Standard Practice for

Emulsified Asphalt Chip Seal Design

AASHTO Designation: PP 82-16[1]
Release: Group 3 (August 2016)

WORKING DRAFT

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1. SCOPE

1.1. This standard practice determines application quantities for applying aggregate chips and emulsified asphalt for chip seals. A chip seal is the application of emulsified asphalt, followed immediately by an application of a single layer of cover aggregate, with the option of including a fog seal to help with chip retention.

2. REFERENCED DOCUMENTS

2.1. *AASHTO Standards*:

- MP 27, Materials for Emulsified Asphalt Chip Seals
- T 19M/T 19, Bulk Density ("Unit Weight") and Voids in Aggregate
- T 84, Specific Gravity and Absorption of Fine Aggregate
- T 85, Specific Gravity and Absorption of Coarse Aggregate

3. TERMINOLOGY

3.1. *Definitions*:

3.1.1. *flushed-bleeding*—free asphalt on the pavement surface with little or no texture.

3.1.2. *smooth, non-porous*—some free asphalt on the pavement surface, but with some texture.

3.1.3. *slightly porous, slightly oxidized*—little or no free asphalt on the surface with noticeable but low texture.

3.1.4. *slightly pocked, porous, oxidized*—raveling beginning to show with moderate texture.

3.1.5. *badly pocked, porous, oxidized*—severe raveling of surface with much texture.

4. SIGNIFICANCE AND USE

4.1. This standard practice may be used to determine the quantities of materials required for the construction of emulsified asphalt chip seals.

5. EMULSIFIED ASPHALT CHIP SEAL DESIGN REQUIREMENTS

5.1. *Materials*—Emulsified asphalt and aggregate used in the design should meet M 27 and be representative of the materials used for the project.

5.1.1. *Aggregate Chips*—Fabricate a board measuring 3 ft by $1^1/_2$ ft. Three-quarter-in. thick particle board works well for this item. Attach 1-in. by 2-in. pine wood strips to the edge of the board to create a raised edge. Weigh the completed board and record the weight in pounds. Place the chips to be used on the project on the board. The quantity will vary depending on the gradation, shape, and crushed content of the chips but should be no less than 5 lb and no greater than 25 lb. Try to fit as many chips on the board within the confines of the edging as possible. The chips should not overlap each other and should be only one stone thick. Push the chips against the edge of the board. Place as many chips as possible onto the board until every gap is filled. Reweigh the board containing the chips in pounds. Subtract the weight of the empty board from the weight of the board with chips. Multiply this value by 2. This is the quantity of chips to be used on the chip seal in pounds per square yard. Record this quantity as Q.

5.1.2. *Emulsified Asphalt*—The emulsified asphalt quantity is estimated by calculating the amount of asphalt needed to fill the voids between the chips to a specific embedment depth. That relationship is expressed as follows:

$$A = \frac{\left\{5.61e \times d \times \left[1 - \left(\frac{W}{62.4G}\right)\right]T\right\} + V}{R} \qquad (1)$$

where:

A = emulsified asphalt quantity, gal/yd^2;
5.61 = constant for converting the units to gal/yd^2
e = percent embedment from Figure 1 expressed as a decimal;
d = average mat depth, 1.33 Q/W;
Q = quantity of chips from the board test, lb/yd^2;
W = dry loose unit weight of chips, pcf (see T 19M/T 19, Section 12 on shoveling);
62.4 = unit weight of water, pcf
G = dry bulk specific gravity of chips (see T 84 and T 85);
T = traffic correction factor from Table 1;
V = pavement surface correction factor; and
R = emulsified asphalt residue, expressed as a decimal, e. g., 0.65 = 65 percent

The result of the calculation for Equation 1 is the estimated emulsified asphalt spray rate.

Table 1—Traffic Correction Factor, *T*

Chip Seal Class >	I			II		III
AADT >	<100	100–250	251–500	501–1000	1001–5000	>5000
Traffic Correction Factor, *T* >	1.20	1.15	1.10	1.05	1.00	[a]

[a] Greater than 5000 AADT has not been evaluated sufficiently to develop a recommended traffic correction factor.

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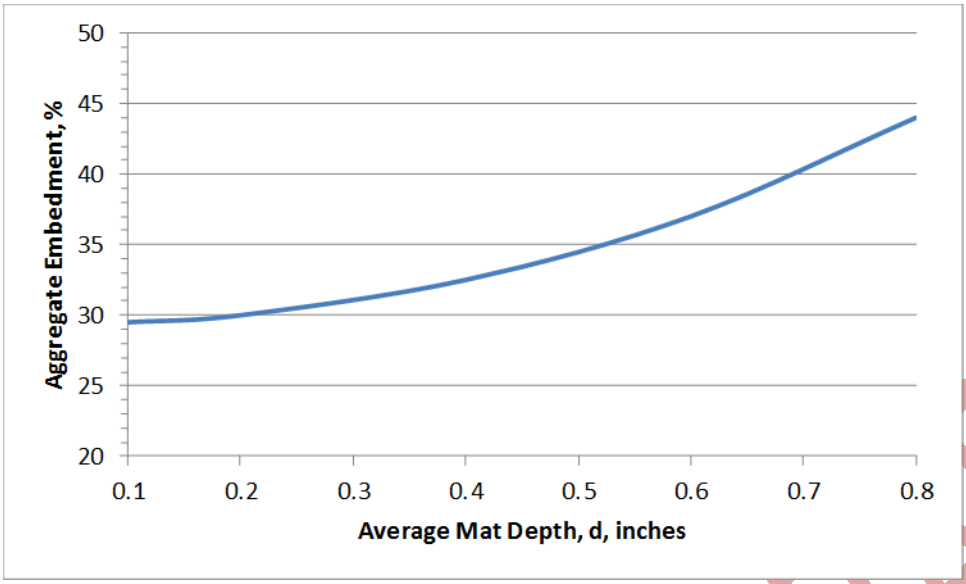

Figure 1—Aggregate Embedment, percent, *e* (before Rolling)

Table 2—Substrate Surface Condition, *V*

Existing Surface Condition	Correction Factor, *V*, gal/yd^2
Flushed-bleeding[a]	–0.06
Smooth, non-porous[a]	–0.03
Slightly porous, slightly oxidized	0.00
Slightly pocked, porous, oxidized[b]	+0.03
Badly pocked, porous, oxidized[b]	+0.06

[a] A quantitative method using the Ball Penetration Test has also been reported in NCHRP Report 680.

[b] A quantitative method using the Sand Patch Test has also been reported in NCHRP Report 680.

5.1.3. *Extra Chips to Avoid Roller Pick-Up*—More aggregate should be spread during chip seal construction with emulsified asphalt than is actually needed to produce a one-stone layer. This extra material is applied to aid in reducing the potential for chips to be picked up by pneumatic rollers during construction. The amount of excess material will vary, but should be approximately 5 to 10 percent and never more than 10 percent. Adjustment up or down is necessary based on when the rollers begin to pick up the chips.

5.2. All design work will be carried out using aggregate either directly from the job site stockpile or equivalent material from the same source and having substantially the same material properties.

6. REPORT

6.1. Report the aggregate spread rate, *Q*, in pounds per square yard to the nearest 1.0 lb/yd^2.

6.2. Report the emulsified asphalt spray rate, *A*, in gallons per square yard to the nearest 0.01 gal/yd^2.

7. KEYWORDS

7.1. Aggregate; aggregate chips; chip seal; emulsified asphalt.

[1] This provisional standard was first published in 2016.

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