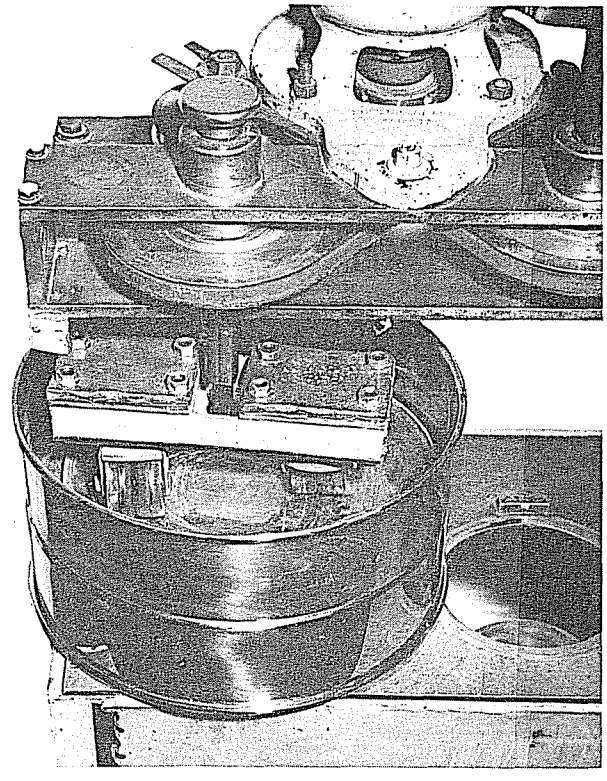


FIGURE 1

Preparation of the Sample

3. (a) Weigh out approximately 105 g. of representative aggregates.

(b) Dry to constant weight and allow to cool to room temperature.

Determination of Surface Area and Absorption

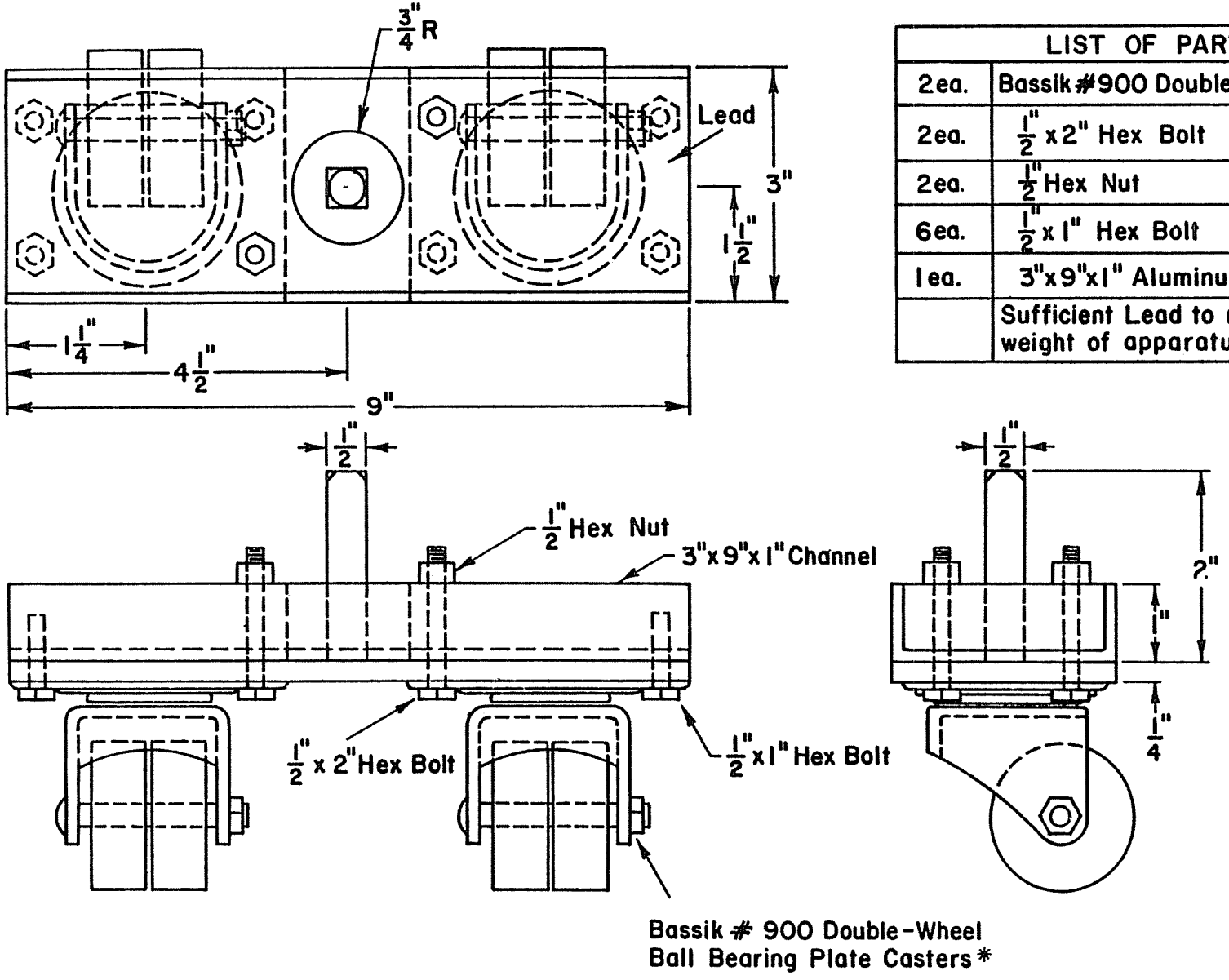
4. (a) Place sample in a tared centrifuge cup containing filter paper and adjust the weight of the material to exactly 100 g.

(b) Place the cup and sample in the centrifuge, quickly pour about 20 ml. of kerosene over the sample and immediately centrifuge for 2 minutes at a force of 400 G.

NOTE: *The centrifuge must be in operation within 5 seconds after adding kerosene, as an additional time allows the kerosene to be absorbed by the aggregate and will not represent true surface area.*

(c) Weigh centrifuged sample to the nearest 0.1 g. and record the amount of kerosene retained. Correct for specific gravity as follows:

ABRADING ASSEMBLY



LIST OF PARTS	
2ea.	Bassik #900 Double Wheel Casters
2ea.	1/2" x 2" Hex Bolt
2ea.	1/2" Hex Nut
6ea.	1/2" x 1" Hex Bolt
1ea.	3"x9"x1" Aluminum Channel
	Sufficient Lead to make total weight of apparatus 13.5 lbs.

* Wheels machined for true flat surface.

FIGURE 2

$$\text{Correction} = \frac{\text{(g. kerosene ret.)} \times \text{avg. sp. gr. agg.}}{2.65}$$

(d) Use the surface area chart in Fig. 3. Place the straightedge on the horizontal line representing the corrected amount of kerosene retained; follow straightedge horizontally to the right to the point of intersection with the diagonal line and then move vertically downward to the intersection with the bottom scale to obtain the surface area.

(e) After step (c), place the sample and cup in a small pan containing a ½-in. depth of kerosene and pour approximately 35 ml. of kerosene over the sample. Allow to soak for 10 minutes.

(f) Remove the sample from the bath and centrifuge for 2 minutes at a force of 400 G.

(g) Reweigh and record the amount of kerosene retained. Make a correction for specific gravity as in step (c).

(h) Subtract the correction result in (c) above from the result of (g) and record the difference as the absorption.

Total Liquid Content of Mixture

5. (a) Pour 500 g. of quartered aggregate into the tared plastic cylinder (Fig. 4). Add water slowly from the bottom by attaching a length of hose between a water faucet and the valve at the bottom of the graduate until free water appears on the surface of the sample.

(b) Record the total weight of the water.

NOTE: *If the aggregate column breaks up during addition of water, rod with a small metal rod until the column goes back together.*

(c) The above procedure will establish the maximum amount of liquid (emulsion plus water) that the aggregate can accommodate.

Optimum Asphalt Content

6. (a) Quarter out 3 separate 500-g. samples of aggregate for fabrication of test specimens.

(b) Add 5.0 percent water by weight of the dry material, to the first test sample and mix thoroughly. Plot the surface area of the material on Fig. 5 or Table 1 to determine the amount of emulsion required to give an asphalt film thickness of 9 microns. Add this amount of emulsion plus sufficient water to bring to the previously established total liquid content (section 5). This added amount of water will be in addition to the 5.0 percent added for initial mixing. Mix thoroughly.

TABLE 1
CONVERSION TABLE *

Surface Area	PER CENT ASPHALT TO FILM THICKNESS(μ)									
	2.0%	4.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0
45	2.2μ	4.4	6.5	8.7	10.9	13.1	15.2	17.4	19.6	21.8
50	2.0	3.9	5.9	7.8	9.0	11.8	13.7	15.7	17.8	19.6
55	1.8	3.6	5.4	7.1	8.9	10.7	12.5	14.3	16.1	17.8
60	1.6	3.3	4.9	6.5	8.2	9.8	11.5	13.1	14.8	16.3
65	1.5	3.0	4.6	6.0	7.5	9.1	10.6	12.1	13.6	15.1
70	1.4	2.8	4.2	5.6	7.0	8.4	9.8	11.2	12.6	14.0
75	1.3	2.6	3.9	5.2	6.5	7.8	9.1	10.4	11.8	13.1
80	1.2	2.4	3.7	4.9	6.1	7.3	8.6	9.8	11.0	12.3
85	1.2	2.3	3.5	4.6	5.7	6.9	8.1	9.2	10.4	11.5
90	1.1	2.2	3.3	4.4	5.4	6.5	7.6	8.7	9.8	10.9
95	1.0	2.1	3.1	4.1	5.2	6.2	7.2	8.2	9.3	10.3
100	1.0	1.9	2.9	3.9	4.9	5.9	6.9	7.8	8.8	9.8

* Based on 60% asphalt in the emulsion.

(c) Place a metal ring on a disk cut from roofing felt to the outside diameter of the ring, and flow the mixed material into the ring. Strike off excess material flush with the top of the ring and allow to stand at room temperature for 15 minutes.

(d) Remove the metal ring and place the test specimen with supporting disk in a 140° F oven to dry to constant weight. Record the weight, after allowing specimen to cool to room temperature.

(e) In order to provide a range for visual inspection and evaluation of the abrasion test, repeat the above procedure on the other 2 samples using appropriate percentages of asphalt required (Fig. 5) to provide about 1 micron film thickness above and below the 9 micron level.

Resistance to Abrasion

7. (a) Place the 3 specimens that were prepared in section 6 in pans and cover each with 350 ml. of water at room temperature. Allow to soak for 1 hour.

(b) Place the pan with specimen and water in abraiding unit and abraid for 15 minutes.

(c) Remove the specimen from the bath and dry in a 140° F oven to constant weight. Subtract this weight from the oven-dry weight before the abrasion test (section 6.(d) above). This difference represents abrasion loss.

(d) Repeat steps (b) and (c) for the other 2 specimens. Multiply the grams lost in abrasion by 6.20. This equal grams abraided per square foot. The quantity 6.20 is a constant designating the area enencompassed by the wheel track (1/6.20 sq. ft.). If the dimensions of the wheels are changed, this factor must be adjusted.

NOTE: *Determining optimum asphalt content for a slurry seal mixture will depend on the judgment of the individual. This mixture after curing should present a dense, voidless mastic-like appearance, black in color, with no visible signs of free asphalt. Excessive loss in the abrasion test will normally be indication of insufficient asphalt and an excess of asphalt will usually be evidenced by the mixture picking up on the rubber wheels of the abrasion apparatus.*

An abrasion loss in excess of 100 g. per square foot of surface on the specimen determined to have optimum asphalt content will be cause for rejection of the mixture. Causes of the excessive abrasion loss for this specimen can usually be attributed to hydrophylic aggregates or possibly to a faulty emulsion which tends to separate and inadequately coat the aggregate particles. Additional mixtures should be tested in which the emulsion in question is mixed with an aggregate of known non-hydrophylic characteristics. In addition, the aggregates in question should be tested with an emulsion from a different source to isolate the cause of the abrasion loss.

SURFACE AREA CHART

Corrected Amount Kero. Ret. = $\frac{\text{Grams Kero. Ret. by Sample x average Sp. Gr. of Agg.}}{2.65}$

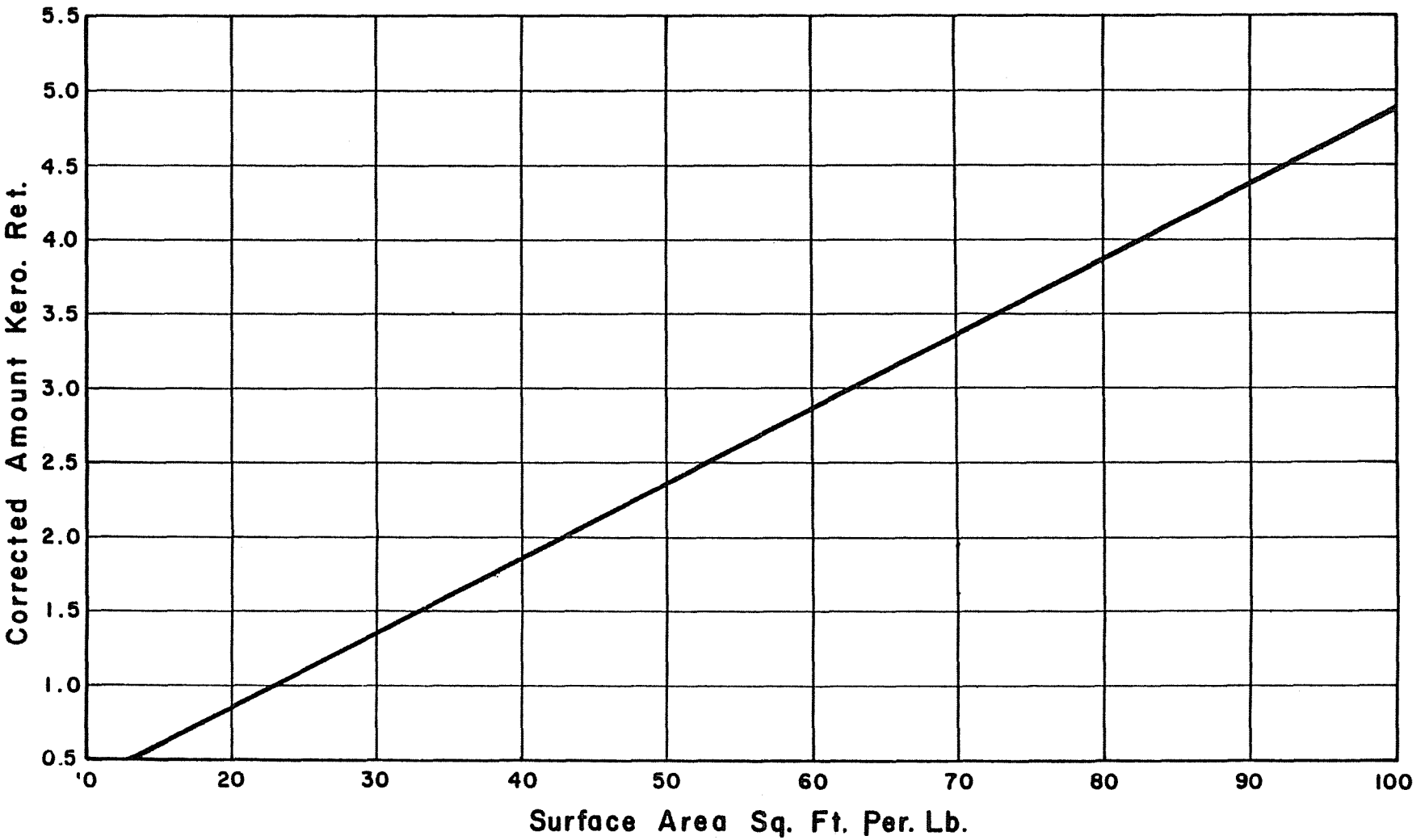


FIGURE 3

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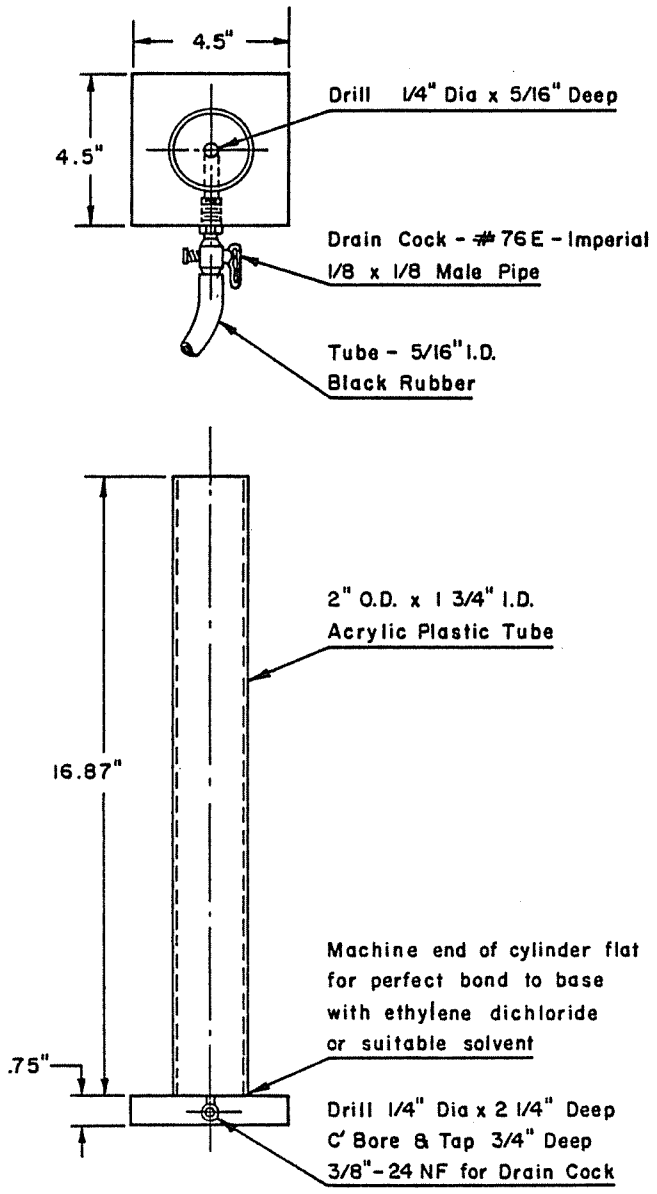

NOTE: CYLINDER & BASE TO BE OF MOULDED TRANSPARENT ACRYLIC PLASTIC

500 ML CYLINDER

FIGURE 4

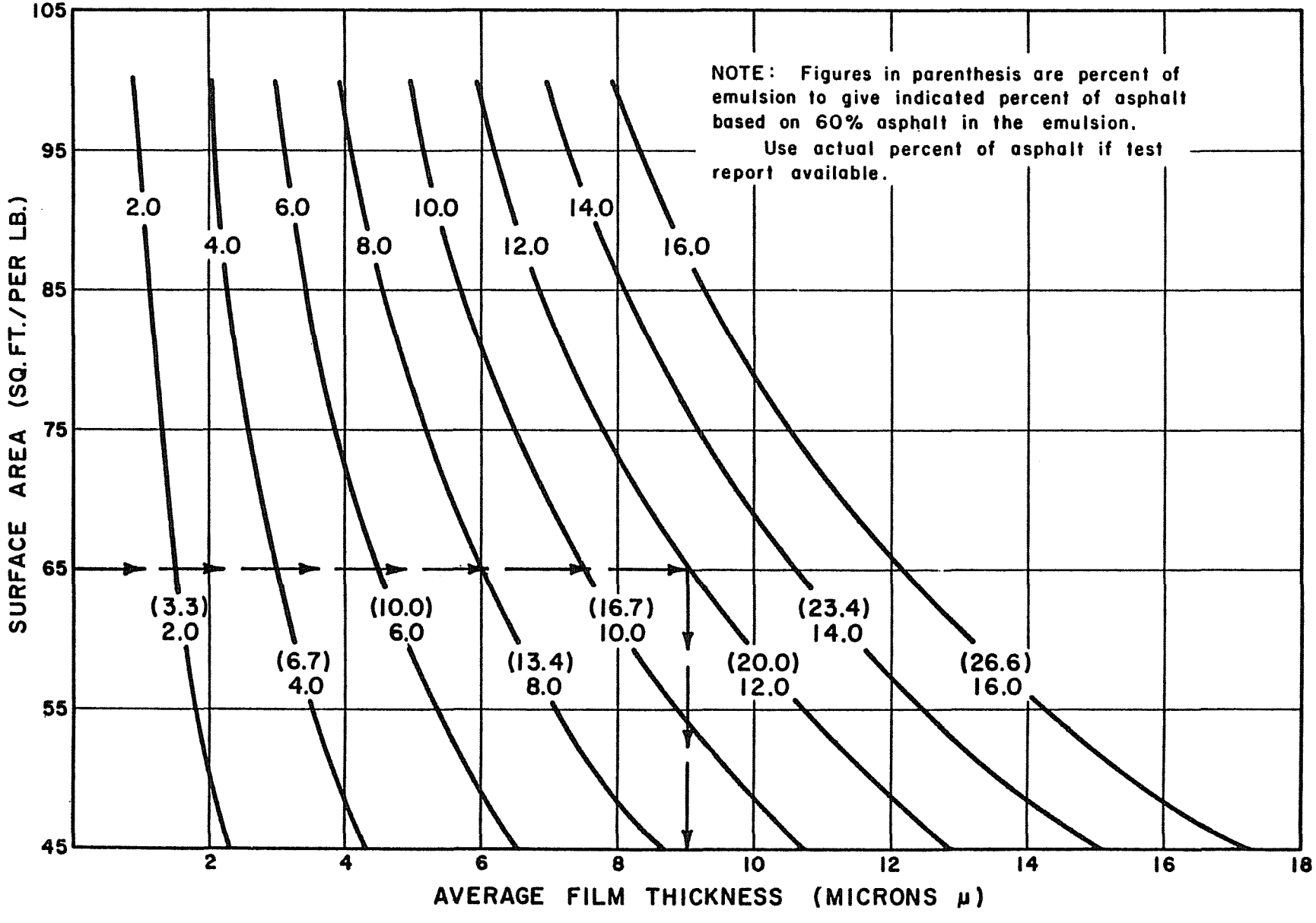
NOTE: Figures in parenthesis are percent of emulsion to give indicated percent of asphalt based on 60% asphalt in the emulsion.
Use actual percent of asphalt if test report available.
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
(3.3)
2.0
(6.7)
4.0
(10.0)
6.0
(13.4)
8.0
(16.7)
10.0
(20.0)
12.0
(23.4)
14.0
(26.6)
16.0
105
95
85
75
65
55
45
SURFACE AREA (SQ.FT./PER LB.)
2
4
6
8
10
12
14
16
18
AVERAGE FILM THICKNESS (MICRONS μ)

FIGURE 5